ENHANCED COASTAL SENSITIVITY MAPPING

Consolidated Ecosystem Services Report

Submitted to:

Esso Exploration & Production Guyana Limited (EEPGL)

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EMC
ENVIRONMENTAL MANAGEMENT CONSULTANTS Inc.

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ACRONYMS

CDC	Community Development Council
CHW	Community Health Worker
EEPGL	Esso Exploration and Production Guyana Ltd.
EMC	Environmental Management Consultants Inc.
EPA	Environmental Protection Agency
ESS	Ecosystem Services Study
GIS	Geographical Information System
GMCS	Guyana Marine Conservation Society
GWI	Guyana Water Inc.
NAREI	National Agricultural Research and Extension Institute
NDC	Neighbourhood Democratic Council
NTC	National Toshaos Council
PAC	Protected Area Commission
RDC	Regional Democratic Council
SBPA	Shell Beach Protected Area
VC	Village Council

1.0 INTRODUCTION

In June 2017, the Environmental Protection Agency (EPA) issued an Environmental Permit to Esso Exploration and Production Guyana Limited (EEPGL) for the Liza Phase 1 Development Project. A condition of the Environmental Permit required EEPGL to conduct field studies to verify (by ground truthing) selected shoreline and coastal habitat classifications that were included in coastal sensitivity maps provided the Liza Phase 1 Development Project Environmental Impact Assessment (EIA). Subsequently, in August 2017, EPA requested the inclusion of shoreline and coastal ecosystem services in the coastal sensitivity mapping project for Regions 1 to 4. On its own initiative, EEPGL surpassed the regulatory requirement by mapping ecosystem services for the Regions 5 and 6.

The Enhanced Coastal Sensitivity Mapping Study – Ecosystem Services Study - Year 1 (ESS-1) was the first study of its kind in Guyana. The Study contributed significantly to the existing base of knowledge on the use of resources along the shoreline and the immediate coastal areas by coastal communities in Regions 1 to 6 because these were not previously compiled comprehensively. More importantly, all ecosystem services, identified via a dual approach comprising local stakeholder engagements and ground verification, were mapped. ESS-1 was executed through a collaboration between Environmental Resources Management (ERM) and Environmental Management Consultants Inc. (EMC), a Guyanese firm that specializes in environmental consulting services. In this partnership, ERM provided international expertise on the methodology and data analysis, including the GIS approach. EMC led field engagements with local stakeholders and supported reporting.

ESS-1 was implemented over the period 2017 to 2019 in two phases. The first phase entailed meetings with local stakeholders (Neighbourhood Democratic Councils [NDCs], Village Councils [VCs], Community Development Councils [CDCs], Town Councils [TCs] and community members) to gather information on the relationship between coastal communities and the natural environment. Following the meetings, ecosystem services reported by local stakeholders were ground verified by the study team. On several occasions, local stakeholders accompanied the study team on the ground verification exercises. During the second phase, the maps and key findings of the first phase were presented to local stakeholders for validation.

In December 2021, on its own initiative, EEPGL contracted EMC to update the coastal sensitivity maps for biodiversity habitats and ecosystem services in Regions 1 to 6. The studies were executed concurrently with field deployments commencing in January 2022.

This consolidated report presents the findings of the update of ecosystem services (hereafter ESS-2). The overarching objective of ESS-2 was to verify and update the ESS-1 baseline. Specifically, it provides:

- The methodology that guided ESS-2 execution.
- A summary of the ecosystem services that were identified in ESS-2 for Guyana's coastal regions (Regions 1 to 6).
- The detailed findings on the relationship between local communities and the natural environment for districts that are located along the shoreline or that that typically utilize shoreline resources in Regions 1 to 6.

The updated ecosystem services maps for Regions 1 to 6, inclusive of regional and district maps, are compiled and presented separately in a Map Book.

1.1 Definition of Ecosystem Services

Ecosystem services are typically defined as the benefits that people obtain from the natural environment, including natural resources that underpin basic human health and survival needs, support economic activities and provide cultural fulfilment.

There are four standard categories of ecosystem services: *provisioning, regulating, cultural and supporting* services, defined as follows:[1]

- **Provisioning services:** The goods or products obtained from ecosystems such as food, freshwater, timber, fiber and other goods.

- **Regulating services:** The benefits obtained from an ecosystem's control of natural processes such as climate, water flow, disease regulation, pollination, and protection from natural hazards.

- **Cultural services:** The non-material benefits obtained from ecosystems such as recreation, spiritual values, and aesthetic enjoyment.

- **Supporting services:** The natural processes such as erosion control, soil formation, nutrient cycling, and primary productivity that maintain other services.

Additional details about the types of services under each category are provided in Appendix A.

[1] Millennium Ecosystem Assessment (MA). 2005. Synthesis Report. Island Press, Washington DC.

2.0 METHODOLOGY

2.1 Scoping Of Ecosystem Services

The findings of ESS-1 (reports and maps) were used as the foundation for stakeholder engagements and ground verification exercises. For ESS-2, the Study Area was defined as the immediate coastal area up to one kilometre inland from the shoreline in Regions 2 to 6. Mapping of ecosystem services in these regions was disaggregated based on the boundaries of local authority districts whose jurisdictions included a section of the shoreline. In total, ecosystem services were mapped for 47 local authority districts in Regions 2 to 6. The approach was specially modified for Region 1, given the unique circumstances that prevail in that region. Ecosystem services were mapped for 13 villages, the same 13 villages which were included in ESS-1. The selection of the villages in Region 1 scoped into the Study were guided by two criteria. Firstly, all villages which had a section of their boundaries located along the shoreline were included in the Study. There were only three such villages in Region 1, namely Father's Beach, Almond Beach and Three Brothers. In the remaining 10 villages, key activities used to support sustenance and livelihoods, such as crabbing and marine fisheries, relied on utilization of shoreline resources and for this reason, these villages were also scoped in to the Study.

Prior to commencing field work, the study team also convened meetings with the EPA, the National Agricultural Research and Extension Institute (NAREI), and the Guyana Marine Conservation Society (GMCS). During these meetings, the study team briefed stakeholders on the scope and proposed approach to ESS-2 and invited recommendations on these topics that may be considered in study design.

2.2 Screening of Ecosystem Services

Prior to field deployments, a desktop screening of ESS-1 findings (reports and maps) was conducted to establish a starting point for the study, to establish any additional issues on which local stakeholders should be engaged and to facilitate preliminary identification of sites for ground verification. All ecosystem services identified in ESS-1 were grouped based on the category of service, for ease of review. Additional secondary sources of information including recent imagery of the coastline provided by EEPGL, complementary outputs from the desktop screening for the Biodiversity Habitats Study, reports from governmental and non-governmental agencies, and newspaper reports were also reviewed to identify potential changes in the Study area since the conclusion of ESS-1. Ultimately, the screening exercise helped to identify changes in the Study Area which may have influenced the type of ecosystem services from which stakeholder can benefit.

Geographic Information System (GIS) Approach

The ArcGIS web platform and tools (Survey123 and Field Maps) were used as key tools in the pre-fieldwork screening so as to identify areas of focus for ground verification. The Study Area was delineated on base maps created using imagery that was provided by EEPGL as well as imagery from Landsat satellites that were included in the ArcGIS web platform. Thereafter, ESS-1 data points and attributes were pre-loaded to an iPad to support ecosystem services screening.

2.3 Verifying and Updating Ecosystem Services

Verifying and updating the findings of ESS-1 involved a dual approach of engagements with local stakeholders and ground verification of selected ecosystem services led by the study team. However, this dual approach was not adopted for three new NDCs in Region 2 which were established in 2019 namely, Nile/Cozier NDC, Kitty/Providence NDC and the Moruka/Phoenix Park NDC. These three NDCs are located along the banks of the Pomeroon River and also along a section of the Essequibo

Coast shoreline. These NDCs were not included in the lists of local authorities published by the Ministry of Local Government and Regional Development and as a consequence, engagements with the NDCs were not scheduled in advance of the field deployments. Instead, for all three NDCs, ecosystem services were mapped by ground verification of the services located along the banks of the Pomeroon River and interactions with local stakeholders from these villages.

During the meetings conducted as part of the scoping phase, the EPA expressed particular interest in the fieldwork and findings for Regions 1 and 2 given that some of the oil spill modelling scenarios for the Yellowtail Development Project EIA indicated possible impacts to the Region's coastline should an unplanned event occur. The GMCS expressed interest in participating in activities in Region 1. However, during the period when the Region 2 engagements were being organised there was an upsurge in COVID 19 cases locally, and given the concerns over in-person meetings, there was a request by several NDCs for the number of persons attending the meetings to be limited. This was discussed with the EPA and the ESS field team, which consisted of four personnel proceeded with the engagements and field exercises so as to assuage reservations shared by NDCs. However, representatives from the EPA, GMCS and the National Tosahos Council accompanied the study team on all activities conducted in Region 1.

Stakeholder Engagements

The Community Based Participation Research approach was utilized to engage local stakeholders so as to validate the findings of ESS-1 and identify new services in the Study Area. In Regions 2 to 6, the study team scheduled meetings with the NDCs to present the findings of ESS-1 (maps and summary of services identified for each district), discuss the status of previously reported ecosystem services, identify any new ecosystem services and collect updated socio-economic data. At this stage, all ecosystem services identified in ESS-1 as well as potential new ecosystem service types identified during the screening process were scoped in to the discussions. These engagements were also used to support data collection for the Biodiversity Habitats Study, where possible.

In Region 1, the study team scheduled meetings with Village Councils (VCs) and Community Development Councils (CDCs) to present the findings of ESS-1 (maps and summary of services), discuss the status of previously reported ecosystem services, identify any new ecosystem services and collect updated socio-economic data. In order to facilitate discussions, a summary of the ESS-1 findings for each VC and CDC was excerpted from the *Detailed Findings Table* and sent with the invitation to the participate in a meeting on the ESS more than two weeks in advance of each meeting. Moreover, given the challenges of electricity in Region 1, all materials developed to facilitate discussions during the meetings were enlarged and printed in hard-copy for display. These materials included the ESS-1 regional map, the types of ecosystem services in Region 1, a summary of services for the region and an excerpt of the *Detailed Findings Table* for each VC and CDC. The materials on display for meetings in Manawarin and Father's Beach are presented in Figure 2-1.

Figure 2-1: Materials Prepared to Facilitate Stakeholder Engagements in Manawarin (Left) and Father's Beach (Right)

All ecosystem services identified in ESS-1 as well as potential new ecosystem service types identified during the screening process were scoped in to the discussions. These engagements were also used to support data collection for the Biodiversity Habitats Study, where possible. Although the meeting targeted representatives of the CDCs and VCs, in several villages, other community members (including vulnerable groups like women and young people) also attended the meetings and participated in discussions.

During the stakeholder meetings, the screening checklist of ecosystem services developed in ESS-1 was used to guide discussions. The screening checklist is provided in Appendix A. In each meeting, the study team presented the ESS-1 findings and maps, and asked stakeholders a series of questions as detailed below:

- Is the information presented for your NDC correct? If not, what do we need to change/adjust?
- Are the locations for the various services presented on the map correct?
- Has there been any notable growth or decline in any particular sector? What sector? What has changed?
- Has there been any increase in coastal resources over the past year? What purpose and where?
- Has there been any new use of coastal resources within the area over the past year? What purpose and where?
- What is the current population estimate or trend (increased or decreased over past year)? What is contributing to the trend?
- Has the COVID-19 pandemic impacted the use of ecosystem services? If yes, how?
- Has there been a change (growth or loss) of mangrove cover?
- Have there been changes to the sea defences in the NDC such as new sea defence structures, or damaged/breached structures?
- Is there any area along the shoreline which people prefer to fish with pin seines, cast nets or lines?
- Is there any area along the shoreline where many birds are observed or hunted/trapped?
- Are there any other notable socioeconomic data that you wish to have documented?

Any new service identified by the NDC had meet two criteria:

- Habitats present in the Study Area are believed to provide this service or are similar to habitats elsewhere that provide this service; and

- People are believed to benefit from the service, either at the local, national, or global level.

The VCs, CDCs and NDCs with whom the study team met and the dates of the meetings are outlined in Table 2-1.

Table 2-1: VCs, CDCs, NDCs Engaged in Regions 1 to 6 and Dates of Meetings

VCs, CDCs, NDCs and Town Councils	Meeting Date
Region 1	
Father's Beach CDC	June 13, 2022
Manawarin VC	June 13, 2022
Waramuri VC	June 14, 2022
Santa Rosa VC	June 14, 2022
Assakata VC	June 15, 2022
Warapoka VC	June 16, 2022
Three Brothers VC	June 16, 2022
Mabaruma Town Council	June 17, 2022
Aruka Mouth CDC	June 17, 2022
Smith's Creek CDC	June 17, 2022
Almond Beach CDC	June 18, 2022
Imbotero CDC	June 18, 2022
Morawhanna CDC	June 18, 2022
Region 2	
Charity/Urasara NDC	February 15, 2022
Evergreen/Paradise NDC	February 16, 2022
Anna Regina Town Council	February 16, 2022
Aberdeen/Zorg-en-Vlygt	February 17, 2022
Annadale/Riverstown	February 17, 2022
Good Hope/Pomona	February 18, 2022
Region 3	
Wakenaam	May 16, 2022
Leguan	May 16, 2022
Parika/Mora	May 17, 2022
Hydronie/Good Hope	May 17, 2022
Greenwich Park/Vergenoegen	May 18, 2022
Tuschen/Uitvlugt	May 18, 2022
Stewartville/Cornelia Ida	May 19, 2022
Hague/Den Amstel	May 19, 2022
La Jalousie/Novelle Flanders	May 20, 2022
Best/Klien Pouderoyen	May 20, 2022
Region 4	
Industry/Plaisance	January 24, 2022
Better Hope/La Bonne Intention (LBI)	January 24, 2022
Beterverwagting/ Triumph	February 22, 2022
Mon Repos/ La Reconnaissance	January 25, 2022
Buxton/Foulis	January 26, 2022
Enmore/Hope	January 26, 2022
Haslington/Grove	January 27, 2022
Unity/Vereeniging	January 27, 2022
Region 5	
Woodlands/Farm	April 11, 2022

VCs, CDCs, NDCs and Town Councils	Meeting Date
Mahaicony/Abary	April 11, 2022
Profit/Rising Sun	April 12, 2022
Seafield/Tempie	April 12, 2022
Union/Naarstigheid	April 13, 2022
Bath/Woodley Park	April 13, 2022
Woodlands/Bel Air	April 14, 2022
Zeelust/Rosignol	April 14, 2022
Region 6	
Ordinance/Fort Lands	March 07, 2022
Kintyre/Borlam	March 07, 2022
Gibraltar/Fyrish	March 08, 2022
Kilcoy/Hampshire	March 08, 2022
Rose Hall Town Council	March 09, 2022
Port Mourant/John	March 09, 2022
Bloomfield/Whim	March 10, 2022
Lancaster/Hogstye	March 10, 2022
Bushlot/Adventure	March 11, 2022
Maida/Tarlogie	March 11, 2022
Macedonia/Joppa	March 14, 2022
Good Hope/No.51	March 15, 2022
No. 52/No.74	March 15, 2022
Corriverton Town Council	March 16, 2022

Ground Verification

In Regions 2 to 6, the study team selected locations for ground verification that were a representative sample of the ecosystem services in each district surveyed. Generally, ground verification occurred principally along the shoreline for all districts surveyed because the uses of the other immediate coastal areas in the Study Area were used almost exclusively for residential housing or commercial activities. All new ecosystem services identified during the stakeholder engagements were scoped in to the study and in addition to the ESS-1 findings, formed the basis on which sites for ground verified were identified. The sites selected for ground verification accounted for at least 20 percent of the services scoped in to the study. In addition, to the extent feasible, depending on access to the location, all new services reported by NDCs as well as all services which were no longer occurring were ground verified. The following criteria guided site selection:

- The site provided access to at least two ecosystem services.
- The services that were ranked as having either **Critical** or **High** priority in ESS-1.
- The site supported more than one category of ecosystem services.
- Significant changes were observed or reported at the site since ESS-1. These may include mangrove growth or loss, the construction of new hard sea defence structures, new intensive economic/livelihood activities or any other infrastructural development.

In Region 1, challenges of accessibility limited the ground verification of ecosystem services reported to be found within the boundaries of the villages surveyed. As such, ESS points mapped for provisioning services in the villages, such as crop cultivation, livestock rearing, hunting/trapping, and traditional practices among others, are symbolic of the services from which villages benefit. Generally, these ESS points are not location-specific and do not represent the spatial extent of the services. Opportunities for ground verification of shoreline services were also limited. However, in this instance, reports from local stakeholders were ground verified by the ESS study team or the biodiversity habitats study teams who analysed fish habitats and waterbird habitats along the entire Region 1 shoreline. As

a result, all ESS points and polygons located along the Region 1 shoreline are location-specific and representative of the spatial extent of the sevices.

2.4 Prioritizing Ecosystem Services

The ecosystem services prioritization has been designed to be consistent with the ESS-1 framework and with international best practice, using the 2012 International Finance Corporation (IFC) Performance Standards (PS) as guidance. The prioritization process focuses on identifying services that are important to local stakeholders and difficult to replace, where loss or degradation of the service could adversely affect local communities. The prioritization of ecosystem services considered the importance of the ecosystem service and the availability of spatial alternatives.

Importance of Ecosystem Services

The importance of ecosystem services to beneficiaries was assessed according to the following criteria and assigned a rating from **Low** to **Essential** based on the intensity of use, the scope of use, the degree of dependence, the cultural and/or historical importance and the importance expressed by stakeholders. The definitions for the rating importance are provided in Table 2-2 below.

Table 2-2: Definitions for Rating Importance of Ecosystem Services

Rating	Definition
Low	A service that is used seasonally or less frequently by one stakeholder group. The service does not support livelihoods. The service may have a cultural or historical value.
Moderate	A service that is used weekly or seasonally by one or more stakeholder groups. The service may be used to support commercial and/or subsistence activities. The service may have cultural or historical value.
High	A service that is used weekly by one or more stakeholder groups to support commercial and/or subsistence activities. The service may have cultural or historical value.
Essential	The service is used daily by one or more stakeholder groups to support commercial and/or subsistence activities. The service may also have cultural or historical value.

The weight given to each of these components varied depending upon the service, but the importance to stakeholders and beneficiaries took precedence. Where a service was of greater or lesser importance to different stakeholder groups, two (or more) ratings were assigned so that impacts on these groups could have been assessed individually.

Replaceability

The replaceability (availability of alternative locations) assessed the extent to which a community was adversely impacted if that service declines. The 'replaceability' of a service was assessed according to the existence of spatial alternatives (natural replacements and man-made substitutes), the accessibility, cost and sustainability of potential alternatives, and the preference and cultural appropriateness of alternatives. The replaceability of the service was rated from **Low** to **High** guided by the definitions provided in Table 2-3 below.

Table 2-3: Definitions for Rating Replaceability of Ecosystem Services

Rating	Definition
Low	No spatial alternatives
Moderate	Few spatial alternatives
High	Many spatial alternatives

After compiling information on the importance and replaceability of each service, these ratings were combined to assign a priority rating to the service (see Figure 2-1 below). Priority ratings were assigned by the study team to each location-specific ecosystem service based on feedback provided by the NDC, observations during ground verification and interactions with other local stakeholders who were present at the site. Priority ratings for the all location-specific ecosystem services identified in ESS-2 are presented in Table 4-2.

		Replaceability of Service		
		High	**Moderate**	**Low**
Importance of Service to Beneficiaries	**Essential**	*High*	*Critical*	*Critical*
	High	*Medium*	*High*	*Critical*
	Moderate	*Low*	*Medium*	*High*
	Low	*Low*	*Low*	*Medium*

Figure 2-1: Matrix for Assigning Priority Ratings to Ecosystem Services

Ecosystem services with *Critical or High* priority ratings were considered as Priority Services. Priority services which were spread spatially across the Study Area were represented by polygons on the coastal sensitivity maps. The exception is the commercial and residential uses of the Study Area, which were of *Critical Priority* in several districts, are represented by the imagery of the base map. On the other hand, ecosystem services with *Medium or Low* priority ratings which had spatial spread, were represented as by a point.

3.0 SUMMARY OF ESS-2 FINDINGS

Based on the findings of ESS-2, provisioning services were the primary service provided by the coastal ecosystem accounting for approximately 70 percent of the location-specific services identified in the six regions. Indeed, provisioning services were also the most common category of ecosystem service in Regions 1 to 6. The most common provisioning services identified include:

- Fishing and shrimping for subsistence and commercial sale. In Region 1, freshwater fishing in rivers, creeks and lakes was the dominant type of fishing practiced by locals, particularly in the Moruca sub-district. However, marine fisheries is also commonly practiced particularly in the Mabaruma sub-district. By contrast, in Regions 2 to 4, the marine fisheries are almost exclusively practiced with few instances of freshwater and coastal fishing. Finally, in Regions 5 and 6, both marine fisheries and coastal fishing in swamps and canals are common. In Region 6, a fusion of marine and coastal fisheries is common in which mangroves are breached to facilitate an inflow of brackish water, rich with juvenile fish and shrimp, into "aquaculture" ponds.

- Crabbing for subsistence and commercial sale. Crabbing was most prevalent in Regions 1, 2 and 6 where several species of crabs are captured. In Region 1, the capture of red crabs was principally done seasonally whereas in Regions 2 and 6, this species was reportedly captured throughout the year by people who extract them from their burrows.

- Aquatic transportation to facilitate movement of people and cargo within and among the six coastal regions.

- Freshwater collected from surface water systems, such as creeks, were used in all villages in Region 1. Moreover, some communities in Region 3, particularly the islands in the Essequibo River, rely on freshwater from the River for crop irrigation and animal husbandry.

- Socio-economic activities and income generators or services supporting income generation (e.g., settlements, boat building, repairs and commercial activities in the Study Area).

- Annual and permanent cultivated crops grown for subsistence use and commercial sale. All villages in Region 1 were engaged in crop cultivation in their villages and, with the exception of three villages, crop cultivation generally did not occur in proximity to the shoreline. By contrast, in Regions 5 and 6, crop cultivation was widely practiced on sea dams.

- Agricultural and grazing, including livestock farming supported by coastal grassland and plants. This activity was particularly common in Regions 5 and 6.

- Traditional resource use in Region 1, including traditional medicine, traditional religious and indigenous crafts.

- Animals hunted primarily for food. Hunting along the shoreline was common in areas where mangroves are prevalent. In Region 1, wildlife is also trapped for sale.

Cultural services were the second most prevalent ecosystem service, representing approximately 17 percent of the location-specific services identified in the four regions. The most common cultural services identified include:

- Cultural value placed on traditional practices, particularly among local Hindu communities, for conducting prayer services and other rituals along shoreline areas. In addition, some Christian communities also uses canals and rivers for baptisms.

- Use of natural spaces and resources for local tourism or local recreation including use of sea walls and beaches for relaxation and exercise. Sea walls, beaches and other accessible areas of the shoreline throughout the Study Area in Regions 2 to 6 are popularly used during the Easter weekend for kite flying and picnics.

- Development of eco-tourism, targeting local and foreign guests, particularly in Region 1. The Warapoka village has a well-developed tourism product including a guest house, shell mounds, and a harpy eagle nesting site. Efforts are also underway to develop water-based tours and sport tourism (like canoeing), and to promote research tourism. Other villages such as Santa Rosa, Assakata and Waramuri are also taking action to develop ecotourism in their villages.

Regulating services were the third-most prevalent, representing approximately 8 percent of the location-specific services identified in the four regions. The most common regulating services identified include:

- Shoreline and riverbank protection and the role of mangroves in protecting crops, buildings, recreation areas from waves, wind and flooding.

- Erosion protection and the role of vegetation in regulating erosion on slopes.

- Global climate regulation provided by mangrove forests located along the shoreline.

Supporting services are intermediate ecological outcomes that are not directly used, but rather support other ecosystem services. The service “Habitat Provision” is typically an exception, which is sometimes valued as an “end-use” service by stakeholders in addition to its supporting role. Therefore, the relatively low prevalence of identified supporting services, representing approximately 5 percent of the location-specific services. The services identified relate primarily to the value placed on mangroves for their maintenance of species populations and their ability to allow ecological communities to recover from disturbances, in addition to their regulating role of shoreline protection. In addition, in Region 1, habitats are provided for special species of importance with harpy eagle nesting sites being reported in three villages, sea turtle nesting areas including on Almond Beach where a small community of 23 people reside, and sightings of marine mammals like dolphins.

Figure 3-1 summarizes the distribution of identified ecosystem services across the four ecosystem service categories.

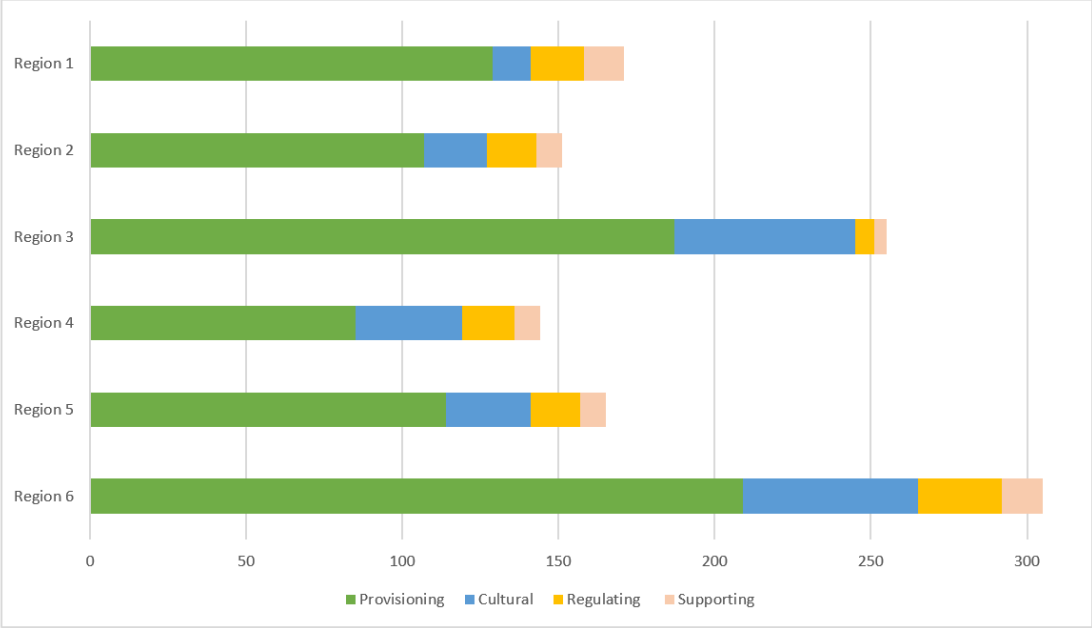
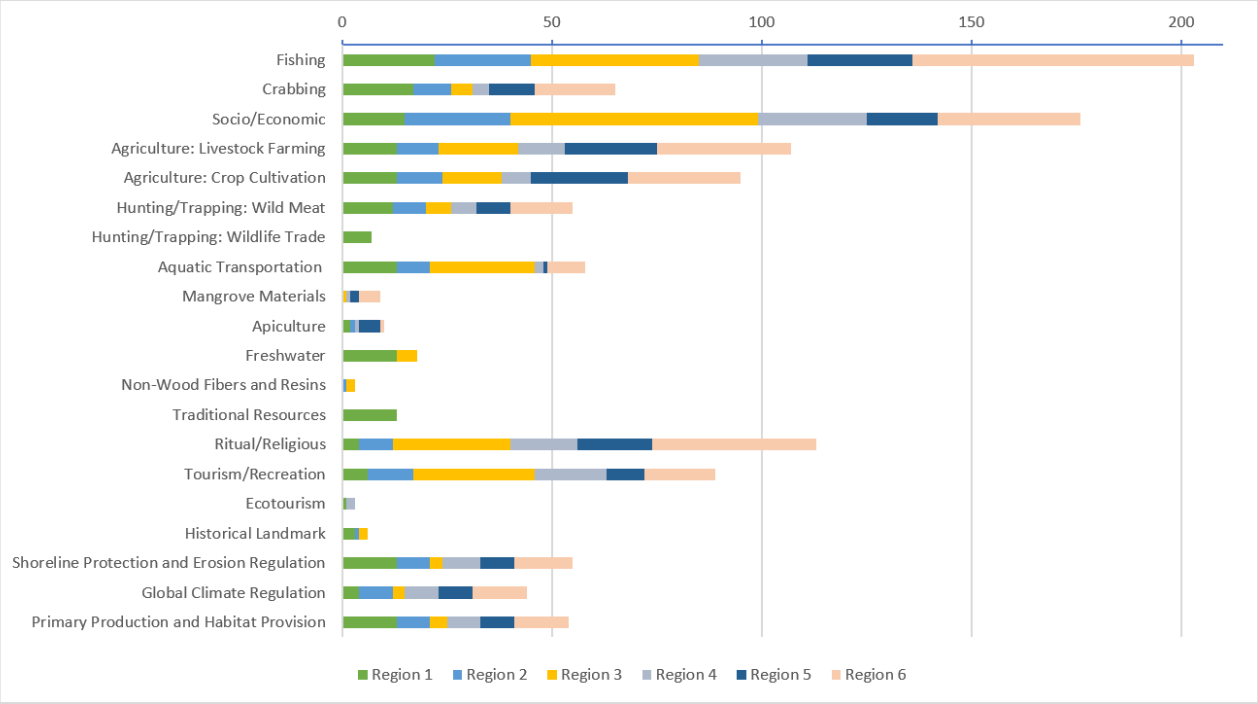


Figure 3-1: Distribution of Ecosystem Service Categories

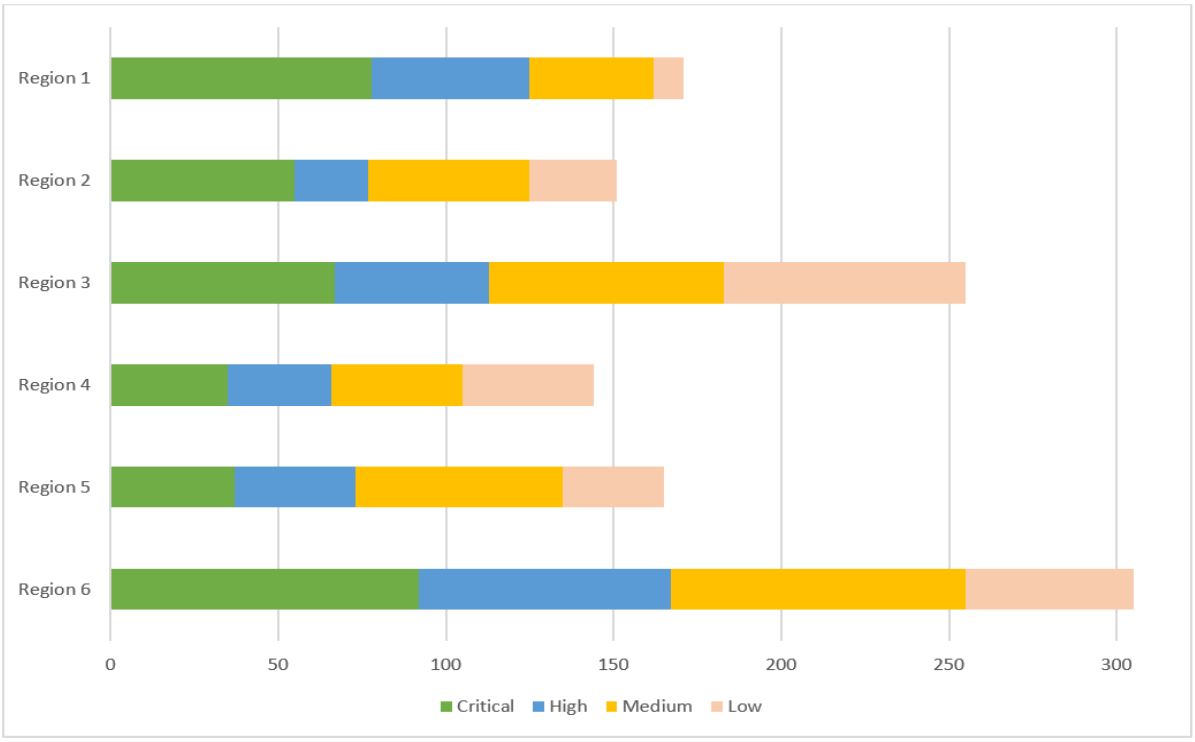
Figure 3-2 summarizes the distribution of specific ecosystem service types across the categories.



Note: When combined in Regions 1 through 6, six ecosystem service types accounted for almost 70 percent of all services with fishing at 17 percent, socioeconomic at 15 percent, crop cultivation at 8 percent, livestock grazing at 9 percent, ritual/religious at 10 percent, and tourism and recreation at 8 percent. Other services included trapping/hunting at 5 percent, crabbing at 6 percent, and shoreline protection/erosion regulation and carbon sequestration each under 5 percent.

Figure 3-2: Distribution of Ecosystem Service Types

Figure 3-3 summarizes the distribution of priority ratings for the location-specific ecosystem services identified.



Note: When combined in Regions 1 through 6, services of Critical Priority were 31 percent, High Priority 22 percent, Medium Priority 30 percent and Low Priority 17 percent.

Figure 3-3: Distribution of Ecosystem Services Priority Rankings

3.1 Common Ratings of Ecosystem Services

For overview and general comparison purposes only, the highest priority rating assigned for each service in each Region is included Table 3-1 below. As described in the methodology, services with *high* or *critical* priority ratings are considered to be 'priority' ecosystem services and would be a primary focus in the event of oil spill response. The overview table also helps to visualize which services which did not feature as having importance to beneficiaries across the regions.

Table 3-1: Highest Ecosystem Service Priority Rating in Each Region

Ecosystem Service Type	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6
Provisioning Services						
Fishing and Shrimping: Marine, Freshwater and Coastal	Critical	Critical	Critical	Critical	Critical	Critical
Crabbing	Critical	Critical	Critical	Medium	Critical	Critical
Cultivated crops	Critical	Critical	Critical	Medium	High	Critical
Livestock grazing	High	High	High	Critical	Critical	Critical
Apiculture and Wild Honey	*	Low	N/A	High	High	Low
Hunting: Wild Meat	High	High	Critical	Medium	Medium	High
Trapping: Wildlife Trade	High	N/A	N/A	N/A	N/A	N/A
Non-wood fibers and resins	*	Low	High	N/A		
Traditional Resource Use/ Traditional Medicine	Critical	N/A	N/A	N/A	N/A	N/A
Freshwater for household use	Critical	N/A	High	N/A	N/A	N/A
Freshwater for irrigation use	N/A	N/A	Critical	N/A	N/A	N/A
Aquatic transportation/ports	Critical	Critical	Critical	Critical	Critical	Critical
Social/Economic	Critical	Critical	Critical	Critical	Critical	Critical
Regulating Services						
Global climate regulation	Medium	Critical	Medium	Critical	Critical	Critical
Erosion regulation	Critical	Critical	Critical	Critical	Critical	Critical
Shoreline protection / Mangroves / River defense	Critical	Critical	Low	Critical	Critical	Critical
Cultural Services						
Cultural, religious, or spiritual value	Low	Critical	Critical	Critical	Critical	Critical
Tourism and recreation	Critical	Critical	Critical	Critical	Critical	Critical

Ecosystem Service Type	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6
Supporting Services						
Habitat provision, primary production	Critical	High	High	High	High	High

4.0 REGION 1 COASTAL ECOSYSTEM SERVICES STUDY FINDINGS

4.1 Population Estimates

Population estimates are based upon data provided by NDC leadership during the ecosystem services-related engagements.

Table 4-1: Population Estimates for Region 1

NDC Name	Population Estimate
Father's Beach	21
Manawarin	1,656
Waramuri	1,500 to 1,800
Santa Rosa	10,500
Assakata	> 300
Warapoka	600
Three Brothers	277
Mabaruma	8,000
Aruka Mouth	320
Smith's Creek	363
Almond Beach	25
Imbotero	595
Morawhanna	85

4.2 Overview of Findings

The villages included in the Study belonged to two of the three sub-districts of Region 1. Seven of the villages were part of the Moruca sub-district[2] and the remaining six villages were part of the Mabaruma sub-district[3]. All of the villages in the Moruca sub-district, with the exception of Father's Beach, are titled Amerindian villages which are independently administered by a VC. None of the villages in the Mabaruma sub-district were titled and therefore, were administered by CDCs. Most villages had the majority of its population being of indigenous descent, principally from the Warrau nation.

Given the remoteness of these villages many social services and utilities are not available. Most villages depend on rainwater or freshwater harvested from rivers and creeks for household use. In few instances where water is supplied by the utility company; it is not treated. Similarly, most villages are not electrified. About a decade ago, rooftop solar panels with battery back-ups (15-watt capacity) were distributed to households in almost all of the villages under the Government's Hinterland Electrification Programme. These systems are no longer functional and have not been replaced. Thus, the majority of the villages rely on homemade kerosene lamps for lighting at night. Due to the high cost of fuel in the region and in the absence of alternatives, local stakeholders in Imbotero reported that firewood (dried mangroves) are sometimes burned at night for light. Moreover, cell phone service, mobile data and wireless internet connect is unavailable or weak in most villages. The exceptions are large settlements like Mabaruma and Santa Rosa where utilities are more readily available. However, local water and electricity providers are also in the process of introducing grid powered electricity and water distribution systems in the central areas of Manawarin and Waramuri. In a few communities like Smith's Creek and Imbotero, sanitation is a challenge and there are limited capacities to manage solid waste and sewage.

[2] The villages in the Moruca sub-district were Father's Beach, Manawarin, Waramuri, Santa Rosa, Assakata, Warapoka and Three Brothers.
[3] The villages in the Mabaruma sub-district were Mabaruma, Aruka Mouth, Morawhanna, Smith's Creek, Almond Beach and Imbotero.

Access to essential social services are also not easily available in most communities. For example, given the small population, there are no functional schools or health care facilities on Father's Beach. In most other communities, health care is provided by Health Posts which are staffed by community health workers. These facilities are only capable of treating minor illnesses or injuries. Serious medical conditions are referred to regional hospitals in Santa Rosa (for most communities in the Moruca sub-district) and Mabaruma (for communities in the Mabaruma sub-district). In addition, access to education is a challenge. Several communities have only nursey or primary level schools thereby requiring students to travel to Santa Rosa or Mabaruma for higher secondary education and the opportunity to sit the CSEC examinations. Some schools are overcrowded, as reported in Manawarin and Imbotero, and others are in dilapidated as also reported in Imbotero.

In Region 1, only three of the villages included in the Study (Father's Beach, Almond Beach and Three Brothers) were located along the shoreline. There are no hard sea defence structures in these villages and natural features, mainly mangroves and shell beaches, were the main types of shoreline protection. In Father's Beach and Three Brothers, earthen dams were constructed to emploder the residential areas and cultivated lands. In the former, blue crabs (locally called 'bundari' crabs) burrow into dams and undermine their integrity. In the latter, persistent heavy rains in combination with spring tides caused frequent overtopping and washing away of the dams. In addition, significant erosion is reported in Father's Beach and Almond Beach. In Father's Beach, emergency emplodering works led by the villagers have slowed the rate of erosion and saline intrusion into the village and its cultivated lands.

Erosion was much more severe at Almond Beach. The rate of erosion required the closure of the primary school at Almond Beach. Livelihoods, particularly crop cultivation, were decimated and large swathes of coconut plantations were washed away. Approximately, three years prior, coconut cultivation was one of the main livelihood activities in this village and water coconuts were being exported to Trinidad and Tobago. Since ESS-1, the population of the community has been halved and only three households remain. Most residents and the regional administration believe that total resettlement of this community will be inevitable. Accordingly, the Regional Democratic Council (RDC) has identified Khan's Hill in Mabaruma for the resettlement of residents from Almond Beach.

Although the other 10 villages studies are not located along the shoreline, they have also experienced flooding which has impacted the ecosystem services from which they benefit in their village. Most of the communities in the Moruca sub-district are located on highlands and thus, flooding of cultivated lands and other areas of the village was associated with heavy and unseasonal rainfall over the last two to three years. By contrast, most communities in the Mabaruma sub-district (and Three Brothers from the Moruca sub-district) are located on river banks and therefore, are exposed to flooding from tidal influences and from heavy rainfall. Most of these communities have been empoldered via the creation of earthen dams to protect them from fluvial flooding. In some cases, like Morawhanna, flood risk is amplified by poor internal drainage systems which are shallow and do not have sluices to control water inflow. In the previous two to three years, the combined effect of heavy rainfall and spring tides has caused flooding in these communities and significantly affected crop cultivation.

4.3 Ecosystem Services

Based on the findings of the assessment, provisioning services were the predominant ecosystem service in all villages and most of the provisioning services were of *Critical Priority*. Cultural services, regulating services and supporting services were significantly less intensive. Supporting services are intermediate ecological outcomes that are not directly used, but rather support other ecosystem services. The service "Habitat Provision" is typically an exception, which is sometimes valued as an "end-use" service by stakeholders in addition to its supporting role. Therefore, there is typically a relatively low prevalence of supporting services.

A common group of provisioning services were reported in all villages. Aquatic transportation is the main mode of transportation in Region 1. Most villages are accessible from outside of the Region and among communities only by boat. In villages where the settlements are dispersed, like Manawarin, Santa Rosa, Imbotero and Mabaruma, boats are also required for transportation around the village (Figure 4-1). Crop cultivation was prevalent in all villages. Cassava and ground provisions were the most commonly cultivated crops. In all titled villages and some of the other communities, each household was allotted between 1 to 5 acres of land for crop cultivation. Traditional practices of shifting agriculture (slash and burn) were still the main form of agriculture but many villages reported that heavy rains adversely impacted this practice. Livestock rearing, particularly for poultry and eggs, is developing in all villages surveyed.

Figure 4-1: Small Motor Boat Transporting Students to School in Santa Rosa (Left) and Canoe to Travel within Manawarin (Right)

Fishing was also reported in all villages. In the Moruca sub-district, mostly freshwater fishing was practiced. All households in these villages fished in nearby rivers and creeks for sustenance and a few persons engaged in commercial freshwater fishing. Marine fisheries in the Moruca sub-district is not common and only few persons are regularly engaged in this activity. One of the main reasons for this is the high investment required for fishing at sea foremost, among which is the cost of fuel and the unavailability of ice.

By contrast, in the Mabaruma sub-district, most of the commercial fishing is done at sea with a cluster of activity around Waini Point. Several fishing huts have been established at Waini Point to be used by fisherfolk during multi-day fishing trips (Figure 4-2). Large fishing vessels (trawlers) from Venezuela and Guyana also fish at Waini Point (Figure 4-3). Freshwater fishing is limited in the Mabaruma sub-district because of the frequent movement of large vessels and reported pollution of freshwater bodies. However, communities in Smith's Creek, Imbotero and Almond Beach still conducted freshwater fishing in creeks located within their villages.

Figure 4-2: One of the Fishing Huts Established at Sea in Waini Point

Figure 4-3: Large Fishing Vessels in Waini Point

Crabbing was also common in all villages for livelihoods, sustenance and recreation. In the Moruca sub-district, crabbing occurred only seasonally in all villages even those like Father's Beach and Three Brothers that are located along the shoreline. On the other hand, all communities in the Mabaruma sub-district are engaged in crabbing throughout the year for livelihoods and for sustenance. In some communities, like Imbotero, up to six different species of crabs are caught.

All villages maintain some traditional practices, the most common of which were the use of traditional medicines (made from plants) and making crafts. In Imbotero, the two main reasons for suggested for the use of traditional medicines. Firstly, many locals believe on the efficacy of these medicines. Secondly, cost constraints limited access to pharmaceuticals particularly the high costs for some drugs and the high costs of fuel (for transportation) to attend Government clinics. Residents of several villages also cut cabbage stems (manicole palms) for sale to the Amazon Caribbean Guyana Limited (AMCAR) company on a freelance basis. In all villages, locals stressed that this was dangerous and challenging work.

Hunting and trapping was reported in several villages. Hunting for wild meat is principally done for sustenance although, in some villages, surplus may be sold. In addition, trapping wildlife for trade is common in several villages. Wildlife trade is on the decline in the Moruca sub-district and previously, most of the trade occurred in Santa Rosa. However, in 2018, the Santa Rosa Village Council banned

wildlife trade in the village market requiring traders to travel to directly to other villages to purchase wildlife. In the Mabaruma sub-district, wildlife trapping and trade continues and at least three wildlife buyers are active in this area. Most wildlife is exported to Georgetown.

The most common cultural services identified was the value placed on ecotourism both if a well-developed product exists, as in the case of Warapoka, or whether work is on-going to develop ecotourism as in Waramuri, Santa Rosa, Assakata and Mabaruma. Archaeological sites are also available in several villages in the Moruca sub-district including shell mounds in Waramuri and Warapoka. The large shell mound in Waramuri and the Warapoka Guest House are shown in Figure 4-4.

Figure 4-4: Shell Mound in Waramuri (Left) and Guest House in Warapoka (Right)

The most common regulating services identified included shoreline and riverine protection and erosion regulation from mangroves and other types of vegetation. Some villages have standing hardwood forests which may also sequester carbon and support global climate regulation. The only supporting service identified was primary productivity and the provision of habitats.

4.4 Detailed Findings

Detailed information on all ecosystem services scoped in for the Study Area are listed by CDC/VC/TC and provided in the scoping tables located in Appendix B.

Figure 4-5 shows the ecosystem service locations, by type, identified by the Region 1 village leaders and villagers during the engagement process and which were mapped during the field observations. They are displayed by ecosystem service (color of symbol) and priority (size of symbol) — *Critical, High, Medium, or Low*. Detailed maps by are provided in the Coastal Mapping map book (separate from this report).

Figure 4-6 shows a heat map for priority ecosystem services – rated to be of *Critical* or *High Priority* – in Region 1.

Figure 4-5: Ecosystem Services in Region 1

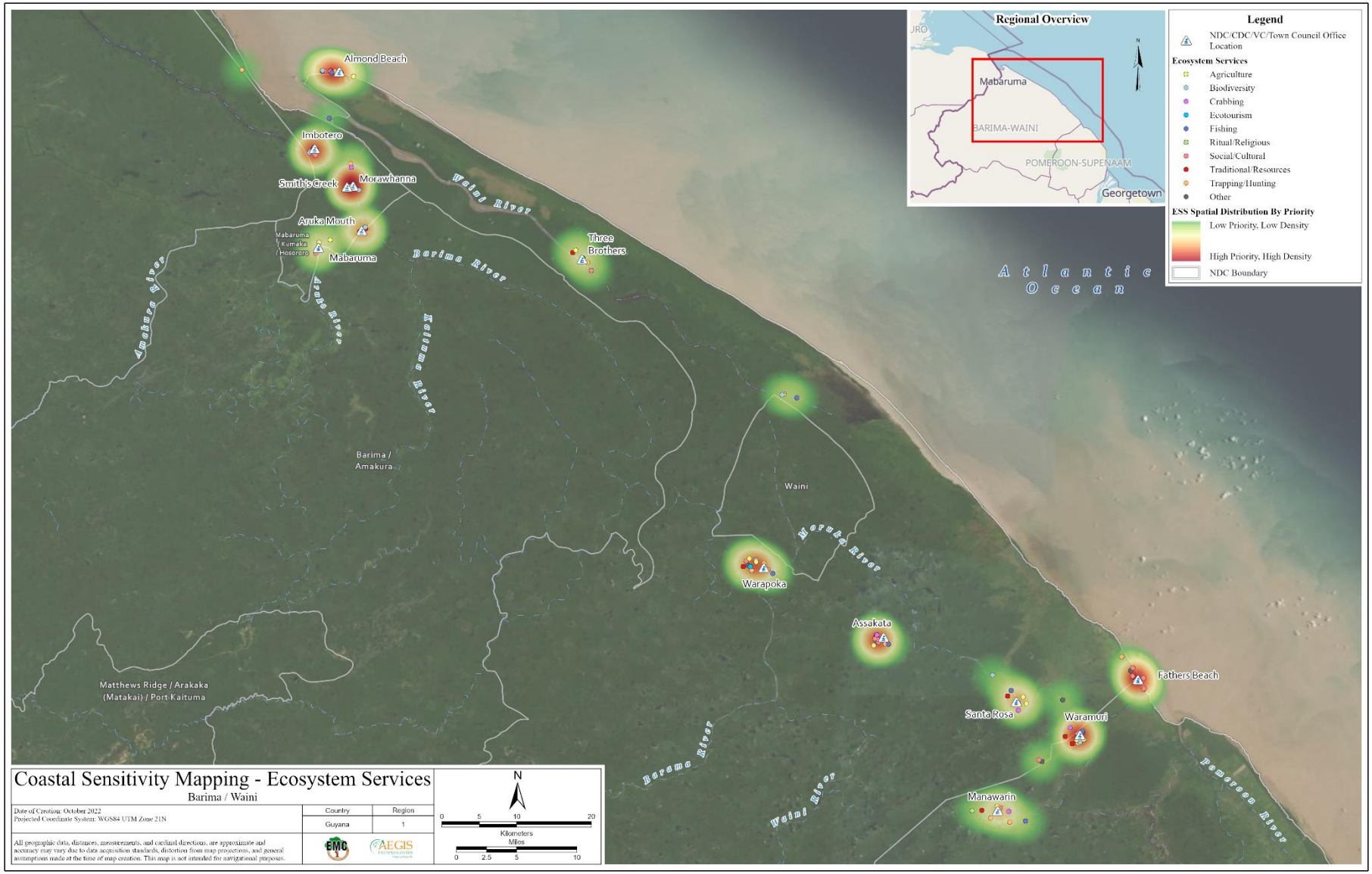


Figure 4-6: Heat Map of Ecosystem Services in Region 1

5.0 REGION 2 COASTAL ECOSYSTEM SERVICES STUDY FINDINGS

5.1 Population Estimates

Population estimates are based upon data provided by NDC leadership during the ecosystem services-related engagements. The exception is the population of the Nile/Cozier NDC, Kitty/Providence NDC and the Moruka/Phoenix Park NDC which were informed by the 2012 National Census.

Table 5-1: Population Estimates for Region 2

NDC Name	Population Estimate
Charity/Urasara NDC	7,800
Nile/Cozier NDC	1,299
Kitty/Providence NDC	367
Moruka/Phoenix Park	1,644
Evergreen/Paradise NDC	7,500
Anna Regina Town Council	19,000
Aberdeen/Zorg-en-Vlygt	7,870
Annadale/Riverstown	10,400
Good Hope/Pomona	5,540

5.2 Overview of Findings

The immediate coastal area of Region 2 is below sea level. Some sections of the shoreline are protected only by natural features (mangroves) such as the entire shoreline of the NDCs for Charity/Urasara, Nile/Cozier, Kitty/Providence and Moruka/Phoenix Park. Other natural features were also reported to provide shoreline protection in the Good/Hope Pomona where local stakeholders reported that Tiger Island, which is located east of the Essequibo Coast, buffers the intensity with which waves hit the shoreline thereby reducing erosion and flood risks. In some districts, only hard sea defence structures protect the shoreline such as the Annadale/Riverstown NDC. In most districts, the shoreline is protected by alternating, non-contiguous sections of either mangroves or hard structures. There are few instances, such as in some sections of the Anna Regina Town Council, which hard structures and natural features occur in complement of each other. Generally, the coupling of natural and hard shoreline features are the result of restoration efforts led by NAREI to plant mangroves in nearshore areas adjacent to sea defence structures.

Drainage of the coastland is facilitated via kokers (outfalls) which are opened during low tides for the release of fresh water into the Atlantic Ocean. At several locations, large pump stations have been constructed to augment drainage and to allow discharges during high tide periods. Throughout most of the Essequibo Coast, the vast majority of commercial and residential activities are concentrated in the Study Area. Cultural services such as recreational and religious uses of the shoreline are also common, depending on accessibility and mangrove density. Places of worship (churches, temples and mosques) are located in all districts and several of these are immediately adjacent to the shoreline. In addition, most districts in Region 2 contain social services and utilities including public schools and community sports grounds. In particular, in Anna Regina, there are three sports grounds which are located immediately adjacent to the shoreline. Several of the districts also have water wells managed by the Guyana Water Inc. and hospitals or health centres. The exception to the concentration of residential and commercial activities in immediate coastal areas are the NDCs which are located along the Pomeroon River as well as a section of the Evergreen/Paradise NDC where all residential and commercial areas are located farther inland.

In recent years, there has been a proliferation of mangroves along most of the Region 2 shoreline both by natural generation and by restoration efforts led by NAREI. Mangrove restoration led by NAREI is continuing in 2022 and there are plans to install bamboo groynes[4] along the shoreline of Better Success (Evergreen/Paradise NDC) and Columbia (Aberdeen/Zorg-en-Vlygt NDC) just north-east of hard structures. Mangroves significantly influenced the relationship between local communities and the natural environment in the Study Area. Specifically, the following impacts of mangrove proliferation on ecosystem system services in the Study Area were widely reported by local stakeholders:

- There has been a significant increase in crabbing in all NDCs (except in the Annadale/Riverstown NDC and the Good Hope/Pomona NDC) due to increased demand and concomitant higher prices for crabs and crab meat. In particular, demand has risen in local markets as well as in markets in other parts of Guyana such as Parika (Region 3) and Georgetown (Region 4). Export markets typically outcompete the local markets because of the prices obtained. Currently, crabbing is the primary livelihood activity for several persons throughout the year in most districts. During the July to September crab season, hundreds of persons are reported to engage in crabbing for sale, sustenance and recreation. The only district where no crabbing activities were reported was the Annadale/Riverstown NDC and this was due to there being no mangroves along the shoreline of that district.

- Hunting/trapping in mangroves has increased in all NDCs with the exception of the Annadale/Riverstown NDC (where there are no mangroves). In ESS-1, the species typically hunted were iguanas and wild birds. These species are still hunted by local communities. However, most stakeholders also reported that large mammals such as labba, watrush, acouri and bush turkey among others, are frequently captured in the mangroves and this is related to the increased density of mangroves along the shoreline.

- There have been disruptions to the operations of landing sites for artisanal fishing boats due to mangrove proliferation and the accretion of expansive mudflats. Mangroves either cause siltation or overgrown channels to kokers or nearshore areas where fishing boats dock. According to feedback provided by local stakeholders, mud accretion and proliferation at the Sparta landing site stopped its use approximately five years ago. In addition, fewer vessels land at Anna Regina because of mangrove proliferation. These vessels have all relocated to the Hampton Court/Windsor Castle landing site.

- There has been a significant reduction in the use of shoreline areas for local recreational or religious purposes in several districts with the greatest disruptions being reported in the Anna Regina Town Council. Local stakeholders indicated that mangroves present several safety and security concerns including disturbance from pests (mosquitoes and sandflies) and petty criminals who reportedly conceal themselves in mangroves to ambush passers-by. According to the NDCs, residents illegally dump garbage over the sea wall and rubbish is trapped by the mangroves resulting in poor sanitation and malodours. This has caused inconvenience and also incurs expenses for residents who have to travel to other districts to access cultural services.

Fishing activities occurred with reduced intensity at several other landing sites including Three Friends (Anna Regina Municipality), Capoey and La Union (Aberdeen/Zorg-en-Vlygt NDC), and Riverstown (Annadale/Riverstown NDC). The reduction in use was unrelated to mangrove proliferation but the reasons for the declines were not known by the local stakeholders with whom the team engaged. At Riverstown, the presumed reason for fewer fishing vessels using the landing site was the operation of a cargo wharf for construction materials (sand and aggregate) on the opposite bank of the canal. Local

[4] A groyne is a rigid hydraulic structure built perpendicularly from a shoreline or river bank interrupting water flow and limiting the movement of sediment.

stakeholders in several districts also reported that fisherfolk report persistent low catches which has impacted fishing activities in Region 2 and resulted in significant economic hardships. Moreover, in some NDCs such as the Charity/Urasara NDC and the Aberdeen/Riverstown NDC, increased squatting on sea defence reserves were reported. In both instances, the squatters were Venezuelan migrants. Both NDCs have port areas where migrants are reported to enter namely, the Charity waterfront area (Charity/Urasara) and the Uno Creek at Abram's Zuil (Aberdeen/Riverstown). Local stakeholders reported that the squatters lived in poor sanitary conditions, and without amenities such as electricity and running water.

According to local stakeholders, the COVID-19 pandemic did not significantly impact ecosystem services. In some NDCs, economic hardships associated with the COVID-19 pandemic led to decreased revenue streams as constituents were unable to pay rates and due to COVID-19 economic challenges. In districts where there were markets, reduced commercial activities resulting from the COVID-19 lockdowns also impacted vendors' capacities to pay market fees to the NDCs which also reduced revenue streams.

Based on changes of habitats along the shoreline of the Study Area in combination with the COVID-19 pandemic, there has been a discernable increase in the intensity with which local communities use the natural environment in the Study Area for provisioning services and a slight decline in intensity of socio-cultural uses in some districts since ESS-1.

5.3 Ecosystem Services

Provisioning services were the primary service accounting for approximately 71 percent of the ecosystem services identified. Cultural services and regulating services were the second and third most prevalent ecosystem service, representing approximately 13 percent and 11 percent of the services identified respectively. Supporting services are intermediate ecological outcomes that are not directly used, but rather support other ecosystem services and only 5 percent of the services identified were the supporting services of primary productivity and habitat provision. Figure 5-1 summarizes the distribution of identified ecosystem services across the four ecosystem service categories.

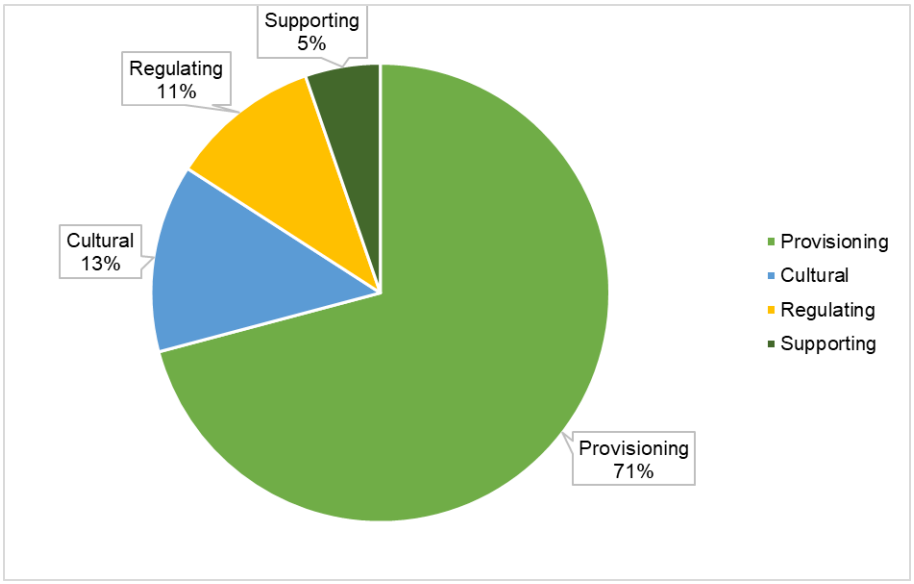


Figure 5-1: Distribution of Ecosystem Services Categories in Region 2

The most common provisioning services identified were socio/economic activities including the use of the Study Area for housing including both regulated and informal housing (squatting), and commercial activities. Several socio/economic services were located in Charity/Urasara and the Good Hope/Pomona NDC via the operation of several ports/wharf for trade of goods, produce and fuel. Overall, socio/economic services accounted for 17 percent of all services. Fishing and crabbing were the second and third most common accounting for 15 percent and 13 percent of all services respectively. Most fishing and crabbing activities were for commercial sale. In most districts, crabbing increased significantly since ESS-1 and this is associated with the proliferation of mangroves along the shoreline.

The provisioning services of significantly lower intensity were crop cultivation, livestock farming, and trapping/hunting in mangroves for sale or subsistence. Aquatic transportation is a *Critical Priority* service for Region 2 as this is the primary mode of transportation between the Essequibo Coast and other regions of Guyana. However, it also occurred with low intensity across the region as ports are located only in the Charity/Urasara NDC and the Good Hope/Pomona NDC. Harvesting of bamboo (non-fiber wood) was reported on in the Charity/Urasara NDC while apiculture (honey collection from wild bee hives) was reported only in the Anna Regina municipality.

The most common cultural services identified included the value placed on the Study Area for tourism/recreational purposes. The use of the shoreline and immediate coastal area for prayer services was also common. The most common regulating services identified included shoreline protection and the role of mangroves in protecting crops, buildings, recreation areas from waves, wind and flooding and erosion protection and the role of vegetation in regulating erosion on slopes. The only supporting service identified was primary productivity and the provision of habitats. Figure 5-2 summarizes the distribution of ecosystem service types across the categories.

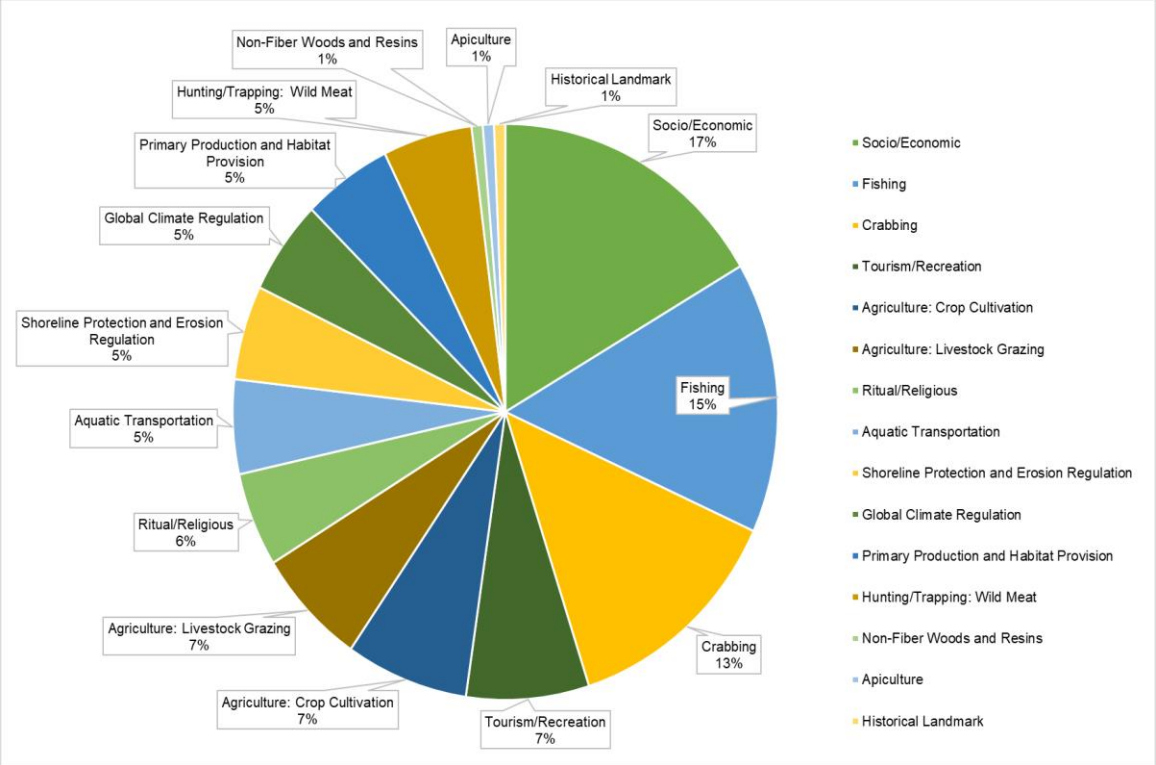


Figure 5-2: Distribution of Ecosystem Service Types in Region 2

The priority rankings for ecosystems services for Region 2 indicated that most services were of *Critical Priority*. Ecosystem services of *Critical Priority* accounted for 36 percent of all services while those of *High Priority* accounted for 15 percent of all services. Services of *Medium Priority* were the second most intensely reported accounting for 32 percent of all services. The remaining 17 percent of services were of *Low Priority.* Figure 5-3 shows the distribution of priority rankings for ecosystem services.

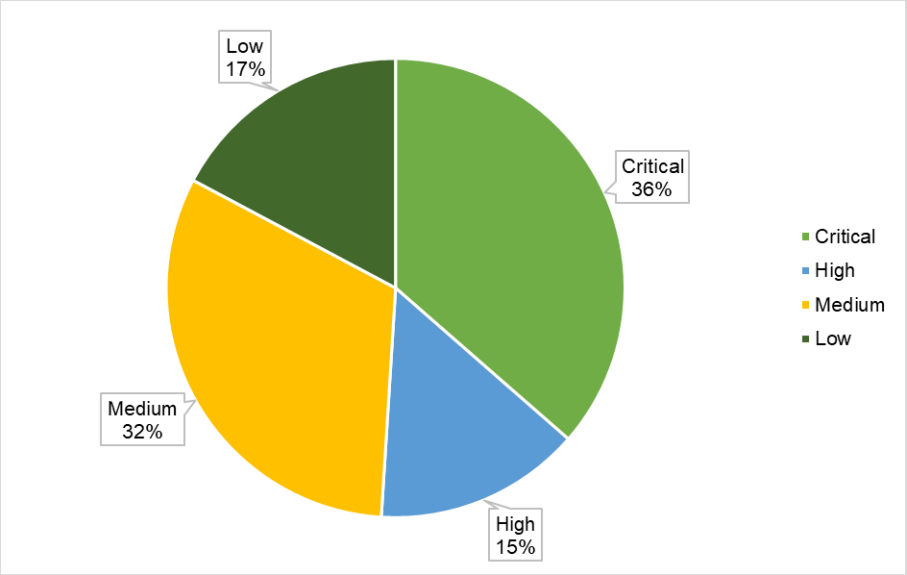


Figure 5-3: Distribution of Priority Rankings for Ecosystem Services in Region 2

5.4 Detailed Findings

Detailed information on all ecosystem services scoped in for the Study Area are listed for each NDC and TC in Region 2 and provided in the scoping tables located in Appendix B.

Figure 5-4 shows the ecosystem service locations, by type, identified by the local stakeholders in Region 2 during the engagement process and which were mapped during the field observations. They are displayed by ecosystem service (color of symbol) and priority (size of symbol) — *Critical, High, Medium, or Low*. Detailed maps by are provided in the Coastal Mapping map book (separate from this report).

Figure 5-5 shows a heat map for priority ecosystem services – rated to be of *Critical* or *High Priority* – along the shoreline of Region 2.

Figure 5-4: Ecosystem Services in Region 1

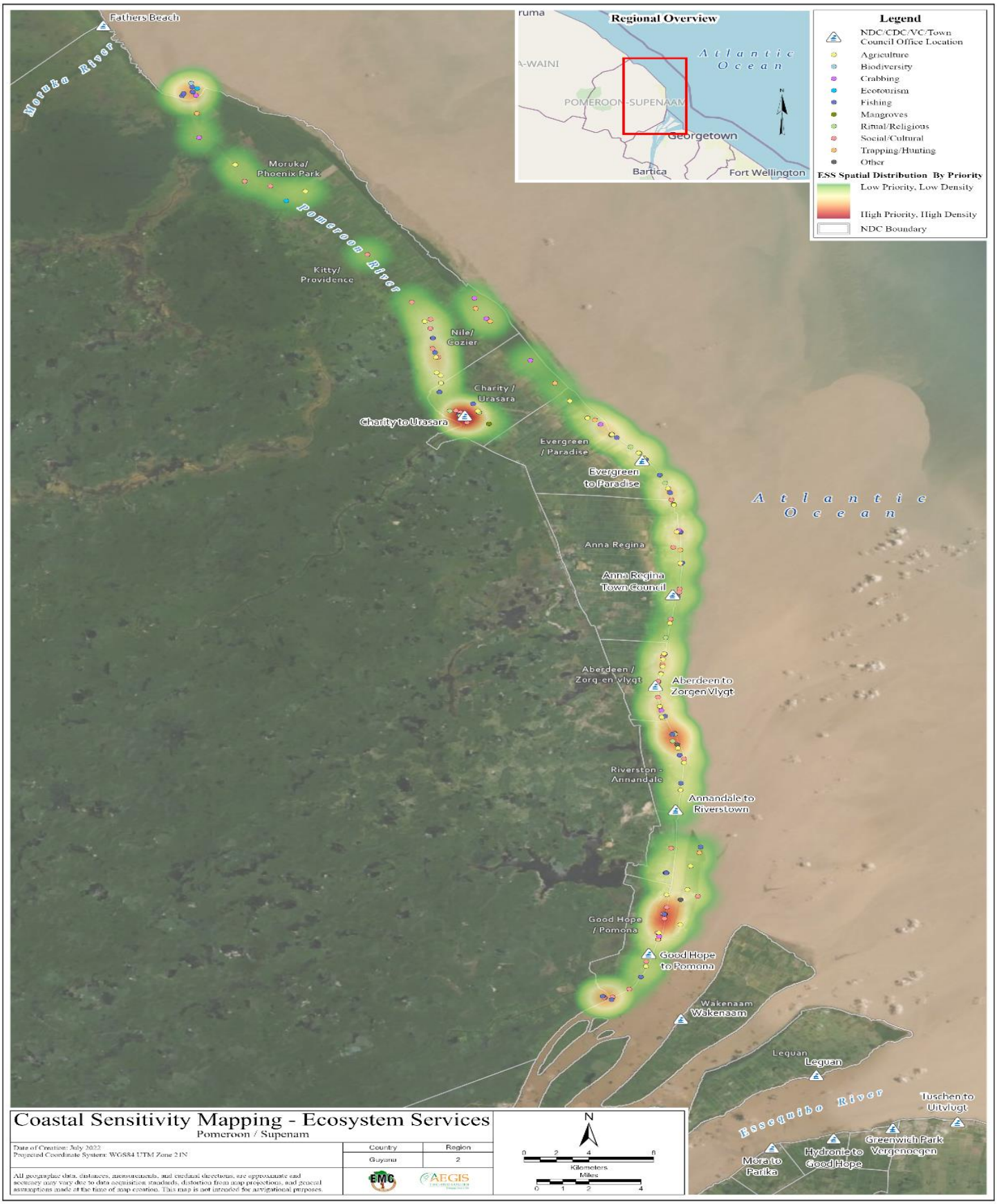


Figure 5-6: Heat Map of Ecosystem Services in Region 1

6.0 REGION 3 COASTAL ECOSYSTEM SERVICES STUDY FINDINGS

6.1 Population Estimates

Population estimates are based upon data provided by NDC leadership during the ecosystem services-related engagements.

Table 6-1: Population Estimates for Region 3

NDC Name	Population Estimate
Wakenaam	3,200
Leguan	2,500
Parika/Mora	15,000
Hydronie/Good Hope	4,445
Greenwich Park/Vergenoegen	12,000
Tuschen/Uitvlugt	More than 30,000
Stewartville/Cornelia Ida	30,000
Hague/Den Amstel	4,200
La Jalousie/Novelle Flanders	10,000
Best/Klien Pouderoyen	34,800

6.2 Overview of Findings

Generally, the immediate coastal area of Region 3, including the Essequibo islands, is below sea level and the majority of the shoreline is protected by approximately hard sea defence structures including sea walls, rip raps and jetties. Drainage of the coastlands is facilitated via kokers (outfalls) which are opened during low tides to the release fresh water into the Atlantic Ocean. At several locations, large pump stations have been constructed to augment drainage and to allow discharges during high tide periods. In most areas in Region 3, the immediate coastal area south of the sea defence structures are used for housing and commercial activities. Cultural services such as recreational and religious uses are also common in these areas. Places of worship (churches, temples and mosques) are located in all districts but few are immediately adjacent to the shoreline. In addition, most districts in Region 3 contain social services and utilities including public schools and community sports grounds. Several of the districts also have water wells managed by the Guyana Water Inc. and hospitals or health centres.

Generally, mangrove cover along the shoreline in this region is limited and is found principally in three districts, namely, Wakenaam NDC, Leguan NDC and the Best/Klien Pouderoyen NDC. Generally, these were the main districts where provisioning services that are typically associated with mangrove cover, such as crabbing and hunting, were reported by local stakeholders. These were the only districts where the regulating and supporting services were identified because these are associated with the role mangroves play in global climate regulation, erosion regulation, shoreline protection and habitat provision. Significant shoreline erosion and mangrove cover loss were reported on the western boundary of both Essequibo River islands and Government projects to construct hard sea defence structures are ongoing along sections of the shoreline in both islands. In Wakenaam, local stakeholders shared the belief that the draft produced by large vessels, including the ferry, was the primary cause of the erosion.

Shoreline erosion in Wakenaam and Leguan has impacted cultural services on the island. On Wakenaam, the beach at Wakenaam Point, one of the two beaches which were used for recreation in ESS-1, has eroded and is no longer used by locals. On Leguan, the beach at Uniform is eroding and in ESS-1, this beach was used as a cremation site and was also for recreation. According to the

Leguan NDC, the Uniform beach is no longer used for recreation and an alternative site for cremations is being developed. The impact of erosion on cultural services on these islands were varied. On Wakenaam, there was only one alternative beach which is accessed via an earthen dam that is in poor condition with the result of the beach being rarely used. On Leguan, there were three alternative beaches on the eastern boundary of that were regularly used by local communities for both religious and recreational purposes. On the mainland of Region 3, limited mangrove cover allowed ease of access to shoreline area for cultural services including religious and recreational uses. Moreover, on the mainland of Region 3, the shoreline area of all districts (except the Mora/Parika NDC) were regularly used for these purposes.

On Wakenaam and Leguan, freshwater from the Essequibo River was inlet into canals that are used for irrigation of agricultural lands and livestock watering. Some households also use this freshwater to support gardening. Although several other districts are bordered by the Essequibo River, the only other use of freshwater from the river occurs in the Parika/Mora NDC where informal housing settlements (squatters) collect freshwater for household purposes like cleaning, washing and bathing. However, in Wakenaam and Leguan, inletting freshwater also supports vibrant coastal fisheries on the islands where freshwater species are caught in canals for sustenance and sale. Coastal fisheries were not reported in the Study Area on the Region 3 mainland.

Agriculture, both crop cultivation and livestock grazing, are important livelihood activities on Wakenaam and Leguan. On the mainland, livestock grazing occurred in most districts but was typically small-scale whereas crop cultivation on sea dams and reserves was rarely reported or observed during ground verifications. Moreover, on the mainland, there were few agricultural lands located in proximity to the shoreline with the exception being the La Jalousie/Nouvelle Flanders NDC where rice fields were located in the Study Area.

According to local stakeholders, the COVID-19 pandemic did not significantly impact ecosystem services. The primary adverse impacts pertained to the use of the shoreline area for recreational purposes. This was most prominent at the Bushy Park Beach (Hydronie/Good Hope NDC) where there were large gatherings on weekends and national holidays but activities at the beach as returning to the pre-pandemic norm.

There has not been a discernable change in either the types of ecosystem services from which local communities benefit or the intensity with which they are uses since ESS-1. However, commercial and industrial developments in the Best/Klien Pouderoyen NDC, namely the establishment of a new shore base facility, may result in significant changes in ecosystem services in this district in the near future.

6.3 Ecosystem Services

Provisioning services were the primary service accounting for 73 percent of the ecosystem services identified. Cultural services were the second most prevalent ecosystem service. Given the absence of mangroves from the shoreline of this Region, regulating and supporting services were relatively low and each represented only 6 percent of the services identified. Figure 6-1 summarizes the distribution of identified ecosystem services across the four ecosystem service categories.

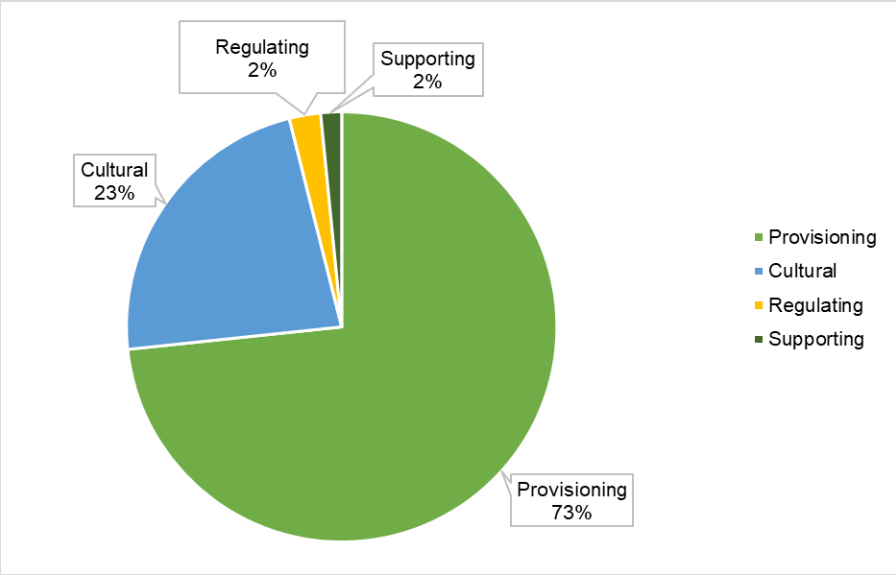


Figure 6-1: Distribution of Ecosystem Services Categories in Region 3

The most common provisioning services identified were socio/economic activities including the use of the Study Area for housing including informal housing (squatting). Several socio/economic services were located in the Parika/Mora NDC and the Best/Klien Pouderyen NDC associated with operations of wharfs that facilitate movement of cargo and docking of vessels, as well as sawmills that used rivers to transport. Aquatic transportation for passenger commute were also important socio/economic services in this region to facilitate transportation of people and cargo to Wakenaam (Figure 6-2 [Left]) and Leguan. Moreover, the Parika Stelling is one of the main hubs for aquatic transportation to several destinations throughout the country (Figure 6-2 [Right]) and the Vreed-en-Hoop Stelling is used by thousands of commuters daily. Fishing was the second most commonly reported provisioning service and occurred in all districts. Most fishing activities were for commercial sale. Fishing activities at two of the larger landing sites in the Region, both located in the Tuschen/Uitvlugt NDC, are shown in Figure 6-3. The provisioning services of significantly lower intensity were livestock grazing, crop cultivation, crabbing and trapping/hunting of birds and iguanas in mangroves for sale or subsistence.

Figure 6-2: Aquatic Transportation for Passenger Commute in Wakenaam (Left) and Parika (Right)

Figure 6-3: Fishing Landing Site at the Boeraserie Canal (Left) and Shrimp Processing at the Zeeburg Seawall (Right)

The most common cultural services identified included the value placed on shoreline area for use for religious and recreational purposes. In addition, the use of sea walls for local tourism and recreation was also common. The Bushy Park Beach located in the Hydronie/Good Hope NDC is one of the most popular sites on Region 3 for recreational purposes and according to local stakeholders, weekend parties were common prior to the COVID-19 pandemic. Religious tourism also occurred to Leguan and to the Parika/Mora NDC by Hindu communities from across the country who visited to worship at the large murtis (statues) of the deity, Lord Hanuman. In addition, the Bushy Park Beach was widely used by local Hindu communities throughout the Region 3 mainland for religious and ritual purposes (Figure 6-4 [Left]). Moreover, in Leguan, the historic St. Peter's Anglican Church is a national heritage site and is also a main tourism attraction on the island (Figure 6-4 [Right]).

Figure 6-4: Hindu Ritual and Religious Activities at the Bushy Park Beach (Left) and the St. Peter's Anglican Church (Right)

Regulating services identified included shoreline protection and the role of mangroves in protecting crops, buildings, recreation areas from waves, wind and flooding and erosion protection and the role of vegetation in regulating erosion. The only supporting service identified was primary productivity and the provision of habitats. Figure 6-5 summarizes the distribution of ecosystem service types across the categories.

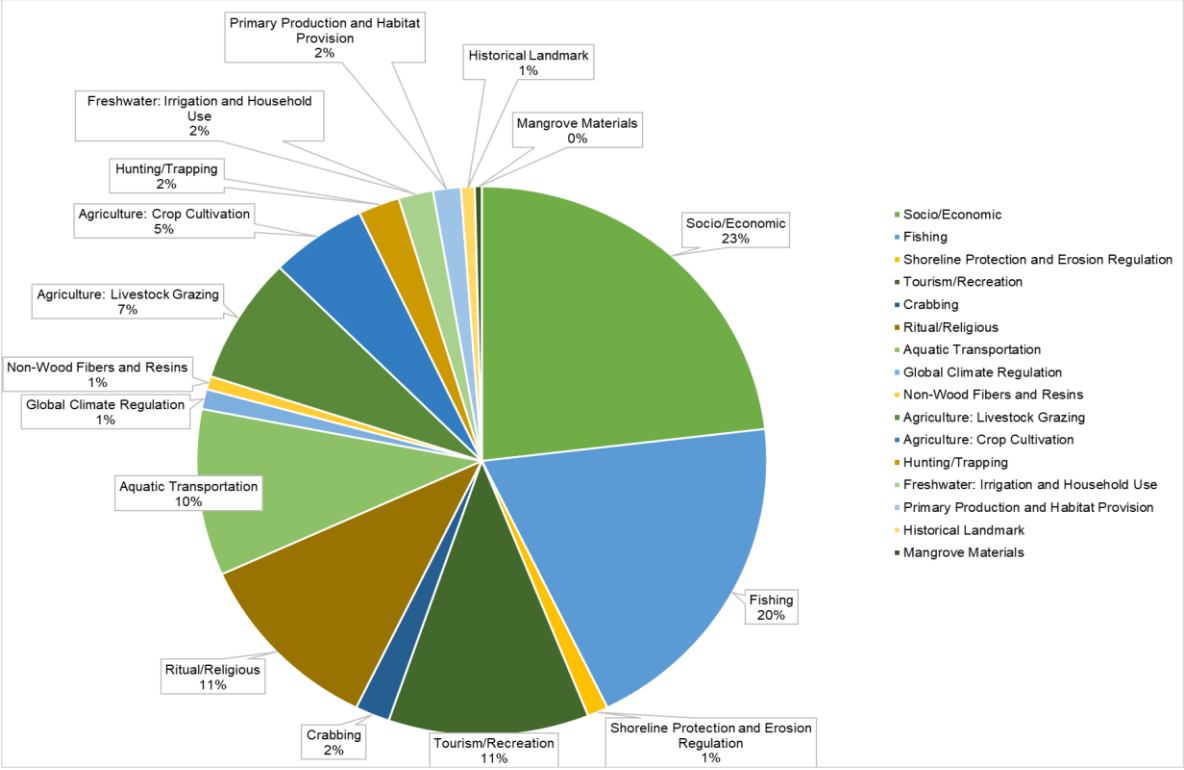


Figure 6-5: Distribution of Ecosystem Service Types in Region 3

The priority rankings for ecosystems services were relatively evenly distributed for Region 3. Ecosystem services of *Critical Priority* accounted for 26 percent of all services while ecosystem services of *High Priority* accounted for 18 percent of all services. An equal number of services were of *Medium Priority* or *Low Priority*, each representing 28 percent of all services reported. Figure 6-6 shows the distribution of priority rankings for ecosystem services.

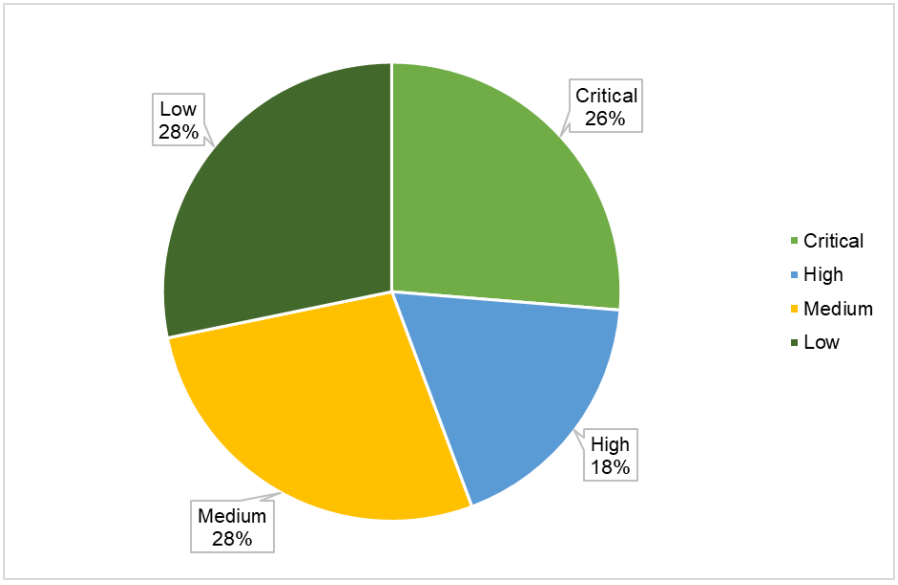


Figure 6-6: Distribution of Priority Rankings for Ecosystem Services in Region 3

6.4 Detailed Findings

Detailed information on all ecosystem services scoped in for the Study Area are listed for each NDC in Region 3 and provided in the scoping tables located in Appendix B.

Figure 6-7 shows the ecosystem service locations, by type, identified by the local stakeholders in Region 3 during the engagement process and which were mapped during the field observations. They are displayed by ecosystem service (color of symbol) and priority (size of symbol) — *Critical, High, Medium, or Low*. Detailed maps by are provided in the Coastal Mapping map book (separate from this report).

Figure 6-8 shows a heat map for priority ecosystem services – rated to be of *Critical* or *High Priority* – along the shoreline of Region 3.

Figure 6-4: Ecosystem Services in Region 3

Figure 6-5: Priority Heat Map for Ecosystem Services in Region 3

7.0 REGION 4 COASTAL ECOSYSTEM SERVICES STUDY FINDINGS

7.1 Population Estimates

Population estimates are based upon data provided by NDC leadership during the ecosystem services-related engagements. The exception is the population of Georgetown which was informed by the 2012 National Census.

Table 7-1: Population Estimates for Region 4

NDC Name	Population Estimate
Georgetown	132,000
Industry/Plaisance	25,000
Better Hope/ La Bonne Intention	30,000
Beterverwagting/Triumph	7,000
Mon Repos/ La Reconnaissance	40,000
Buxton/Foulis	7,000
Unity/Vereeniging	13,000
Haslington/Grove	22,000
Enmore/Hope	18,000

7.2 Overview of Findings

Generally, the immediate coastal area of Region 4 is below sea level and is protected by approximately 38 kilometers of hard sea defence structures including sea walls, rip raps and jetties. Drainage of the coastlands is facilitated via kokers (outfalls) which are opened during low tides to the release fresh water into the Atlantic Ocean. At several locations, large pump stations have been constructed to augment drainage during high tide periods. In most areas in Region 4, the immediate coastal area south of the sea defence structures are used for housing and commercial activities. Cultural services such as recreational and religious uses are also common in these areas. Places of worship (churches, temples and mosques) are located in all districts but none are immediately adjacent to the shoreline. In addition, most districts in Region 4 contain social services and utilities including public schools and community sports grounds. Several of the districts also have water wells managed by the Guyana Water Inc. and hospitals or health centres.

In recent years, there has been a proliferation of mangroves along most of the Region 4 shoreline both by natural generation and by restoration efforts led by NAREI. Mangrove restoration by NAREI will continue in 2022 with the installation of geotextile groynes along selected sections of the shoreline. Mangroves grow north of the hard sea defence structures but have significantly influenced the relationship between local communities and the natural environment in the Study Area. Specifically, the following impacts of mangrove proliferation on ecosystem system services in the Study Area were widely reported by local stakeholders in Region 4:

- There are fewer landing sites for fishing boats because of the accretion of expansive mudflats that are characteristic of mangrove growth. These mudflats cause siltation of either the access channels to kokers or the nearshore areas where fishing boats dock. According to feedback provided by stakeholders, landing sites for fishing boats in Montrose, Triumph, Django Town (Mon Repos), Non Pariel and Haslington are no longer operational for this reason. Moreover, the landing site at Strathspey was not operational prior to 2019 (ESS-1) due to mud accumulation. Some of vessels from these landing sites were reported to have relocated to other landing sites like Liliendaal, Ogle, Enmore or Hope Canal while other fisherfolks have sought alternative livelihoods mainly in the agriculture sector.

- There are fewer fisherfolk who use pin seines for fishing in nearshore areas because mangrove proliferation has reduced the accessibility of these fishing grounds. In some NDCs, particularly Buxton/Foulis, marine fisheries have altogether ceased because mangrove proliferation has prevented the use of the Study Area for landing hauls.

- There has been a significant reduction in the use of shoreline areas for local recreational and religious purposes in most districts. Local stakeholders indicated that mangroves present several safety and security concerns including disturbance from pests (mosquitoes and sandflies) and petty criminals who reportedly conceal themselves in mangroves to ambush passers-by. According to the NDCs, residents illegally dump garbage over the sea wall and this becomes trapped in the mangroves resulting in poor sanitation and malodours. Local stakeholders reported seeking out alternative sites in the Region, particularly for religious purposes, including travelling to Georgetown (beach behind the Marriott Hotel or the Kingston sea wall) or to the Unity beach (Mahaica/Vereenging NDC). This has caused inconvenience and also incurs expenses for residents who do not have their own means of transport.

- Although the growth of mangroves has disrupted economic and socio-cultural uses of the Study Area, they have had a significant positive impact in reducing flooding in at least one district surveyed. According to NDC representatives of the Better Hope/La Bonne Intention NDC, the immediate coastal areas in Better Hope, Kersaint Park and La Bonne Intention were regularly flooded during spring tides. Mangroves have prevented the routine recurrence of such events.

According to local stakeholders, the COVID-19 pandemic also impacted ecosystem services. In particular, restrictions on public gatherings hindered recreational uses of sea walls especially on weekends. Ecotourism activities in the Haslington/Grove NDC (birdwatching and mangrove tours at the NAREI Mangrove Reserve) and in the Unity/Vereeniging NDC (tours on Mahaica River for bird watching) also virtually ceased during the pandemic and have not yet returned to the intensity with which they were practiced in ESS-1. In some NDCs, economic hardships associated with the COVID-19 pandemic led to increased squatting on sea dams located in the Study Area. Finally, almost all NDCs reported decreased revenue streams as constituents were unable to pay rates and taxes due to COVID-19 economic challenges.

Based on changes of habitats along the shoreline of the Study Area in combination with the COVID-19 pandemic, there has been a discernable decrease in the intensity with which local communities use the natural environment in the Study Area for economic and socio-cultural purposes since ESS-1.

7.3 Ecosystem Services

Provisioning services were the primary service accounting for 59 percent of the ecosystem services identified. Cultural services and regulating services were the second and third most prevalent, representing approximately 24 percent and 12 percent of the services identified respectively. Only 5 percent of the services identified were the supporting services of primary productivity and habitat provision. Figure 7-1 summarizes the distribution of identified ecosystem services across the four ecosystem service categories.

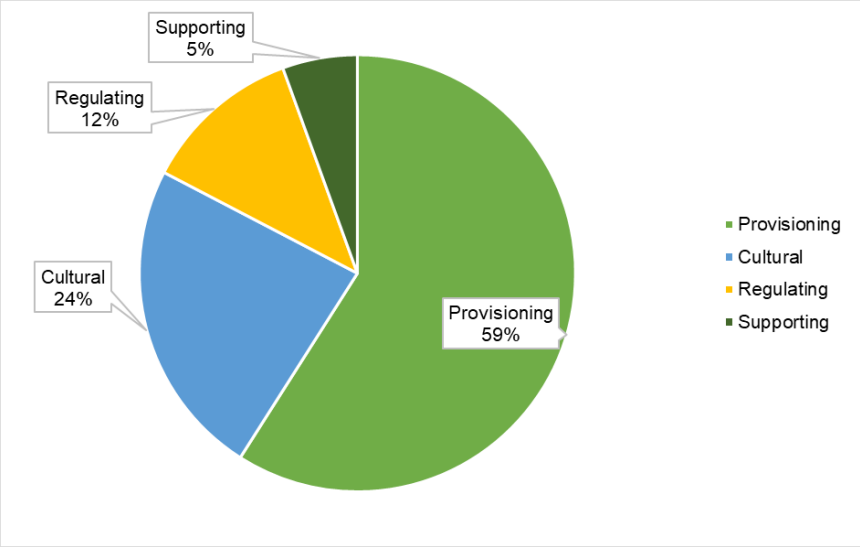


Figure 7-1: Distribution of Ecosystem Services Categories in Region 4

The most common provisioning services identified were socio/economic activities foremost among which was the use of the Study Area for housing including informal housing (squatting). Several socio/economic services were located in Georgetown constituted by operations in the Port of Georgetown by privately operated port facilities used for national and international trade, and to provide services to offshore operations in the oil and gas sector. A section of the Port of Georgetown is shown in Figure 7-2. Aquatic transportation for passenger commute from Regions 1 and 3 were also important socio/economic services in Georgetown. Socio/Economic services were also intensely reported in the Mon Repos/La Reconnaissance NDC with activities pertaining to boat building and repairs, leather tanning using mangrove barks, a heliport and hotel, and coconut packaging enterprises being located in the Study Area.

Figure 7-2: Section of the Port of Georgetown (View from the Vreed-en-Hoop, West Demerara)

Fishing was the second most commonly reported provisioning service and occurred in all districts except the Buxton/Foulis NDC. Most fishing activities were for commercial sale and two landing sites for artisanal vessels are shown in Figure 7-3. In several districts, there was a significant decline in fishing because of the proliferation of mangroves along the shoreline. The provisioning services of

significantly lower intensity were crop cultivation, livestock grazing, crabbing and trapping/hunting of birds and iguanas in mangroves for sale or subsistence.

Figure 7-3: Commercial Fishing Landing Site at Bee Hive (Left) and Fishing for Sustenance and Recreation in Georgetown (Right)

Aquatic transportation was reported only in Georgetown and was associated with ferries that facilitate commute from Georgetown to Region 1 used by thousands of passengers at least monthly, and the daily use of the Georgetown Stelling by thousands of passengers for transportation between Regions 3 and 4 by small privately owned vessels called “speed boats”. Apiculture was practiced in the mangroves only in the Haslington/Grove NDC and harvesting mangroves for firewood and construction poles was reported only in the Unity/Vereeniging NDC.

The most common cultural services identified included the value placed on shoreline area for religious purposes. In addition, the use of sea walls for local tourism and recreation was also common. The use of the sea walls for these religious and recreational significantly decreased in most NDCs due to the proliferation of mangroves along the shoreline. Local communities reportedly sought alterative areas of the Region 4 shoreline in Georgetown or at the Unity beach, particularly for religious purposes.

Figure 7-4: Nooten Zuil Beach Used for Recreation and Religious Purposes

The most common regulating services identified included shoreline protection and the role of mangroves in protecting crops, buildings, recreation areas from waves, wind and flooding and erosion protection and the role of vegetation in regulating erosion on slopes. In addition, as part of the mangrove restoration program, NAREI established a mangrove reserve in the Haslington/Grove NDC (Figure 7-5).

Figure29**7-5: NAREI Mangrove Reserve**

The only supporting -service identified was primary productivity and the provision of habitats. Figure 7-6 summarizes the distribution of ecosystem service types across the categories.

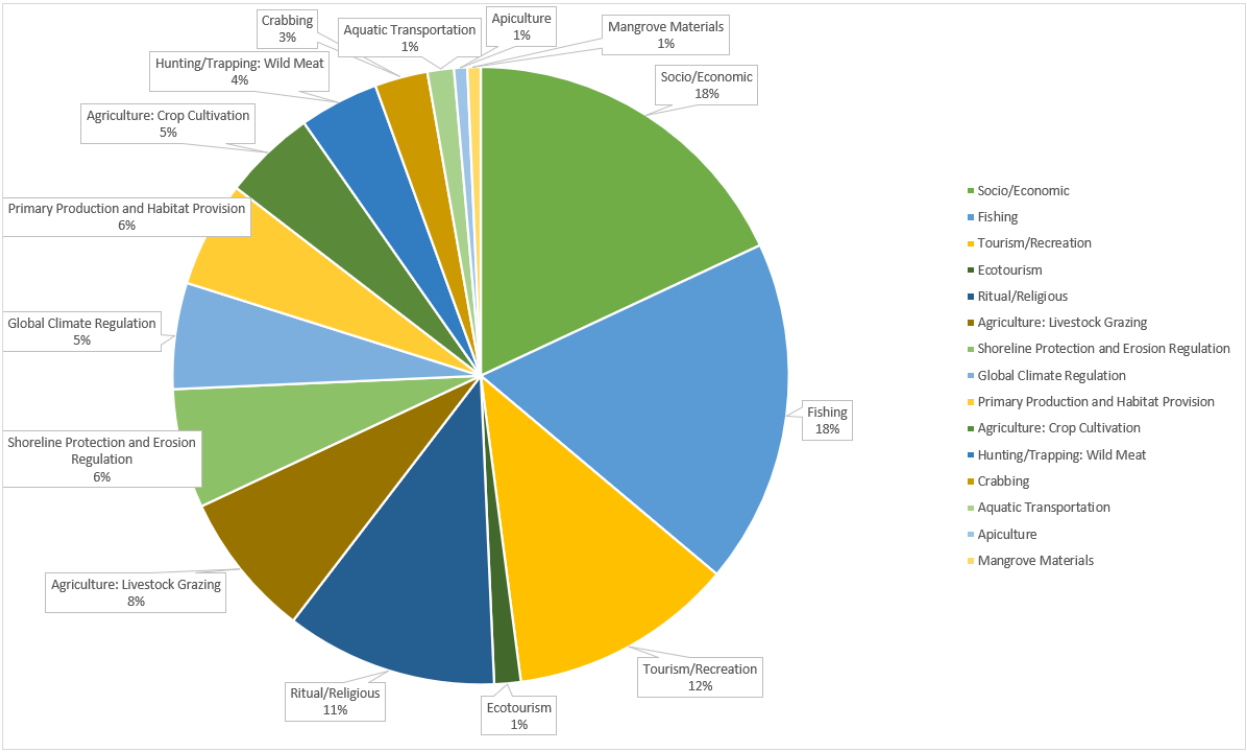


Figure 7-6: Distribution of Ecosystem Service Types in Region 4

The priority rankings for ecosystems services were relatively evenly distributed for Region 4. Ecosystem services of *Critical Priority* accounted for 24 percent of all services while ecosystem services of *High Priority* accounted for 22 percent of all services. An equal number of services were of *Medium Priority* or *Low Priority*, each representing 27 percent of all services reported. Figure 7-7 shows the distribution of priority rankings for ecosystem services.

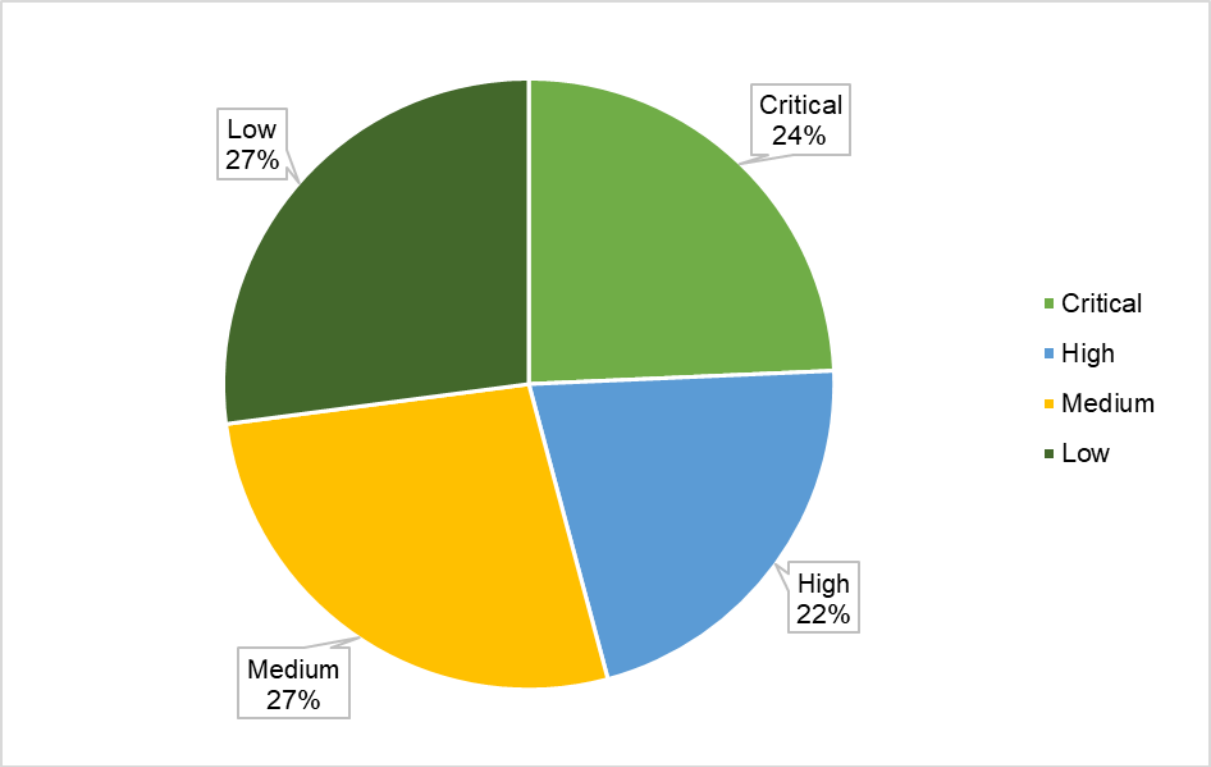


Figure 7-7: Distribution of Priority Rankings for Ecosystem Services in Region 4

7.4 Detailed Findings

Detailed information on all ecosystem services scoped in for the Study Area are listed for each NDC in Region 4 and provided in the scoping tables located in Appendix B.

Figure 7-8 shows the ecosystem service locations, by type, identified by the local stakeholders in Region 4 during the engagement process and which were mapped during the field observations. They are displayed by ecosystem service (color of symbol) and priority (size of symbol) — *Critical, High, Medium, or Low*. Detailed maps by are provided in the Coastal Mapping map book (separate from this report).

Figure 7-9 shows a heat map for priority ecosystem services – rated to be of *Critical* or *High Priority* – along the shoreline of Region 4.

Figure 7-8: Ecosystem Services in Region 4

Figure 7-9: Heat Map of Ecosystem Services in Region 4

8.0 REGION 5 COASTAL ECOSYSTEM SERVICES STUDY FINDINGS

8.1 Population Estimates

Population estimates are based upon data provided by NDC leadership during the ecosystem services-related engagements.

Table 8-1: Population Estimates for Region 5

NDC Name	Population Estimate
Woodlands/Farm	7,000
Mahaicony/Abary	7,000
Profit/Rising Sun	8,000
Seafield/Tempie	5,000
Union/Naarstigheid	15,000
Bath/Woodley Park	18,000
Woodlands/Bel Air	1,264
Zeelust/Rosignol	15,000

8.2 Overview of Findings

Generally, the immediate coastal area of Region 5 is below sea level. The primary forms of shoreline defence are typically mangroves which are supported by earthen sea dams that are established immediately inland. Large canals run in an east-west orientation parallel to the shoreline of the entire Region. In three most easterly NDCs (Woodlands/Farm, Mahaicony/Abary and Profit/Rising Sun), this canal is called the Bellamy Canal. The boundaries of these three districts are three major river systems namely, the Mahaica River, the Mahaicony River and the Abary River. In the remaining districts, this canal is referred to as the “façade” or the “façade drain”. Numerous small canals, oriented north-south, discharge water into these main canals. Drainage of the coastlands is facilitated via kokers (outfalls) which are opened during low tides for the release of fresh water into the Atlantic Ocean. At several locations, large pump stations have been constructed to augment drainage and to allow discharges during high tide periods. All drainage and irrigation works in Region 5 are managed by a statutory entity, the Mahaica Mahaicony Abary - Agricultural Development Authority (MMA/ADA).

In most of the districts surveyed, the immediate coastal area (south of the Bellamy Canal and the façade drains) is used commonly for regularized housing and commercial activities. Places of worship (churches, temples and mosques) are located in all districts but few are located in the Study Area. Other areas of cultural significance, particularly cemeteries, are located along the sea dams in some districts but are located outside of the Study Area. In addition, most districts in Region 5 contain social services and utilities including public schools and community sports grounds. Several of the districts also have water wells managed by the Guyana Water Inc. and hospitals or health centres.

Loss of mangrove cover and shoreline erosion was reported by 5 of the 8 districts surveyed. Since ESS-1, hard sea defence structures were installed in two districts: Woodlands/Farm NDC and Profit/Rising Sun NDC to manage risks of flooding of the immediate coastal area which resulted in erosion of significant sections of the shoreline. According to the NDC, erosion is accelerating in sections of the Profit/Rising Sun NDC where hard structures were not installed. Moreover, sea defences were also breached in the Seafield/Tempie NDC and Government intervention was required for the repair. Flooding during spring tides were reported to occur in the Mahaicony/Abary NDC and the Woodlands/Bel Air NDC as a result of erosion. However,, NAREI’s restoration of mangroves along a section of the shoreline in the Woodlands/Bel Air NDC which are not flooded during spring tides. Mangrove cover gain was reported in a section of the Seafield/Tempie NDC, the Union/Naarstigheid

NDC and in the section of Woodlands/Bel Air which benefited from NAREI's mangrove restoration program.

The changing shoreline habitats of the Study Area has had an appreciable impact on how local communities using the natural environment for their benefit. Specifically, mangrove cover loss or gain had the following impacts on how local communities use the natural environment:

- Fishing, both marine and coastal fishing, significantly declined in the NDCs where the most drastic mangrove cover loss occurred. Specifically, swamps used for coastal fishing were eroded during widespread flooding in the Woodlands/Farm NDC in 2019. Subsequent remediation involved the installation of hard sea defence structures, a secondary dam and flood reservoir which ultimately reduced the extent of the swamps previously used for coastal fishing. On the other hand, marine fisheries stopped altogether in the Profit/Rising Sun NDC as a result of the loss of mangrove cover, shoreline erosion and the construction of hard sea defence structures in Profit to Belladrum. In ESS-1, there were three landing sites in this district which were used by artisanal fishing vessels and all vessels have relocated to landing sites in neighbouring districts.

- However, mangrove cover gain has also adversely impacted marine fishing activities. At the Bushlot landing site, in the Union/Naarstigheid NDC, mangrove proliferation has made access to the landing site challenging and has curtailed the number of fishing trips that can be made by fisherfolk. Some vessels have relocated to another landing site in the district. However, several vessels at this landing site use only sails and these cannot relocate to the alternative site because there is a sand bar that runs parallel to the shoreline on that area that cannot be crossed by sailboats. Fisherfolk whose activities were curtailed have sought alternative livelihoods and several are engaged in hunting birds for sustenance in the mangroves surrounding the landing site. Depending on the quantity of birds caught, the surplus is also sold. Similarly, mangrove proliferation and mud accumulation at the No. 9 outfall, in the Woodlands/Bel Air NDC where mangroves were restored by NAREI, restricted access to the site. As a consequence, the vessels which used this landing site have had to relocate to a site in the neighbouring district.

- The 2019 floods in the Woodlands/Farm NDC also significantly reduced agricultural activities. During the floods, livestock mortality was high and cultivated crops were lost. In the aftermath, saltwater inundation has challenged the resumption of cultivation. A few rice farmers have resumed cultivation in 2022 but the success of these endeavours are not yet known. In addition, suitable grasses for livestock rearing are no longer growing in the Study Area.

- Cultural services were also impacted. Beaches that were being formed in Taymouth Manor (Woodland/Farm NDC) and Abary (Mahaicony/Abary NDC) have been lost to erosion. In addition, the beach in Weldaad (Profit/Rising Sun NDC) which was being used for cremations was also eroded.

Access to the shoreline is limited in the Region. In most districts, there are few routes leading directly to the shoreline. In most cases, the existing access routes are earthen dams that considerably deteriorate during the wet seasons. As a consequence, in most NDCs, ecosystem services in the Study Area occur in clusters along access routes. Moreover, given the challenges in accessing the shoreline, a few beaches are typically "hotspots" in the region as a whole for cultural services associated with ritual/religious purposes, and with tourism and recreation. As a result of access limitations, multiple uses of these areas for provisioning services including fishing are also common. In the Woodlands/Farm NDC and the Mahaicony/Abary NDC, the landing sites used to offload catches from marine fisheries, the markets where the catches are sold, and tug repairs on the river bank were

located farther inland than the 1-kilometer boundary of the Study Area. In these cases, these services were also recorded and mapped.

According to local stakeholders, the COVID-19 pandemic also impacted ecosystem services. Restrictions on public gatherings hindered recreational uses especially on weekends. In particular, the use of turf clubs for horse racing competitions virtually ceased during the pandemic and have not yet returned to the intensity with which they were practiced in ESS-1. Moreover, COVID-19 public health restrictions also ceased use of the water taxi service between Rosignol to New Amsterdam which thousands of people used daily. In some NDCs, economic hardships associated with the COVID-19 pandemic led to decreased revenue streams as constituents were unable to pay rates and taxes due to COVID-19 economic challenges. In districts where there were markets, reduced commercial activities resulting from the COVID-19 lockdowns also impacted vendors' capacities to pay market fees to the NDCs also resulting in reduced revenue streams.

Since ESS-1, there were significant changes in shoreline habitats along sections of Region 5 which significantly influenced how communities benefitted from provisioning and cultural ecosystem services. In addition, the regulating and supporting services provided by mangrove cover along the shoreline were impacted with the result that hard structures, including emergency works, had to be undertaken by the Government to reduce erosion risk. Therefore, continued mangrove cover loss may significantly and adversely impact the existing ecosystem services in Region 5.

8.3 Ecosystem Services

Provisioning services were the primary service accounting for approximately 69 percent of the ecosystem services identified. Cultural services and regulating services were the second and third most prevalent, representing approximately 16 percent and 10 percent of the services identified respectively. Supporting services represented only 5 percent of the services identified and were associated with primary productivity and habitat provision. Figure 8-1 summarizes the distribution of identified ecosystem services across the four ecosystem service categories.

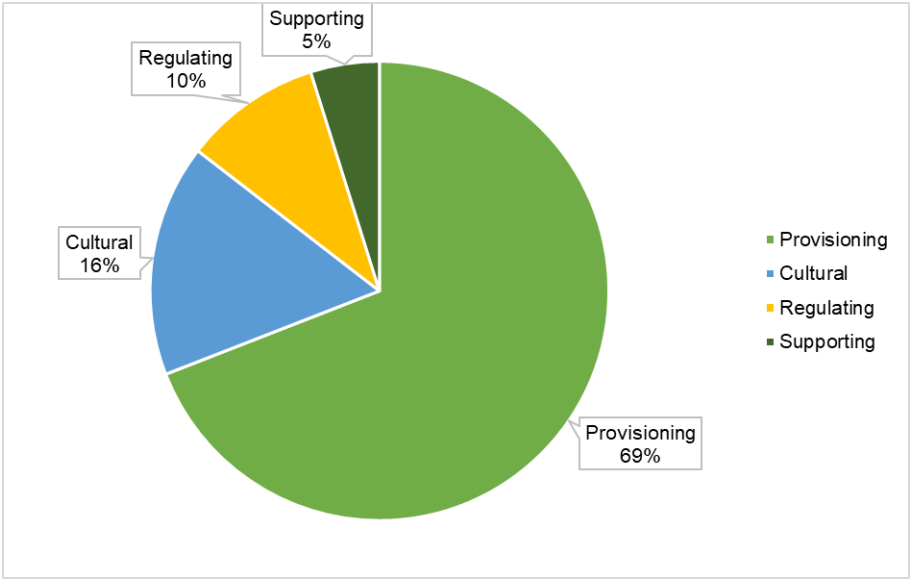


Figure348-1: Distribution of Ecosystem Services Categories in Region 5

The most common provisioning services identified was fishing including both marine fisheries and coastal fisheries involving communal fishing in swamps and canals. Coastal fishing was most

prevalent in the Woodlands/Farm NDC and the Mahaicony/Abary NDC. This may have been attributed to proximity of these two NDCs to the three river systems (the Mahaica, Mahaicony and Abary Rivers) which may have a significant influence on the swampy conditions in the immediate coastal areas as well as on species abundance in these areas.

Figure 8-2: Swamp Fishing in the Woodlands/Farm NDC (Left) and Sail Boats in the Trafalgar Koker (Right)

Agriculture, including both crop cultivation and livestock grazing, were also common provisioning services. An example of crop cultivation is shown in Figure 8-3. These services occurred on sea dams and along the shoreline areas of all districts surveyed. Socio/economic services were primarily associated with regularized housing in all districts except Woodlands/Farm. Most of the other socio/economic services occurred in the Zeelust/Rosignol NDC and were associated with manicole processing, fishing processing and boat building.

Figure 8-3: Crop Cultivation on Sea Dam in Zeelust/Rosignol NDC

Although there is extensive mangrove cover in most districts, crabbing and hunting in the mangroves were practiced with relatively low intensity. In some districts, such as Seafield/Tempie, most of the out-of-season crabbing is done by persons from outside the NDC. Hunting has also increased as an alternative to other coastal ecosystem services as seen by fisherfolk in the Union/Naarstigheid NDC.

On the other hand, apiculture in the mangroves in Region 5 was noteworthy. Beekeeping was practiced in 3 districts and in the Union/Naarstigheid NDC, beekeepers have organized themselves into groups so as maximize opportunities to develop the industry (Figure 8-4).

Figure 8-4: Apiculture in Mangroves in Bushlot (Union/Naarstigheid NDC)

Two ecosystem services were reported at significantly lower intensities. Firstly, mangrove materials were collected or harvested in one district for use as fuel (firewood) and construction material for livestock pens. In ESS-1, aquatic transportation in small privately owned vessels called “water taxis” was common in the Zeelust/Rosignol NDC and were used by thousands of persons daily on the route between Rosignol and New Amsterdam. This service was suspended by the Government as part public health restrictions associated with the COVID-19 pandemic but is expected to resume soon.

The most common cultural services identified included the value placed on sea dams and the shoreline area for use for ritual and religious purposes particularly by local Hindu communities. Recreational activities in the Study Area throughout the region were limited. Two districts had beaches which were used for recreational purposes namely Mahaicony/Abary and Profit/Rising Sun. In Woodlands/Farm and Zeelust/Rosignol, sea dams were used for recreation. On the other hand, there were no recreational sites in Seafield/Tempie and Bath/Woodley Park. Finally, prior to the COVID-19 pandemic, horse racing was a common recreational activity and there are three turf clubs in the region. In Union/Naarstigheid and Woodlands/Bel Air NDCs, these turf clubs were the only recreational areas in the Study Area.

Figure 8-5: Good Faith Beach in the Mahaicony/Abary NDC Used for Recreation and Religious Purposes

The most common regulating services identified included shoreline protection and the role of mangroves in protecting crops, buildings, recreation areas from waves, wind and flooding and erosion protection and the role of vegetation in regulating erosion. The only supporting service identified was primary productivity and the provision of habitats. Figure 8-6 summarizes the distribution of ecosystem service types across the categories.

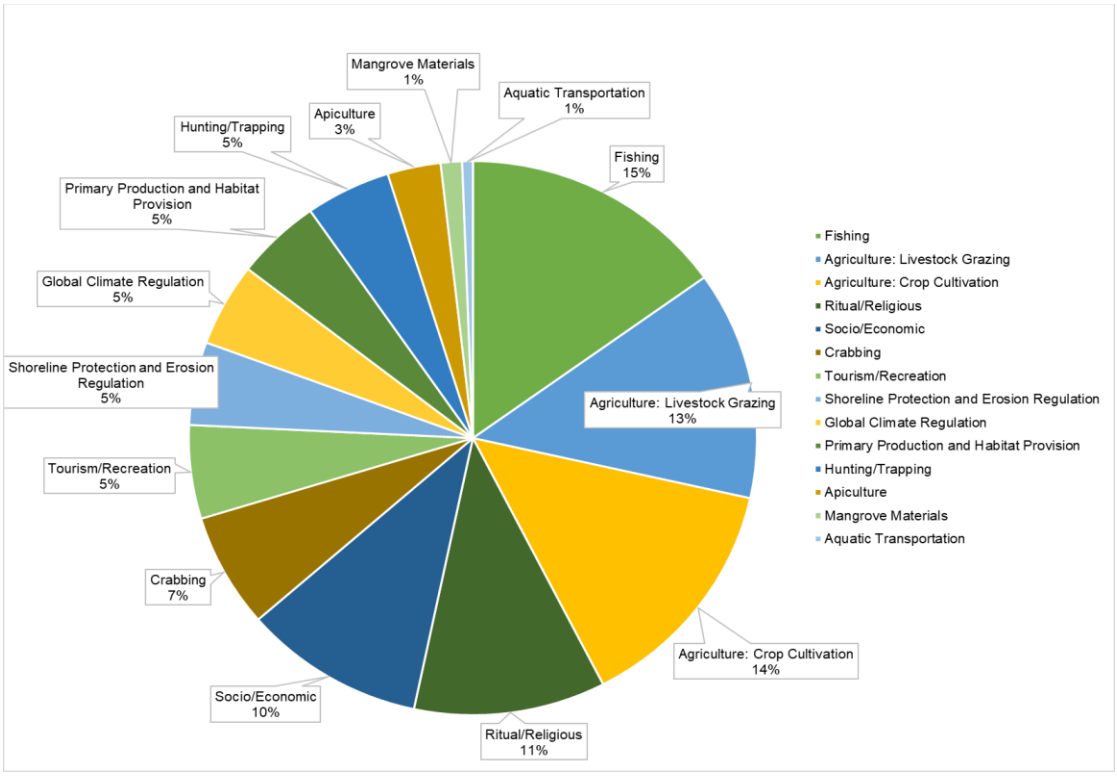


Figure 8-6: Distribution of Ecosystem Service Types in Region 5

The majority of ecosystem services identified, 38 percent, were of *Medium Priority.* Services of *Critical Priority* and *High Priority* were equal, each accounting for 22 percent of all services mapped. The fewest services were of *Low Priority* accounting for 18 percent of all services identified. Figure 8-7 shows the distribution of priority rankings for ecosystem services.

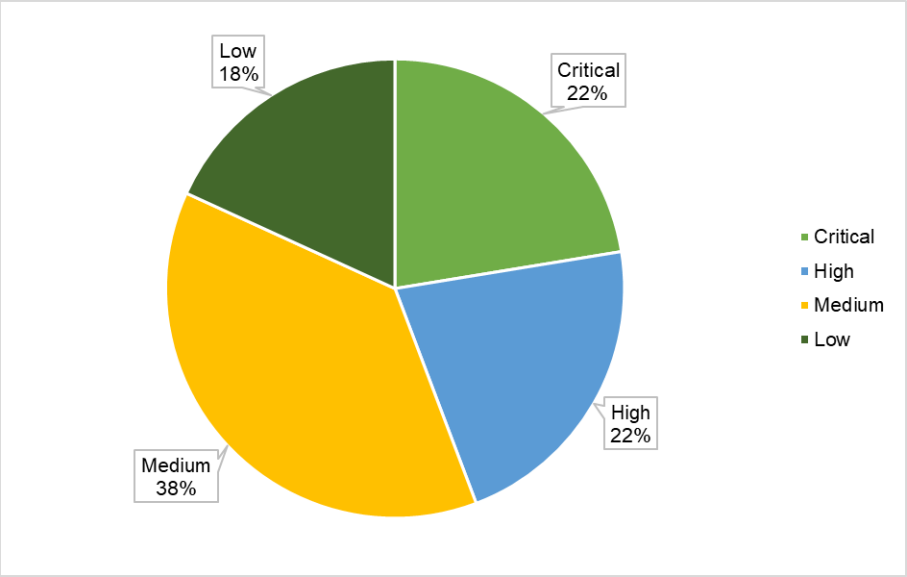


Figure 8-7: Distribution of Priority Rankings for Ecosystem Services in Region 5

8.4 Detailed Findings

Detailed information on all ecosystem services scoped in for the Study Area are listed for each NDC in Region 5 and provided in the scoping tables located in Appendix B.

Figure 8-8 shows the ecosystem service locations, by type, identified by the local stakeholders in Region 5 during the engagement process and which were mapped during the field observations. They are displayed by ecosystem service (color of symbol) and priority (size of symbol) — *Critical, High, Medium, or Low*. Detailed maps by are provided in the Coastal Mapping map book (separate from this report).

Figure 8-9 shows a heat map for priority ecosystem services – rated to be of *Critical* or *High Priority* – along the shoreline of Region 5.

Figure 8-8: Ecosystem Services in Region 5

Figure 8-9: Heat Map of Priority Ecosystem Services in Region 6

9.0 REGION 6 COASTAL ECOSYSTEM SERVICES STUDY FINDINGS

9.1 Population Estimates

Population estimates are based upon data provided by leadership of NDC and TC during the ecosystem services-related engagements.

Table 9-1: Population Estimates for Region 6

NDC Name	Population Estimate
Ordinance/Fort Lands	8,000
Kintyre/Borlam	1,000
Gibraltar/Fyrish	5,600
Kilcoy/Hampshire	More than 25,000
Rose Hall Town Council	15,000
Port Mourant/John	16,000
Bloomfield/Whim	4,000
Lancaster/Hogstye	4,624
Bushlot/Adventure	6,000
Maida/Tarlogie	3,500
Macedonia/Joppa	3,500
Good Hope/No.51	2,300
No. 52/No.74	20,000
Corriverton Town Council	15,000

9.2 Overview of Findings

Generally, the immediate coastal area of Region 6 is below sea level. The primary forms of shoreline defence are typically mangroves which are supported by earthen sea dams that are established immediately inland. Drainage of the coastlands is facilitated via kokers (outfalls) which are opened during low tides for the release of fresh water into the Atlantic Ocean. At several locations, large pump stations have been constructed to augment drainage during high tide periods. Loss of mangrove cover in was reported by NDCs in 50 percent of the districts surveyed and hard sea defence structures were installed in four districts: Bushlot/Adventure NDC, Maida/Tarlogie NDC, No. 52/No. 74 NDC and the Corriverton Town Council. The installations in Maida/Tarlogie and in No. 52/No. 74 were emergency works to mitigate erosion risk. Moreover, in the Good Hope/No. 51 NDC, a drain (approximately 1.2 meters [4 feet] wide) was dug behind the sea dam of No. 47 to No. 49, where mangroves had eroded, to capture overtopping and reduce saltwater intrusion. Local stakeholders have shared several views on the potential reasons for mangrove cover loss including damage caused by deliberate breaching (for “aquaculture”, as discussed below), discharge of contaminated effluent from agricultural lands in back dams, or the accumulation of sawdust in mangrove root systems from downstream sawmilling operations.

Unlike Regions 2 to 5, the immediate coastal area in Region 6 (south of the mangroves) is not used commonly for housing and commercial activities. Small sections of regularized housing areas fall within the Study Area in the Kilcoy/Hampshire NDC, Rose Hall Town Council and the Macedonia/Joppa NDC. In addition, significantly larger sections of regularized housing and commercial activities occur in only 35 percent of the NDCs surveyed including the Lancaster/Hogstye NDC, Bushlot/Adventure NDC, Maida/Tarlogie NDC, No. 52 to No. 74 NDC and the Corriverton Town Council. Places of worship (churches, temples and mosques) are located in all districts but few are located in the Study Area. In Region 6, the notable exceptions are the temples devoted to the worship of Maha Kali (a sect of Hinduism) for which temples have been established on sea dams within the

Study Area in several districts. Other areas of cultural significance, particularly cemeteries, are located along the sea dams in some districts but are located outside of the Study Area. In addition, most districts in Region 6 contain social services and utilities including public schools and community sports grounds but these are not typically with the Study Area. Several of the districts also have water wells managed by the Guyana Water Inc. and hospitals or health centres.

In Region 6, the immediate coastal area south of the mangroves are wetlands (swamps) that are used communally for fishing or have been privately developed into “aquaculture” ponds. The “aquaculture” practiced in the Region is a fusion of marine and coastal fisheries. The aquaculture ponds are filled by breaching the mangroves to allow the inflow of brackish water rich with juvenile fish and shrimp into the ponds from mangrove nurseries. The incoming species are allowed to mature following which they are harvested and the ponds are drained. The cycle subsequently resumes with the refilling of the ponds. In the period since ESS-1, there have been significant investments in aquaculture. Specifically, in 2022, aquaculture operators received Government support to rehabilitate ponds, improve empoldering of berms around the ponds and enhance drainage between production cycles. According to a local aquaculture operator, the ponds most are most productive they are shallow and the substrate is clayey. However, some of ponds which were rehabilitated with Government support were dug too deep and the substrate was sandy. This does not allow the species in the ponds to feed naturally and productivity has lowered.

Aquaculture is widely practiced in 11 of the 14 districts surveyed and is being developed in 2 of the remaining 3 districts. Specifically, aquaculture ponds are being established in the Ordinance/Fort Lands NDC and the Government is exploring the establishments of a shrimp hatchery in the No. 52/No. 74 NDC. The Corriverton Town Council is the only district where aquaculture is not actively being pursued or planned. In some districts, the practice of breaching the mangroves to fill ponds reportedly contributes to mangrove cover loss and shoreline erosion. Moreover, the practice of fishing in swamps and canals for sustenance, recreation and sale is also widespread in all districts with the exception of the Corriverton Town Council.

Given the extensive mangrove cover in the Region, access to the shoreline is limited. In most districts, there are few or no routes leading directly to the shoreline. In most cases, the existing access routes are earthen dams that considerably deteriorate during the wet seasons. As a consequence, in most NDCs, ecosystem services in the Study Area occur in clusters along access routes. Moreover, given the challenges in accessing the shoreline, a few beaches are typically “hotspots” for cultural services associated with ritual/religious purposes, and with tourism and recreation. As a result of access limitations, multiple uses of these areas for provisioning services including fishing and livestock grazing are also common.

According to local stakeholders, the COVID-19 pandemic also impacted ecosystem services. In particular, restrictions on public gatherings hindered recreational uses of beaches especially on weekends. In particular, the use of turf clubs for horse racing competitions virtually ceased during the pandemic and have not yet returned to the intensity with which they were practiced in ESS-1. In some NDCs, economic hardships associated with the COVID-19 pandemic led to seeking alternative livelihoods associated with crabbing, hunting in the mangroves and cultivating cash crops on the sea dams. In some districts, the intense flooding in 2021 caused damage to pastures in the back dam which resulted in increased livestock grazing along the shoreline.

Since ESS-1, there were significant changes in shoreline habitats along sections of Region 6. In general, these changes did not influence how communities benefitted from provisioning and cultural ecosystem services. Indeed, provisioning services associated with mangrove habitats such as fishing (including aquaculture), crabbing as well as trapping/hunting continued and, in several instances, intensified. However, the regulating and supporting services provided by mangrove cover along the shoreline were impacted with the result that hard structures, including emergency works, had to be

undertaken by the Government to reduce erosion risk. Ultimately, the most prevalent and intensively ecosystem services in the Study area are directly dependent on mangrove cover. For example, in districts where there is virtually no mangrove cover, like Corriverton, aquaculture, communal areas for coastal fishing and crabbing are non-existent while trapping/hunting is of *Low Priority*. Therefore, continued mangrove cover loss may significantly and adversely impact the existing ecosystem services in Region 6.

9.3 Ecosystem Services

Provisioning services were the primary service accounting for approximately 69 percent of the ecosystem services identified. Cultural services and regulating services were the second and third most prevalent, representing approximately 18 percent and 9 percent of the services identified respectively. In Region 6, only 4 percent of the services identified were the supporting services of primary productivity and habitat provision. Figure 9-1 summarizes the distribution of identified ecosystem services across the four ecosystem service categories.

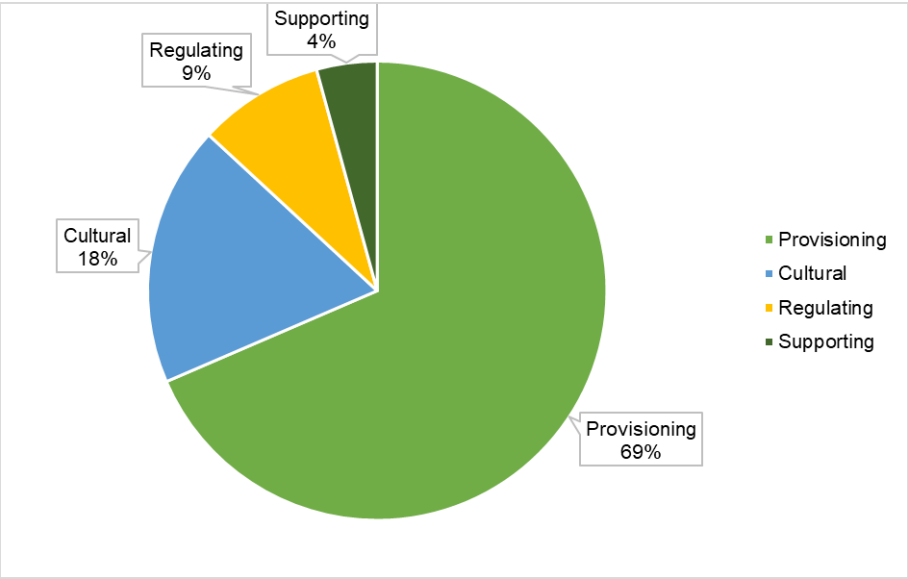


Figure 9-1: Distribution of Ecosystem Services Categories in Region 6

The most common provisioning services identified, by a wide margin, was fishing including both marine fisheries and coastal fisheries (privately operated aquaculture ponds as well as communal fishing in swamps and canals). Indeed, fishing was the most prevalent ecosystem service in 11 of the 14 districts surveyed. The districts where fishing was not most prevalent were the Ordinance/Fort Lands NDC and the Corriverton NDC (where socio/economic services were most common) as well as the Port Mourant/John NDC (where livestock grazing was most common). In the former two districts, aquatic transportation, wharf facilities and commercial activities were among the key socio/economic services identified. Socio/economic services were the second most common provisioning service in Region 6 and also included the regularized housing, squatting, boat building in some districts.

Figure 9-2: Privately Operated Aquaculture Pond in the Good Hope/No. 51 NDC (Left) and Coastal Swamp Fishing for Sustenance in the Bushlot/Adventure NDC (Right)

Figure 9-3: Pin Seine Fishing Along the Shoreline in the Lancaster/Hogstye NDC (Left) and Commercial Fishing Landing Site at No. 43 in the Macedonia/Joppa NDC (Right)

Given the extensive mangrove cover, crabbing and hunting (iguanas and waterbirds) in the mangroves were common. Indeed, local communities hunted in the mangroves in all districts surveyed while crabbing was practiced everywhere with the exception of the Corriverton Town Council. Whilst both crabbing and hunting (particularly for waterbirds) are seasonal activities, they are practiced with a lower intensity throughout the year in most districts. For crabbing, some local persons reportedly extract red crabs directly from their burrows or target sheriga crabs which are populous throughout the year including around aquaculture ponds. Crabbing was of *Critical Priority* or *High Priority* in 11 of the 14 districts surveyed. The number of persons engaged in hunting in the mangroves has also increased relative to ESS-1.

Agriculture, both crop cultivation and livestock grazing, were also common provisioning services in the region. In addition, several ecosystem services were reported at significantly lower intensities. For example, mangrove materials were collected or harvested in five districts for use as fuel (firewood), construction material (locally referred to as “buttonwood”) and for making arbors for gardening. Aquatic transportation associated with the use of the Canje Creek, Berbice River and Corentyne River occurred in the Ordinance/Fort Lands NDC and the Corriverton Town Council. Apiculture was only

reported in the Kilcoy/Hampshire NDC where honey was reported harvested by a few locals from wild beehives.

Figure 9-4: Crop Cultivation on the Kildonan Sea Dam in the Bushlot/Adventure NDC

The most common cultural services identified included the value placed on sea dams and beaches area for ritual and religious purposes particularly by local Hindu communities. Mangrove proliferation along the shoreline hindered religious activities in some districts. For example, Hindu communities in the Kilcoy/Hampshire NDC typically travel to beaches that are located outside the NDC district, including as far east as the No. 63 beach, for religious purposes. There are several beaches which are used for recreational purposes including the in Rose Hall and Port Mourant, Manchester, Alness, Bushlot, and the beach located along the shoreline of the No. 61 to No. 63 villages (called the No. 63 beach). The latter is the most widely used both by communities within and outside the district. On special occasions, like the Easter, people from other parts of the country including Regions 3, 4 and 5 make special trips to the No. 63 beach. Moreover, there are all-weather roads leading to the No. 63 beach whereas, the other beaches are typically accessible only by earthen dams which deteriorate under wet conditions. Indeed, according to local stakeholders, the use of the beaches in Rose Hall and Port Mourant significantly declined during the rainy seasons.

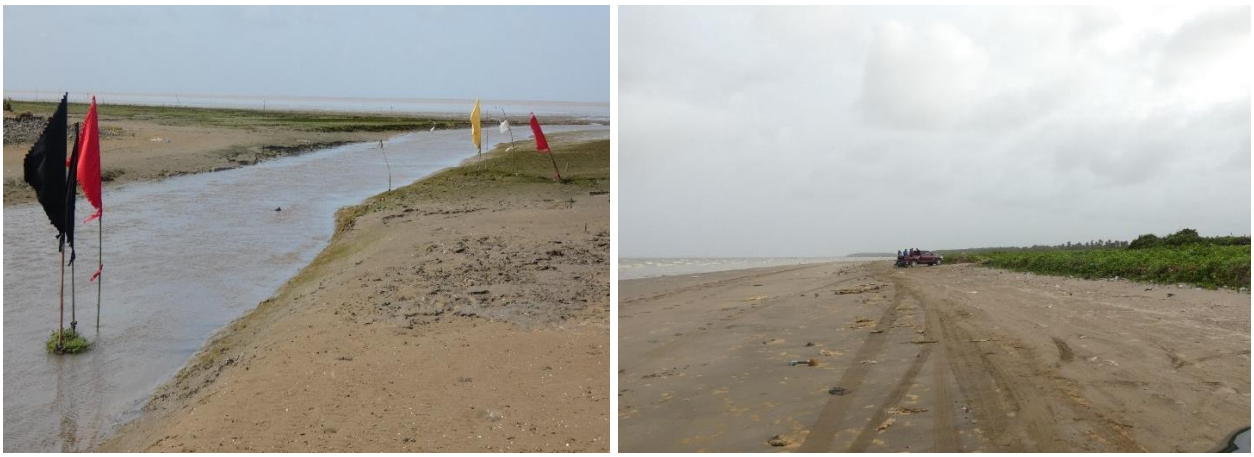


Figure 9-5: Alness Beach in the Lancaster/Hogstye NDC and No. 63 Beach in the No.52/74 NDC Used for Recreation and Religious Purposes

The most common regulating services identified included shoreline protection and the role of mangroves in protecting crops, buildings, recreation areas from waves, wind and flooding and erosion protection and the role of vegetation in regulating erosion. The only supporting service identified was primary productivity and the provision of habitats. Figure 9-6 summarizes the distribution of ecosystem service types across the categories.

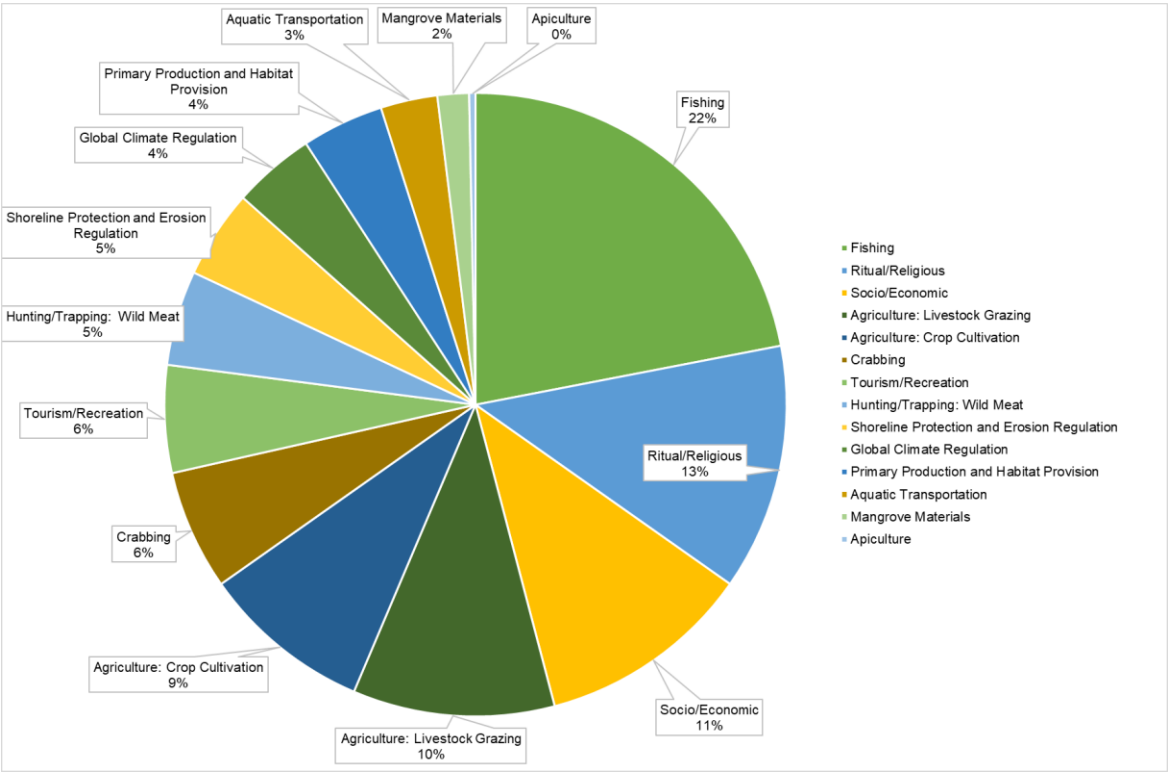


Figure 9-6: Distribution of Ecosystem Service Types in Region 6

The priority rankings for ecosystems services were evenly distributed for *Critical Priority and Medium Priority* accounting for 30 percent and 29 percent of all services identified, respectively. Ecosystem services of *High Priority* accounted for 25 percent of all services. The fewest services were of *Low Priority* accounting for 16 percent of all services identified. Figure 9-7 shows the distribution of priority rankings for ecosystem services.

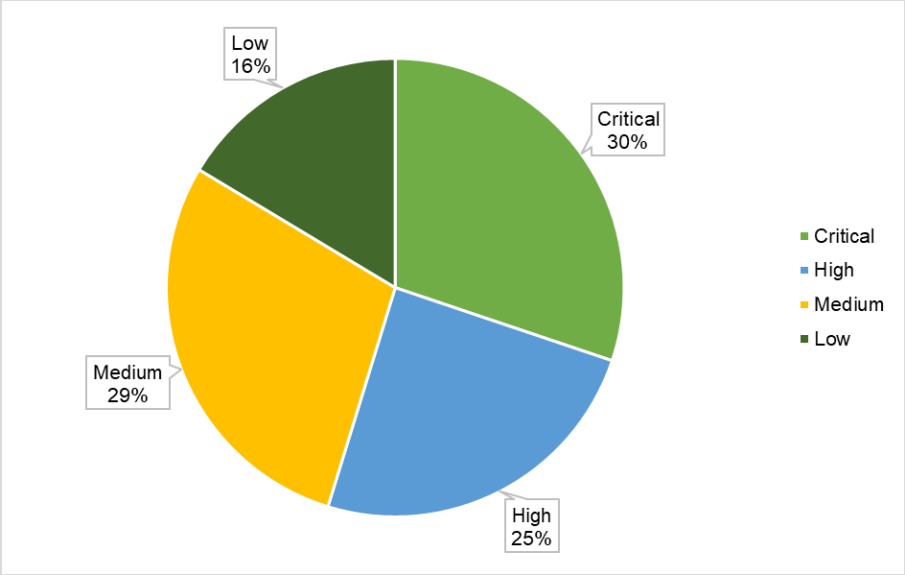


Figure 9-7: Distribution of Priority Rankings for Ecosystem Services in Region 6

9.4 Detailed Findings

Detailed information on all ecosystem services scoped in for the Study Area are listed for each NDC in Region 6 and provided in the scoping tables located in Appendix B.

Figure 9-8 shows the ecosystem service locations, by type, identified by the local stakeholders in Region 6 during the engagement process and which were mapped during the field observations. They are displayed by ecosystem service (color of symbol) and priority (size of symbol) — *Critical, High, Medium, or Low*. Detailed maps by are provided in the Coastal Mapping map book (separate from this report).

Figure 9-9 shows a heat map for priority ecosystem services – rated to be of *Critical* or *High Priority* – along the shoreline of Region 6.

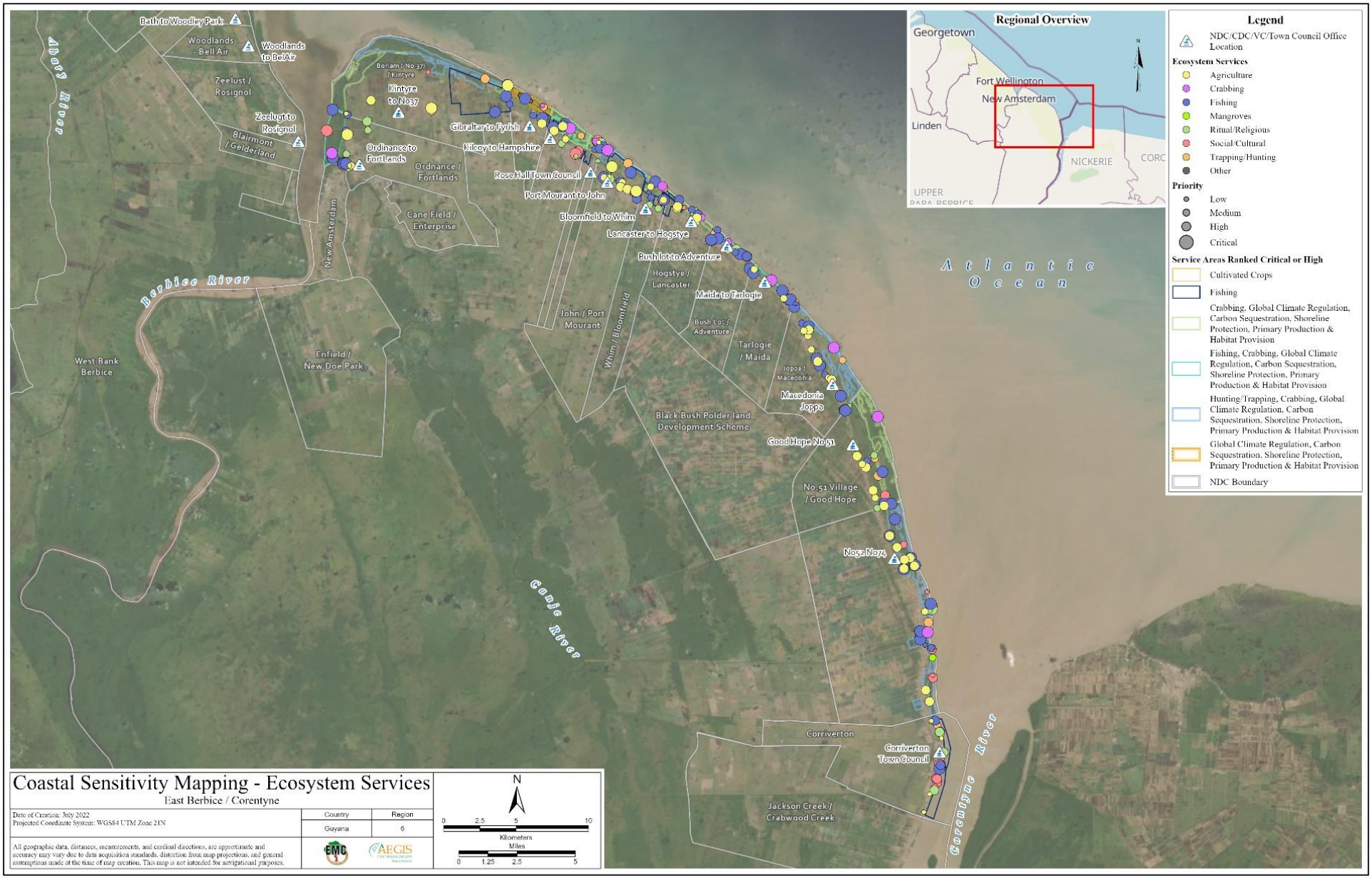


Figure 9-8: Ecosystem Services in Region 6

Figure 9-9: Heat Map Showing Priority Services in Region 6

APPENDIX A – ECOSYSTEM SERVICES SCREENING CHECKLIST

Ecosystem Service	Description, Examples
Provisioning Services	
Food: wild-caught fish and shellfish and aquaculture	Fish caught for subsistence or commercial sale; Fish, shellfish, and/or plants that are bred and reared in ponds, enclosures, and other forms of freshwater or saltwater confinement for harvesting
Food: wild plants, nuts, mushrooms, fruit, honey	Fruit, nuts, wild plants, etc. collected in natural areas for consumption or sale
Food: wild meat	Animals hunted primarily for food (recreational hunting is covered separately under cultural services); extent of wildlife trapping and trade (Region 1)
Food: cultivated crops	Annual and permanent crops grown for subsistence use and commercial sale
Biomass for livestock production	Sedentary and nomadic livestock grazing supported by native forage plants
Biomass fuel	Wood, dung and plant matter collected for charcoal or fuel
Timber and wood products	Wood collected for local use or for sale as timber, wood pulp, paper – wood is used in house construction (importance varies by community)
Non-wood fibers and resins	For example, cane, palm, straw, cotton, hemp, twine and rope, natural rubber
Freshwater - household use	Freshwater for bathing, drinking, laundry, household use
Freshwater - irrigation and industry	Freshwater for irrigation or industrial use
Natural medicines, pharmaceuticals	Natural medicines, biocides, food additives, pharmaceuticals and other biological material for commercial or domestic use
Ornamental resources	For example, pelts, carved or decorative animal products, live animal trade
Genetic resources	Genes and genetic information used for animal breeding, plant improvement, and biotechnology
Transportation	In remote areas no alternative methods of transport; commercial transportation facilities such as wharfs, ferry stellings, etc.
Social / Economic	Income generators or services supporting income generation (e.g., boat building, repairs, transportation services)
Traditional Resource Use (Region 1)	Traditional medicine, manicole and morocut harvesting, logging, non-wood fibers and resins for sustenance and crafts, biomass for fuel, gathering wild plants and honey, turtle/wildlife trappings, and harvesting of shells
Regulating Services	
Regulation of air quality	The influence ecosystems have on air quality by extracting chemicals from the atmosphere (i.e., serving as a “sink”) or emitting chemicals to the atmosphere (i.e., serving as a “source”)
Climate regulation: global	Vegetated areas sequester CO_2, with implications for global climate change
Climate regulation: local	Regulation of temperature, shade air, and quality by vegetated areas

Ecosystem Service	Description, Examples
Regulation of water timing and flows (including flood regulation)	Influence ecosystems have on the timing and magnitude of water runoff, flooding, and aquifer recharge
Water purification and waste treatment	Role played by vegetation in the filtration and decomposition of organic wastes and pollutants and the assimilation and detoxification of compounds
Shoreline protection	Role of natural habitats (e.g., wetlands, beaches, reefs) in protecting crops, buildings, recreation areas from waves, wind and flooding from coastal storms
Fire regulation	Regulation of fire frequency and intensity (e.g., dense forest can provide firebreaks)
Pest regulation	Predators from forests, grassland areas, etc. may control pests attacking crops or livestock
Disease regulation	Influence ecosystems have on the incidence and abundance of human pathogens
Erosion regulation	Role of vegetation in regulating erosion on slopes and riparian areas
Pollination	Birds, insects and some small mammals pollinate certain flora species, including some agricultural crops
Cultural Services	
Spiritual or religious value	Natural spaces or species with spiritual or religious importance
Traditional practices	Cultural value placed on traditional practices such as hunting, fishing, crafts and use of natural resources
Tourism and recreation	Use of natural spaces and resources for tourism or local recreation (e.g., swimming, boating, fishing); tourism potential and infrastructure needs (Region 1)
Aesthetic value	Cultural value placed on the aesthetic value provided by landscapes, natural landmarks
Educational and inspirational values	Information derived from ecosystems used for intellectual development, culture, art, design, and innovation
Non-use value of biodiversity (e.g., existence, bequest value)	Species and areas valued globally as of high conservation value
Cultural Services (Region 1)	Cultural aspects and places of importance and protection for Amerindian communities
Supporting Services	
Habitat provision	Natural spaces that maintain species populations and protect the capacity of ecological communities to recover from disturbances
Primary production	Formation of biological material by plants through photosynthesis and nutrient assimilation
Nutrient cycling	Flow of nutrients (e.g., nitrogen, sulfur, phosphorus, carbon) through ecosystems
Water cycling	Flow of water through ecosystems in its solid, liquid, or gaseous forms.
Soil formation	Natural soil-forming processes throughout vegetated areas

APPENDIX B – ECOSYSTEM SERVICES AND PRIORITY RATINGS IN REGION 1

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
0101 Father's Beach - Population Estimate 21 people (decreasing due to migration)							
Social/Economic: Settlements	Provisioning	• All residents of Father's Beach live within proximity of the shoreline. Most villagers reside in a main settlement area that is accessed via a small channel connected to the Atlantic Ocean. In addition, about three families reside west of the main settlement area. • Generally, people live relatively close to their farms and houses are constructed on stilts to manage flood risk.	Residential, commercial, administrative	Residents of the Father's Beach community	Essential	Low	**Critical**
Social/Economic: Commercial Activities and Emergency Response	Provisioning	• Some residents are engaged in commercial activities associated with fuel sales, boat building and repairs, and engine repairs. • In addition, a few persons also respond to distress calls to rescue crews and provisions (where possible) of vessels traveling along the shoreline of the village and around the mouth of the Moruca River. This service is mainly provided to cargo boats that are at risk of sinking at the mouth of the Moruca River. The villagers who provide this service are contacted via a Digicel cell phone.	Marine habitats	Local communities members providing services and other vessels that benefit particularly from emergency response **ES Linkages:** Aquatic Transportation	Essential	Low	**Critical**
Agriculture: Cultivated Crops	Provisioning	• Crop cultivation is one of the main livelihood activities. Crops cultivated include coconuts, plantains, cassava, vegetables, and fruits. Coconut is the main crop grown by the community and are taken to the Charity market in Region 2 for sale. Coconut products include dry coconuts, water coconuts and copra. In ESS-1, coconut cockles were affecting the	Cultivated crops, coastlands	Local farmers engaged in crop cultivation **ES Linkages:** Aquatic Transportation	Essential	Moderate	**Critical**

		coconuts and this challenge has reduced but has not been entirely addressed. • In the main settlement area, there are 30 acres of farmland along the shoreline. New farmlands have also developed since ESS-1, including a new 30-acre farm which was developed for the cultivation of coconuts and plantains. • Approximately six acres are used as a kitchen garden for the cultivation of cash crops.					
Fishing: Wild Caught Fish and Shellfish (Marine)	Provisioning	• Four persons fish on a commercial basis using seines and hooks. Most fishing occurs offshore Father's Beach but occasionally, fisherfolk travel east towards the mouth of the Pomeroon River, as far as is feasible to travel. • In January and February 2022, fisherfolk reported an unusual sighting of flying fish in areas between Father's Beach and the mouth of the Pomeroon River. This species were never previously observed in this area.	Marine habitats	Fisherfolk engaged in commercial fishing activities	High	Moderate	**High**
Crabbing	Provisioning	• Two types of crabs are captured in Father's Beach namely blue crabs (commonly called bundari crabs) and red crabs. Blue crabs are caught throughout the year for sustenance and sale. However, they are widely considered to be a pest by villagers. The bundari crabs bore holes on the empoldered dams which are critical for drainage and flood prevention. These crabs are also caught in farms and occasionally, causes damage to crops. According to villagers, the adverse impacts of bundari crabs on villagers have intensified since ESS-1. • Red crabs are caught seasonally in the July to September crab seasons. During this season, there are three marches. The first occurs in July; the second, main march in August (locally called	Mangroves, shoreline	a) Local persons catching bundari crabs for sustenance, sale and pest control b) Locals and persons from outside the community engaged in seasonal crabbing for sustenance and sale **ES Linkages:** Mangroves, Crop Cultivation	a) Essential b) Essential	a) Low b) Moderate	**a) Critical** **b) Critical**

		the ‘big march’) and the final in September (locally called the ‘dead march’ because crabs march until they die during this season). In 2020 and 2021, female crabs (locally called ‘she crabs’) also marched in October and this was unusual. During this crabbing season, all villagers are engaged in crabbing for sustenance and sale. In addition, hundreds of people from outside the village visit at night-time to catch crabs during this season.					
Hunting/Trapping: Wild Meat	Provisioning	• Some villagers are engaged in hunting for sustenance but this is rarely done.	Mangroves, shoreline	Local community engaged in hunting for wild meat	Low	High	**Low**
Traditional Resource Use	Provisioning	• Almost all plants including noni and mangroves are used by the locals for medicinal and spiritual purposes. Noni is cultivated in the village and mangroves are readily available on the beach. • Mangroves (a species called ‘maho’) is used to make quake strings and shovel sticks. Mangroves are also used to make plantain poles that are used in the farms in the village and sold to farmers in the Pomeroon River. Mangroves are also used to make fishing poles. • Some villagers still practice traditional Amerindian religion and healing practices. Mangroves are also used for spiritual and healing purposes. • Residents collect shells from the beach to provide nutrients for plants, use for construction of foundation for buildings, and use for fillings of yards. Shells are also used to make crafts. • People from the Essequibo Coast visit the beaches in the village and collect hundreds of bags of shells. The intended use of these shells is not known by local community members.	Mangroves, shoreline, beaches	a) Local community using natural resources for traditional purposes b) Persons from outside the community collecting shells from the beach **ES Linkages:** Mangroves, Tourism and Recreation	a) Essential b) High	a) High b) High	**a) High** **b) Medium**

		• Local fruits like jamoon and cherry are used to make wine and other confectioneries by some villagers.					
Freshwater for Household Use	Provisioning	• The community depends on rain water and some freshwater from the wetlands behind the farms. Water is used for bathing, washing, cooking, and drinking.	Inland freshwater ecosystems	Residents of the Father's Beach community	Essential	Moderate	**Critical**
Aquatic Transportation	Provisioning	• The only mode of access to the community is via river transportation. The main landing area provides docking for cargo boats (used to transport crops to market), fishing boats and other vessels used for passenger transportation.	Marine habitats, shoreline, coastlands	Local People **ES Linkages:** Settlements, Agriculture, Fishing	Essential	Low	**Critical**
Tourism and Recreation	Cultural	• Community members and people from other areas use any areas along the shoreline where there are beaches for recreational purposes.	Shoreline, beach	Local community members and people from other areas **ES Linkage:** Traditional Resource Use	Low	Moderate	**Low**
Shoreline Protection and Erosion Regulation	Regulating	• Extensive area of mangrove forest on the shoreline and the banks of the Moruca River protects against erosion. Erosion is occurring along most of the shoreline of the community and mangroves which provide critical flood defence are being washed away. The situation was partially addressed by the construction of a dam behind the mangrove area which is helping to reduce salt water intrusion. However, movement of the settlement farther inland may be required if erosion accelerates. • Erosion of mangroves is also occurring along the left bank of the Moruca River close to the mouth	Mangroves	Local community residing in Father's Beach **ES Linkages:** Settlements, Crop Cultivation, Crabbing, Global Climate Regulation, Habitat Provision	High	Low	**Critical**

		of the river. The reason for this is believed to be due to the frequent trips by large tugs which are used to transport road construction materials to Santa Rosa. These tugs moor along the mangroves.					
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the community supports carbon sequestration.	Mangroves	Local community **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing	Moderate	Moderate	**Medium**
Primary Production and Habitat Provision	Supporting	• There are lots of animals in the mangroves including mammals, birds, crabs, fish, and reptiles. Macaws and parrots are plentiful in the area and sometimes feed on crops. • Early in 2022, a herd of more than 200 wild hogs passed through the community. Villagers speculated that these animals were possibly displaced from along the banks of Pomeroon River due to the expansion of coconut plantations in that area. Jaguars were commonly sighted in ESS-1 but are only rarely seen now.	Mangroves, shoreline	Local community **ES Linkages:** Shoreline Protection, Global Climate Regulation	Moderate	Moderate	**Medium**
0102 Manawarin – Population Estimate 1,656 people							
Social/Economic: Settlements	Provisioning	• Manawarin is a titled Amerindian village that is accessed via the Manawarin River. There are three clusters of settlements in Manawarin that are called Central Manawarin, Upper Manawarin and Lower Manawarin. • Central Manawarin is the main landing area and it also the section of the village where most social services can be accessed including schools (nursery and primary) and buildings administered by the Village Council. Among	Residential, commercial, administrative	Residents of the Manawarin village **ES Linkages:** Aquatic Transportation, Fishing	Essential	Low	**Critical**

		these buildings is a Guest House, which is undergoing repairs. • Guyana Water Incorporated (GWI) is planning to establish a well for water provision in Central Manawarin and a local utility company is also exploring opportunities for providing electricity to this part of the village. Health Posts are available in Upper Manawarin and Lower Manawarin. • Commercial activities that typically occur throughout the village include numerous small shops, fuel sales, and transportation services.					
Fishing: Wild Caught Fish and Shellfish (Freshwater)	Provisioning	• All villagers fish in rivers and creeks for sustenance and sale. The species commonly caught are hassa, houri, lukanani and patwa. • Fishing for sustenance occurs frequently and several villagers fish daily. In addition, approximately nine 9 households are engaged in freshwater fishing for commercial purposes. The areas which most of this fishing occurs include Plimpa Creek and Fat Poke.	Inland freshwater ecosystems	Community members fishing for sustenance and sale rivers, creeks and savannahs **ES Linkage:** Fishing (Marine)	Essential	Moderate	**Critical**
Fishing: Wild Caught Fish and Shellfish (Marine)	Provisioning	• Marine fisheries is not a commonly done for sustenance or sale. Typically, the 9 households who are regularly engaged in freshwater fishing are also occasionally engaged in marine fisheries. Fishing trips in the marine environment typically occur during the crabbing season on trips where fishing and crabbing are complementary activities. • Nonetheless, marine fishes are consumed in the village. Fisherfolk from other villages visit the main landing area to sell marine species to the school and to other villagers. Approximately 200 pounds of marine species are bought weekly to supply school's feeding program.	Marine habitats and mangroves	Community members engaged in marine fisheries for sale **ES Linkages:** Crabbing, Fishing (Freshwater)	High	High	**Medium**

Crabbing	Provisioning	• Two types of crabs are captured for sustenance and sale. The first are red crabs which are caught in mangroves during the July to September crabbing season. At least one member of all households visit the shoreline areas to crab during the crabbing season with several villagers sharing boats to travel to the crabbing grounds in the mangroves. • 'Bush crabs' are caught in the hilly inland areas of the village during the rainy seasons. These are typically caught in small quantities and are used for sustenance. However, they are also sold to other villagers if caught in large quantities.	Mangroves, shoreline, inland terrestrial ecosystems	Community Members engaged in crabbing for sustenance and sale **ES Linkage:** Fishing	Essential	Moderate	**Critical**
Trapping/Hunting: Wild Meat	Provisioning	• Approximately 40 percent of the population is engaged in hunting of wild meat for sustenance. Species commonly hunted include bush cow, agouti, labba, wild hog, armadillo and deer. Seasonally, particularly if target species are reported to be abundant, all households are engaged in hunting for sustenance.	Coastal wetlands, forested areas	Community members engaged in hunting for wild meat	High	Moderate	**High**
Trapping: Wildlife Trade	Provisioning	• Wildlife trapping for trade has declined in the village and fewer than 10 percent of the population are engaged in trapping species such as boas, anacondas, parrots, and macaws for sale (mainly at Charity).	Coastal wetlands, forested areas	Community members engaged in wildlife trapping and trade	Moderate	Moderate	**Medium**
Agriculture: Cultivated Crops	Provisioning	• Most households have farms with plantains, cassava, vegetables, and fruits. With the onset of the COVID-19 pandemic, the intensity of farming increased and many teachers also became engaged in crop cultivation. However, persistent and unseasonal rainfall reduced agriculture in the village because traditional agricultural practices (slash and burn) cannot be	Cultivated lands, forested areas, residential areas	Local farmers and the general population of Manawarin **ES Linkage:** Aquatic Transportation	Essential	Moderate	**Critical**

		done in the rainy seasons. Heavy rainfall also damaged crops by creating waterlogged conditions for root crops (like cassava). • Crops are for household use and some are sold to the school and other villages. On occasion, produce is transported to Santa Rosa (Region 1), Charity (Region 2) or as far as Parika (Region 3) for sale. However, the costs of transporting produce to markets are high.					
Freshwater for Household Use	Provisioning	• The community depends on freshwater from the rivers and creeks for bathing, washing, cooking, and drinking. Some people harvest rainwater for domestic purposes and others use the groundwater from hand-dug wells. • Guyana Water Incorporated (GWI) plans to establish a well in Central Manawarin later in 2022. Water from the well will be distributed via standpipes placed at various points around the village. There are no plans yet for GWI to provide water to Upper and Lower Manawarin.	Inland freshwater ecosystems	Residents of the Manawarin village	Essential	Moderate	**Critical**
Traditional Resource Use	Provisioning	• Traditional resources are used for several purposes including crafts, medicines and food. • Nibbi, mocru, ite shoots, bamboo and acouro straw are used for crafts. In particular, mocru is used to make matapees and quakes. Acouro straw is used to make fans for baking cassava bread. Bamboo is used to make fish traps. Ite palm is used to make hammocks and car mats. • Several plants are also used for medicinal purposes including wild cane, leaf-of-life, sapodilla, ginger, kapadulla, rose of the mountain, sasporilla, hiari, sepku, tricle, and obadee. Noni is not commonly used in this village.	Forested areas	Residents of Manawarin village	Essential	High	**High**

		• Teas and wines are made using touru and ite shoots. Some people cook cabbage palm. • The community cuts wood for its internal construction and for sale.					
Aquatic Transportation	Provisioning	• The primary mode of access to Central Manawarin is via boat. However, there are also laterite and earthen trails that connect Central Manawarin to Waramuri/Haimakabra, Kewbanna and Santa Rosa. • Boats are the only form of transportation to Upper and Lower Manawarin. Most households or groups of households have small landing areas for embarkation/disembarkation and boat docking.	Inland freshwater ecosystems	Residents of Manawarin village **ES Linkages:** Settlements, Agriculture, Fishing	Essential	Low	**Critical**
Religious/Ritual	Cultural	• Rockstone is a scared spiritual site that is used by practitioners of the traditional indigenous religion. However, the site is located far inland and the trail is challenging. In addition, most villagers are practicing Christians and thus, the site is not widely used. • There are six Christian denominations in the village and 10 churches. Each church has a private landing area for boats. Baptisms are conducted in the rivers and creeks immediately adjacent to the churches.	Inland freshwater and terrestrial ecosystems	a) Residents of the village who visit the traditional Rockstone site b) Local Christian communities	a) Low b) High	a) Low b) Moderate	**a) Medium** **b) High**
River Defense and Erosion Regulation	Regulating	• The rivers are covered by extensive vegetation protecting the banks from the impacts of the boats and water current.	Coastal wetlands, river ecosystems	Residents of Manawarin village **ES Linkage**: Aquatic Transportation	High	Low	**Critical**

Global Climate Regulation	Regulating	• The village encompasses an inland forested area which contributes to carbon sequestration and thereby supports global climate regulation.	Forested areas	Residents of Manawarin	Moderate	Moderate	**Medium**
Primary Productivity and Habitat Provision	Supporting	• There is an abundance of wildlife within the forest and rivers.	Coastal wetlands, forested areas	Residents of Manawarin village **ES Linkages:** Crabbing, Trapping/Hunting, Aquatic Transportation	High	Moderate	**High**
0103 Waramuri – Population estimate 1,500 to 1,800 people							
Social/Economic: Settlements	Provisioning	• Waramuri is a titled Amerindian village with several satellite villages namely, Haimakabra, Para, 7-Miles and Sky Night. All villages are collectively governed by the same Village Council. • Waramuri is located on a white sand highland where several village buildings and social services are centralized. These include the Village Office, Youth Centre, Sports Ground, Health Centre and schools (nursery, primary and primary tops). In addition, there are about 25 shops in the villages. • Previously, the village had a computer hub and an internet connection via INET. However, the computer hub is undergoing repairs and the internet connection is no longer available.	Residential, commercial, administrative	Residents of Waramuri village and its satellites	Essential	Low	**Critical**
Fishing: Wild Caught Fish and Shellfish (Marine)	Provisioning	• Marine fisheries are practiced by residents of Haimakabra, Waramuri and Para. In Haimakabra, approximately 10 persons are engaged in marine fisheries as a primary livelihood activity. In Waramuri, there are two fishing boats engaged in marine fisheries. In	Marine habitats, mangroves	Local fisherfolk engaged in marine fisheries	High	Moderate	**High**

		Para, one fishing boat (operated by one family) is involved in marine fisheries. • Fishing trips typically last for two weeks. During the trips, fisherfolk set up camps on beaches along the shoreline where they land daily and dry or salt their catches for preservation. Fish are preserved by drying, smoking or salting because large quantities of ice are not readily available locally. Fisherfolk interested in preservation by icing must purchase ice from the Big Bird and Sons Complex in Charity. • Fishing grounds are typically located west of the Moruca River (up to Tiger Beach) and east of the Moruca River, with trips reported to occur between the mouth of the Pomeroon River and the Cozier Canal. Catch includes cuirass, basha, snapper, gillbacker and sea catfish among others.		**ES Linkages:** Crabbing, Mangroves			
Fishing: Wild Caught Fish (Freshwater)	Provisioning	• All villagers practice freshwater fishing using lines and rods for sustenance throughout the year in areas close to their homes. Some villagers reported that sustenance fishing with rods is most productive during the dry seasons. • Several persons, mainly from Haimakabra, are also engaged in freshwater fishing for commercial sale in the village and at the Kumaka market (in Santa Rosa) on Saturdays. Commercial freshwater fishing also occurs in inland swampy areas where 'bush fish' are targeted.	Inland freshwater ecosystems	Local fisherfolk and general population engaged in freshwater fishing for sustenance and sale	Essential	Moderate	**Critical**
Crabbing	Provisioning	• Three types of crabs are caught by Waramuri villagers namely, blue crabs (called bundari crabs), red crabs and bush crabs.	Mangroves	Local fisherfolk and general population **ES Linkages:** Mangroves	Essential	High	**High**

		• Bundari crabs are caught throughout the year by marine fisherfolk in an attempt to increase the volume and value of catch taken to market. • Red crabs are mainly caught during the July to September crab season. Every household visits the shoreline to catch crabs for sustenance. Approximately 20 people are engaged in seasonal crabbing for livelihoods. Out-of-season, some fisherfolk also catch red crabs to supplement fish catch. This is done by removing crabs from their holes. According to local fisherfolk, out-of-season capture for red crabs is not done in April to May because the crab shells are soft causing high mortality of the catch (this period is locally referred to as the 'water period'). • During the rainy season, bush crabs are caught in the hilly areas of the village.					
Trapping/Hunting: Wild Meat	Provisioning	• Approximately 7 to 8 persons hunt for sustenance and to a limited extent, for sale if orders are placed by villagers. Species typically hunted include labba, acouri, deer, bush hog, alligators and tapir. Iguanas are hunted seasonally. • Ducks are scare in the inland areas of the village and have to be caught along the shoreline. In addition, turtles were previously captured but this was stopped officially due to conservation efforts. However, turtle poaching may still be on-going.	Coastal wetlands, forested areas	Villagers engaged in hunting for sustenance and sale	Moderate	Moderate	**Medium**
Trapping/Hunting: Wildlife Trade	Provisioning	• Previously, several persons from the village trapped birds and other wildlife for trade. The wildlife was sold to a trader who visited the Kumaka market (in Santa Rosa) every Friday and Saturday. However, this practice was	Coastal wetlands, forested areas	Villagers engaged in wildlife trapping for trade	Low	High	**Low**

		banned in Santa Rosa. As such, there is limited or no capture of wildlife for trade.					
Agriculture: Livestock	Provisioning	• Chicken rearing is practiced in Waramuri and Haimakabra for sustenance and sale. In addition, community groups have been formed by persons engaged in chicken rearing for sale of meat.	Residential areas	Local livestock farmers and other villagers	Moderate	Moderate	**Medium**
Agriculture: Cultivated Crops	Provisioning	• Many villagers cultivate crops for substance as well as for sale within the village and at the Kumaka market (in Santa Rosa). Cassava is the main crop cultivated and it is the staple food in the village. Other crops include yams, plantains, bananas and coconuts. Small quantities of peanuts and red beans are also cultivated. • Heavy, unseasonal rainfall has significantly affected agriculture in the village. Waterlogged conditions have led to cassava rot. In addition, banana farms were damaged due to heavy rainfall as there were significant cost constraints in establishing appropriate drainage systems. • Coconut cultivation is challenged by a disease with attacks the coconut trees. Water coconuts and copra are transported to Charity for sale and there are also significant challenges associated with transportation.	Cultivated lands	Local farmers and general population	Essential	High	**High**
Traditional Resource Use	Provisioning	• Traditional resources are harvested and utilized by most villagers. • Most people cook with cooking gas. Firewood is mainly used for making cassava bread. • Honey is gathered from wild bees along the beach, primarily for sale. • The ite palm is recognized by the village as the tree of life providing tibisiri for craft and hammocks, clothing, household items, roof	Coastal wetlands, forested areas, shoreline	Residents of Waramuri	High	Moderate	**High**

		material; fruit for drink making; and the tapacoma worm. • Lumber is cut for use within the village and no harvested lumber is exported. The village has a Saw Pit Licence that allows for chain sawn lumber. Previously, villagers from Santa Rosa were harvesting timber from within the boundaries of Waramuri but this has stopped. • The village has stone deposits along the Manabo Road at an area called Rock Island in Haimakabra. Stone is mined and used within the community for all projects.					
Freshwater for Household Use	Provisioning	• The community depends on freshwater from the rivers and creeks that are critical for fishing and transportation. Freshwater in the creeks and rivers is also used for bathing, washing, cooking, and drinking. • Since ESS-1, GWI has established a well in Waramuri and water is distributed by standpipes which are located in proximity to residences. GWI water distribution and supply systems are not active in any of the satellites.	Inland freshwater ecosystems	Residents of Waramuri and its satellites **ES Linkage**: Aquatic Transportation	Essential	Moderate	**Critical**
Aquatic Transportation	Provisioning	• Transportation to the village (particularly Waramuri and Haimakabra) is via boat. • However, there is laterite capped and earthen road network connecting Waramuri to 7-Miles and ultimately to Santa Rosa.	Inland freshwater ecosystems	Residents of Waramuri and its satellites **ES Linkages:** Fishing, Agriculture (Crop Cultivation and Livestock), Socio/Economic	Essential	Moderate	**Critical**
Cultural Services	Cultural	• There is shell mound in Waramuri that is valued as a local heritage site. The Village Council is interested in promoting the shell mound as part of tourism package to be developed.	Residential, administrative	Residents of Waramuri and its satellites	Moderate	Moderate	**Medium**

				ES Linkage: Tourism and Recreation			
Tourism and Recreation	Cultural	• The Village Council is interested in developing tourism as an economic activity. Earlier in June 2022, the Guyana Tourism Authority (GTA) visited Waramuri and discussed the potential for developing “circuit tourism” with other villages in the Moruca sub-district. Attractions in Waramuri include the shell mound. • However, significant infrastructural developments will be required in the village including the construction of a guest house. Earlier in June 2022, the Toshao from Warapoka also visited Waramuri to share the former’s experiences in developing tourism in the village.	Residential, commercial	Residents of Waramuri and its satellites **ES Linkage:** Cultural Services	Moderate	High	**Low**
River Defense and Erosion Regulation	Regulating	• The rivers are covered by extensive vegetation protecting the banks from the impacts of the boats and water current.	Coastal wetlands, river ecosystems	Residents of Waramuri and its satellites **ES Linkage**: Aquatic Transportation	High	Low	**Critical**
Global Climate Regulation	Regulating	• The village encompasses an inland forested area which contributes to carbon sequestration and thereby supports global climate regulation.	Forested areas	Residents of Manawarin	Moderate	Moderate	**Medium**
Primary Production and Habitat Provision	Supporting	• Numerous species of birds, fishes, mammals including manatees and river otters are found in the rivers. • The village is also home to troops of howler monkeys and squirrel monkeys. Efforts are made in the village to protect these monkeys and they do not interfere with daily lives of the villagers.	Coastal wetlands, forested areas	Residents of Waramuri and its satellites **ES Linkages:** Tourism and recreation	High	Moderate	**High**

0105 Santa Rosa – Population estimate 10,500 people							
Social/Economic: Settlements	Provisioning	• Santa Rosa comprises 13 villages namely, Santa Rosa Village, Mora, Karaburi, Kumaka, Rincon, Kamwatta, Ko-Ko, Parakese, Wallaba, Cabora, Haimaruni, Kare and Islands, and Santa Rosa and Islands. • Santa Rosa is the administrative hub for the Moruca Sub District of Region 1. Most commercial activities and social services are available in this village. • In addition, the village has reliable mobile phone service (including data) from Digicel, grid supplied electricity for 16-hours each day, and water from the utility company in three villages.	Commercial, administrative, residential	Residents of Santa Rosa **ES Linkages:** Aquatic Transportation	Essential	Low	**Critical**
Fishing: Wild Caught Fish and Shellfish (Marine)	Provisioning	• Approximately 20 persons from Santa Rosa, mostly from Parakese, are engaged in marine fisheries as a livelihood activity. Fishing trips are made weekly in fishing grounds located between Iron Punt and the Pomeroon River. • Landed produce includes fresh fish as well as dried or salted fish (refer to as “corned fish”). Fish are preserved by drying, smoking or salting because large quantities of ice are not readily available locally. Fisherfolk interested in preservation by icing must purchase ice from the Big Bird and Sons Complex in Charity. A privately owned ice factory was established in Santa Rosa but this was not a feasible undertaking as a bowl (approximately 0.125 kilograms) of ice was sold for GYD $100. • Catch is sold at the weekly market in Kumaka and at Charity (Region 2). Generally, high-value species and scaled fishes are taken to the Charity market for sale and skin fishes are sold in Kumaka.	Marine habitats, mangroves	Local fisherfolk engaged in marine fisheries **ES Linkages:** Crabbing, Mangroves	High	Moderate	**High**

		• Although residents of Santa Rosa fish for sale, most of the catch sold at the Kumaka market is by fisherfolk from Haimokabra.					
Fishing: Wild Caught Fish (Freshwater)	Provisioning	• Almost all villagers fish for sustenance, as frequently as daily, in the Moruca River. • Approximately 40 persons are engaged in freshwater fishing for commercial purposes. Commonly used fishing grounds are Dog Creek, Luri Creek, Baramanni, Biara, and Waini Rivers. Species caught include yarrow, patwa, houri, hassa, lukanani, bass, imeri and morocut. As with marine fisheries, landed produce is also “fresh” or “corn”.	Inland freshwater ecosystems	Local fisherfolk and general population engaged in freshwater fishing for sustenance and sale	Essential	Moderate	**Critical**
Crabbing	Provisioning	• Two types of crabs are caught namely, red crabs and rain crabs. Currently, one person is engaged in capture of red crabs throughout the year for sale. During the July to September crab season, almost all households are engaged in crabbing for sustenance. During this season, crabbing is also a recreational activity for young persons. • Rain crabs are caught in small quantities, mainly for sustenance, during the rainy season.	Mangroves, inland terrestrial ecosystems	General population of Santa Rosa	High	High	**Medium**
Agriculture: Livestock	Provisioning	• Approximately eight persons rear cattle, sheep and pigs for meat. Livestock are grazed in the savannas close to the village. • Almost all households rear creole fowls and ducks, mainly for sustenance. In addition, a large number of persons are also engaged in rearing poultry for sale of meat.	Residential, savannas	Livestock farmers and general population	High	Moderate	**High**
Agriculture: Crop Cultivation	Provisioning	• All households have small farms or kitchen gardens where cassava and cash crops are cultivated for sustenance.	Residential, cultivated lands	Farmers and general population	High	Moderate	**High**

		• Larger scale farming in increasing in intensity in the village. For example, a large farm is being established along the 4-miles road shortcut for the cultivation of coconuts, bananas, plantains, avocado and cherries.					
Trapping/Hunting: Wild Meat and Wildlife Trade	Provisioning	• A few persons from the village are engaged in hunting wild meat for sustenance and sale. However, hunting does not occur on village lands but species like labba, acouri and deer are captured on state lands. Restrictions on hunting on village lands are part of a conservation effort to help to develop eco-tourism in the village. • Trapping wildlife for trade is banned as the village is trying to develop eco-tourism and this encourages biodiversity conservation. A trader who previously bought and sold wildlife at the Kumaka market has also been banned from operating at the market. The ban on wildlife trade is reflected in the village by-laws and the Village Council is working towards it being published in the Gazette.	Coastal wetlands, forested areas	Local persons engaged in hunting for wild meat	Low	High	**Low**
Traditional Resource Use	Provisioning	• Traditional resources are harvested and utilized in a limited manner. • “Bush medicines” are prepared using various plants and are commonly used in the village. • Turtle shells are used for traditional spiritual purposes. • Cabbage palm is only cooked rarely in the village. Some locals believe that the previous widespread use of cabbage palm has reduced the habitats for parrots in the village.	Coastal wetlands, forested areas	General population of Santa Rosa	High	Moderate	**High**
Freshwater for Household Use	Provisioning	• GWI provides water to Kumaka, Rincon and a section of Mora. Water is supplied twice daily but the water is not treated prior to distribution.	Inland freshwater ecosystems	General population of Santa Rosa	Essential	Moderate	**Critical**

		There is a separate well that supplies water to the Santa Rosa Secondary School. • All other communities rely on the rivers and creeks for bathing, washing, cooking, and drinking.		**ES Linkages:** Fishing, Tourism and Recreation, Transportation, Socio/Economic			
Aquatic Transportation	Provisioning	• Santa Rosa is the trading and transportation hub for the Moruca Sub District of Region 1. Numerous boats and small vessels arrive in the village to ply their trade at the Kumaka waterfront at two times weekly. • In addition, over 300 people leave/arrive in the area daily. Commercial passenger boats connect to other villages in Region 1 including Kwebanna and Port Kaituma, and to Charity (Region 2). • The road network in Santa Rosa is being developed. There are laterite capped or earthen roads that lead to most communities. In addition, roads in Kumaka and some other areas have impervious surfaces like concrete or asphalt.	Marine habitats, inland freshwater ecosystems	General population of Santa Rosa, traders, miners, visitors **ES Linkages:** Fishing, Tourism and Recreation, Transportation, Socio/Economic	Essential	Moderate	**Critical**
Tourism and Recreation	Cultural	• The village also has a 200 year old church that is considered as a heritage site. • There are hieroglyphics in the Kamwatta backdam. • The Moruca River and its numerous waterways are used for swimming and other recreational activities like fishing. • Harpy eagles were sighted at 1-Mile recently (by visitors from Warapoka) and this presents opportunities for bird watching in the village. • The Santa Rosa Village Council is developing a Tourism Package for the Moruca-sub-district soon. The package will leverage facilities which are already available in Santa Rosa, including the airstrip and hotels/guest houses although	Inland freshwater ecosystems, inland terrestrial ecosystems	General population of Santa Rosa and visitors to the village **ES Linkage:** Aquatic Transportation	Moderate	Moderate	**Medium**

		some of these facilities will have to be enhanced further. In Santa Rosa, tourism activities will involve trips to the church, Hero's monument and the Kamwatta hieroglyphics. The Village Council's Tourism Committee is developing activities for nature walks, canoeing and biking. From Santa Rosa, tours will also be offered to Shell Beach (for turtles), Warapoka (for the shell mound and harpy eagles) and Waramuri (for the shell mounds).					
River Defense and Erosion Regulation	Regulating	• The rivers are covered by extensive vegetation protecting the banks from the impacts of the motor boats and water current.	Coastal wetlands, river ecosystems	General population of Santa Rosa and visitors to the village **ES Linkage:** Aquatic Transportation	High	Moderate	**High**
Global Climate Regulation	Regulating	• The village encompasses an inland forested area which contributes to carbon sequestration and thereby supports global climate regulation.	Forested areas	Residents of Santa Rosa	Moderate	Moderate	**Medium**
Primary Productivity and Habitat Provision	Supporting	• The village and its surrounding areas are populated by numerous species of birds, fishes, mammals including numerous jaguars. Harpy eagles were also recently sighted in the village.	Coastal wetlands, forested areas	General population of Santa Rosa and visitors to the village **ES Linkage:** Tourism and Recreation	High	Moderate	**High**
0106 Assakata – Population Estimate >300 people							
Social/Economic: Settlements	Provisioning	• Assakata is a titled Amerindian village. Residences are dispersed throughout the village. In addition, there are numerous small businesses with people actively involved in the	Commercial, administrative, residential	Residents of Assakata	Essential	Low	**Critical**

		cash economy. Services like schools and health care are centralized in a highland area. • Facilities operated by the village council are also located in this centralized area include the Guest House. The Village Council also plans to establish a Multi-Purpose Building.					
Fishing: Wild Caught Fish and Shellfish (Marine)	Provisioning	• Approximately six persons (three families) are engaged in marine fisheries. Fishing trips last for approximately five days and fisherfolk set up camps at the beach. • Landed produce is fresh and corn (salted, smoked or dried). Catches are sold in the village or are taken to the market in Kumaka (Santa Rosa) for sale.	Marine environment, mangroves	Local fisherfolk engaged in marine fisheries **ES Linkages:** Fishing (Freshwater), Crabbing, Trapping/Hunting, Aquatic Transportation	Essential	High	**High**
Fishing: Wild Caught Fish (Freshwater)	Provisioning	• All 54 households in Assakata are engaged in freshwater fishing in waterways close to the community for sustenance or for small-scale sale in the community. The intensity of freshwater fishing has increased over the last few years because heavy rainfall significantly impacted the viability of crop cultivation in the village. • Six persons (three families), the same persons who are engaged in marine fisheries, practice freshwater fishing on a commercial scale with fishing trips to Baramanni Lake and Luri Creek. Luri Creek leads to the beach from where marine fisheries activities are conducted. Dog Creek was previously used but this Creek is blocked. Landed produce is fresh or corn and is taken to the Kumaka market (in Santa Rosa) for sale.	Inland freshwater ecosystems	Local fisherfolk and general population **ES Linkages:** Fishing (Marine), Trapping/Hunting, Aquatic Transportation	Essential	Moderate	**Critical**

Crabbing	Provisioning	• Four types of crabs are caught by villagers. Blue crabs (locally called bundari crabs), red crabs and sheriga crabs are caught along the shoreline during the July to September crabbing season. During the season, every household makes about 2 trips per season. Crabbing is not common out-of-season, although fisherfolk may occasionally capture crabs during fishing trips for sustenance and for sale. • Rain crabs are caught in hilly areas of the village during rainy seasons, in small quantities, and are used mainly for sustenance.	Mangroves	Residents of Assakata **ES Linkages:** Fishing (Marine), Trapping/Hunting, Aquatic Transportation	Moderate	Moderate	**Medium**
Agriculture: Cultivated Crops	Provisioning	• All households have farms that range from 1 to 5 acres. Cassava is the main crop used as the staple along with fish for a daily meal. Cash crop includes bananas, coconuts, fruits and vegetables. Crops are sold in the village and are also transported to the Kumaka market (Santa Rosa) for sale. • In the previous two years, crop cultivation has been significantly impacted by heavy rainfall. Due to these challenges, more persons became involved in freshwater fishing.	Cultivated lands, residential areas	Residents of Assakata	Essential	Moderate	**Critical**
Freshwater for Household Use	Provisioning	• Villagers have created hand dug wells from which water is sourced. In addition, GWI has installed solar pumps which are connected to a well but all residents do not benefit from this service. Water is also sourced from water palms. • If water is not available from any of those three sources, villagers collect water from nearby creeks for bathing, washing, cooking, and drinking.	Coastal wetlands, river ecosystems	Residents of Assakata **ES Linkages:** Aquatic Transportation	Essential	High	**High**
Traditional Resource Use	Provisioning	• About 30 villagers cut approximately 2,500 cabbage stems per trip making at least a trip per month. These stems are sold to a private	Forested areas		Essential	Low	**High**

		company, AMCAR. Some households cook cabbage palms. • All households are engaged in making traditional medicines using locally available plants. • Lumber is cut for household and community projects and for use by households. Approximately seven persons are engaged in timber harvesting.		Residents of Assakata			
Trapping/Hunting: Wild Meat	Provisioning	• Iguanas, tapirs, labba, deer and powis are caught on within the village or along the seashore on fishing and hunting trips, or along Luri Creek and Baramani Lake. • Nobody from the village is involved in wildlife trade.	Mangroves, shoreline, coastal wetlands	Local persons engaged in hunting for wild meat **ES Linkages:** Fishing, Crabbing, Aquatic Transportation	Moderate	Moderate	**Medium**
Aquatic Transportation	Provisioning	• Access to the community is only via boats through the freshwater river network.	Inland freshwater ecosystems	Residents of Assakata **ES Linkages:** Socio/Economic, Agriculture, Crabbing, Fishing, Trapping/Hunting	Essential	Low	**Critical**
Cultural Services	Cultural	• There are two shell mounds in the village which are considered as heritage sites. These shell mounds are intended to be used as part of an ecotourism package that is being developed in the village.	Inland terrestrial ecosystems	Residents of Assakata and visitors to the village	High	Low	**Critical**
Tourism and Recreation	Cultural	• The Village Council is interested in developing an Ecotourism Plan to guide development of tourism and ecotourism in the village. • The village has a freshwater lake that is being developed into a tourist attraction and a	Administrative, commercial, inland freshwater ecosystems	Locals Villagers, Region 1, Guyana	High	Moderate	**High**

		bridge/boardwalk with hanokus (Warrau word for 'benab') was constructed. There is local folklore about a large snake that lives in this lake. Additional plans for development of the lake include the creation of a white sand beach in the swampy areas surrounding the lake. • The village has also developed a Guest House. • Local biodiversity may also support ecotourism in the village. For example, recent visits from bird experts observed a species of birds, locally referred to as 'bandit birds', which were not previously known to be found in this area. Sightings of this species may positively contribute to bird watching in the village.					
River Defense and Erosion Regulation	Regulating	• The rivers are covered by extensive vegetation protecting the banks from the impacts of the motor boats and water current.	Coastal wetlands, river ecosystems	Residents of Assakata **ES Linkage**: Aquatic Transportation	High	Low	**Critical**
Global Climate Regulation	Regulating	• The village encompasses an inland forested area which contributes to carbon sequestration and thereby supports global climate regulation.	Forested areas	Residents of Assakata	Moderate	Moderate	**Medium**
Primary Production and Habitat Provision	Supporting	• Numerous species of birds, fishes, mammals including river otters, tapir, deer, acouri, and labba are found in the rivers and environment.	Coastal wetlands, forested areas	Residents of Assakata	High	Moderate	**High**
0107 Warapoka – Population estimate 600 people							
Social/Economic: Settlements	Provisioning	• Warapoka is a titled Amerindian village located in the Moruca sub-district of Region 1. The village has numerous small businesses and according to villagers, shops are well-stocked in comparison to immediately preceding years. • Ecotourism is being developed in Warapoka and there is a guest house for accommodation for	commercial, administrative, residential	Residents of Warapoka and visitors **ES Linkage:** Tourism and Recreation	Essential	Low	**Critical**

		villagers. Other services are located in Warapoka including schools (nursery, primary and primary tops) and a health post. In addition, there are several communal buildings which are administered by the Village Council including a computer hub and Hanoko (Warrau word for 'benab'). The Village Council intends to construct a Village Office in 2022 as the previous office space was converted into the computer hub. • There is internet connection in the village and visitors and guests are charged for connection. Cell phone service is poor and is typically only accessed in one area of the village.					
Fishing: Wild Caught Fish and Shellfish (Marine)	Provisioning Services	• Approximately 20 people fish at sea using four boats. Catch includes queriman, bangamary, butterfish, cuirass, gillbacker, cuffum, pica, basha, and others. Fishing trips last for 1 to 2 weeks and trips are made at least two times per month. During these fishing trips, fisherfolk set up camps on the beach. • Due to the unavailability of ice in the village, catches are persevered by smoking, drying or salting on camps at the beach. Therefore, landed catch comprises both fresh and corn products. Catch is sold wherever there are markets including in Santa Rosa, Mabaruma, to mining camps and in the village.	Marine habitats, mangroves	Local fisherfolk engaged in marine fisheries **ES Linkages:** Trapping/Hunting, Aquatic Transportation	High	Moderate	**High**
Fishing: Wild Caught Fish and Shellfish (Freshwater)	Provisioning Services	• Men from all households in the village fish in freshwater rivers and creeks for sustenance. • Approximately 10 families are engaged in freshwater fishing for commercial purposes. Fishing trips are made to Baramanni Lake, Waini River and Luri Creek for commercial purposes. Most of the catch is sold fresh at the Kumaka	Inland freshwater ecosystems	Local fisherfolk and general population of Warapoka	Essential	Moderate	**Critical**

		market (Santa Rosa) although a few persons also transport their catch to Mabaruma for sale.					
Crabbing	Provisioning Services	• Crabs are caught seasonally in July to September along the shoreline by every household in the village. Crabs are not caught for sale. In addition, crabbing out-of-season is rare.	Mangroves	General population of Warapoka	Moderate	Moderate	**Medium**
Agriculture: Cultivated Crops	Provisioning Services	• All families have farms of about 1 to 2 acres. Interest in farming as a livelihood is increasing due to the rising cost of living and impacts of COVID-19. As such, many persons are trying to obtain additional lands for farming. In addition, due to the persistent rainfall, farming is being done in both the wet and dry seasons unlike traditional methods when farming mostly occurred in the dry season. • Cassava is the main crop cultivated and is the staple food in the village. Other crops include plantains, pepper (a variety called bokroman) and fruits. • Most of the harvest is for sustenance but surplus is sold to the Tourist Centre and to the Schools for the hot meals programs.	Forests, Bush Islands	General population of Warapoka **ES Linkages:** Tourism and Recreation, Socio/Economic	Essential	Moderate	**Critical**
Agriculture: Livestock	Provisioning	• All households rear creole fowls for sustenance. In addition, there are two families that rear poultry for sale.	Residential areas	Poultry farmers and general population of Warapoka	High	High	**Medium**
Trapping/Hunting: Wild Meat	Provisioning Services	• Hunting of wild meat for sustenance and sale is a cultural activity. Species hunted include iguanas, tapirs, labba, deer, powis and wild ducks. • Duck eggs are collected along the shoreline to be used for food. Within the village birds eggs	Coastal wetlands, forested areas, shoreline	Local persons engaged in hunting for meat **ES Linkages:** Fishing	High	Moderate	**High**

		are collected seasonally (blue tiger bird and qak). The village will collectively decide whether collection of bird eggs for food will continue or whether it will be banned.					
Trapping/Hunting: Wildlife Trade	Provisioning	• Approximately eight persons regularly capture wildlife for sale. Species captured include red and blue macaws, snakes and mammals. However, markets for wildlife trade reduced following the ban on wildlife trade in Santa Rosa. In addition, a vendor who visited the village directly to purchase wildlife died, further reducing the market. • The village has deliberated whether wildlife trade should continue, particularly given the developments in ecotourism. However, there are no viable alternative livelihoods which locals may pursue. • If wildlife trade continues, the village emphasized the importance of ensuring that villagers are paid fair prices for the captures. Villagers described wildlife capture as a dangerous undertaking in which involved significant personal safety and security risk.	Forested areas	Local persons engaged in wildlife capture and trade	High	Moderate	**High**
Traditional Resource Use	Provisioning Services	• Approximately 20 households cut cabbage stems at least once per month for sale to AMCAR. During the COVID-19 lockdown, cabbage cutting increased becoming regular employment for some villagers and part-time employment for others. • Traditional medicines are common and all households have herbal remedies for various ailments. There are some traditional healers in the village. Many villagers believed that traditional medicines in the village were a cure for COVID-19.	Forested areas, inland freshwater ecosystems, shoreline	General population of Warapoka **ES Linkages:** Socio/Economic, Aquatic Transportation, Tourism and Recreation	Essential	High	**High**

		• Morocut is caught in the freshwater rivers for sale. • People gather honey from wild bees along the shoreline for sale. This is typically done only if hives are available or if there is an order for honey. • Timber is harvested for use in the village. Previously, the village was engaged in logging and is considering returning to the practice to provide additional livelihood options for its people. • A few persons make crafts and furniture using local materials like local hardwoods, nibi, mocru fibre, ite palm and bina rope among others. Crafts are also sold outside the village and a life-size canoe model was sold to the Canadian embassy. The village hopes for additional such opportunities and believes that ecotourism development will help to promote local products. • Traditional beverages are made using turo, ite and manicole.					
Aquatic Transportation	Provisioning	• Access to the village is only via boat.	Inland freshwater ecosystems	General population of Warapoka **ES Linkage:** Socio/Economic	Essential	Moderate	**Critical**
Freshwater for Household Use	Provisioning	• The main source of freshwater for household purposes (washing, cooking, bathing and drinking) is from nearby rivers and creeks. • In addition, at some homes, there are a few wells with hand pumps which have been dug to depths of 8-feet around the village as well as a few shallow hand dug ponds.	Inland freshwater ecosystems	General population of Warapoka **ES Linkage:** Socio/Economic, Aquatic Transportation	Essential	Moderate	**Critical**
Cultural Services	Cultural	• There are two shell mounds in the village which are considered as heritage sites.	Inland terrestrial ecosystems	General population and visitors	High	Low	**Critical**

				ES Linkage: Tourism and Recreation			
Tourism and Recreation (Ecotourism)	Provisioning	• Warapoka has a well-developed tourism product. There is a guest house with six rooms, four of which are self-contained. Tourists can visit the shell mounds and experience the Amerindian culture. The village is working to develop other nature-based activities like canoeing in the Warapoka Creek, Luri Creek, Maribu and to Alako (where the larger of the two shell mounds is located). • The village is home to nesting harpy eagles which provides opportunities for bird watching. Other species which are of interest to birders are also sighted in the village including tiger birds and agami heron. There are also opportunities to develop sport fishing. • The Village Council is interested in promoting research tourism in the village and during the visit by the study team, researchers from a UK university were staying at the guest house to study local biodiversity.	Forested areas, inland freshwater ecosystems, residential areas	General population and visitors **ES Linkages:** Socio/Economic, Cultural Services, Biodiversity	Essential	Moderate	**Critical**
Global Climate Regulation	Regulating	• The village has forested lands which may be used to earn carbon credits and payments from the Government for the climate regulating service that the forests provide. Such payments are intended to be invested in further developing ecotourism in the village and may help to provide alternative livelihoods for villages engaged in wildlife trade and those considering a return to commercial logging.	Forested areas	General population of Warapoka	Moderate	Moderate	**Medium**

Primary Productivity and Habitat Provision	Supporting	• Numerous species of birds, fishes, mammals including harpy eagles, river otters, tapir, deer, acouri, and labba are found in the rivers and environment. Four river turtles are found within the area (red neck, side neck, jumbie head, and black turtle). Manatees are also observed in Luri and Muribu Creeks. The village has two harpy eagles nesting sites.	Coastal wetlands, forested areas	General population and visitors **ES Linkages:** Hunting/Trapping, Tourism and Recreation	High	Moderate	**High**
0108 Three Brothers – Population estimate 277 people							
Socio/Economic: Settlements	Provisioning	• Three Brothers is a titled Amerindian village in the Moruca sub-district of Region 1. It is comprised of three villages. Residential commercial and administrative areas are generally located on flat lands on the right bank of the Waini River. Thus, the village is prone to flooded and lands adjacent to the river bank must be empoldered to be protected against flooding from high-tides. • The village has schools for students in Grades 1 to 9, and two Health Posts. A Multi-Purpose Building is administered by the Village Council.	Residential, commercial and administrative	General population of Three Brothers	Essential	Moderate	**Critical**
Fishing: Wild Caught Fish and Shellfish (Freshwater)	Provisioning	• There are about 10 fisherfolk who are engaged in freshwater fishing for commercial purposes. Fishing trips are made mainly to Luri Creek. Produce is transported to markets in Santa Rosa, Mabaruma and Port Kaituma for sale, depending on where the best markets are believed to be obtained. • Currently, fisherfolk have reported significant challenges including low catch and significant price competitiveness by Venezuelan vessels in local markets.	Inland freshwater ecosystems	Local fisherfolk engaged in freshwater fishing	Essential	Moderate	**Critical**

Fishing: Wild Caught Fish and Shellfish (Marine)	Provisioning	• Fishing trips in the marine environment are rare and fisherfolk may occasionally fish at the mouth of the Waini River. Typically, such fishing trips occur about once per year. • However, local fisherfolk plan to resume fishing at sea because of the challenges being encountered in agriculture in the village. Offshore areas will be accessed via Luri Creek.	Marine habitat and mangroves	Local fisherfolk engaged in marine fisheries	Low	High	**Low**
Crabbing	Provisioning	• Five species of crabs are caught along the shoreline namely, blue crabs (called bundari crabs), red crabs, jumbie crabs, sheriga crabs and boson crabs. During the July to September crab season, at least one member of each household visits the mangroves in the vicinity of the mouth of the Waini River to catch crabs. • Crabbing out-of-season is rare and when done, is used only for sustenance.	Mangroves	General population of Three Brothers	Moderate	Moderate	**Medium**
Trapping/Hunting: Wild Meat	Provisioning	• Approximately five persons regularly hunt for sustenance and meat is also provided to the extended family and to friends. Species hunted include deer, agouti, labba and wild hog. Iguanas and land turtles are captured during the dry seasons. • There is no wildlife trading in the village.	Coastal wetlands, forested areas, mangroves	Local persons engaged in hunting for wild meat	Moderate	Moderate	**Medium**
Agriculture: Cultivated Crops	Provisioning	• Over the previous three years, persistent inclement weather conditions in combination with high tides have destroyed farms even though all farming areas were empoldered. Most farms have been fully or partly inundated since 2019. Coconuts are the only crops surviving. • Previously, cassava, plantains, coconuts and other ground provisions were the main crops. Vegetables and fruits were also cultivated for home use and for sale in the village.	Cultivated lands	General population of Three Brothers	High	Low	**Critical**

Traditional Resource Use	Provisioning	• Approximately 90 percent of the village cuts cabbage stems for sale to AMCAR. • Mangrove is used for building and dried mangroves are used for firewood by a few people. • Traditional medicines are commonly used including noni, crabwood bark, crabwood seed, coconuts, calabash and soursop leaves. A special vine is used to treat snake bites. • Crafts made using local materials include quakes, sifters, fans and behe (Warrau word for basin or tub). • The village has a Crabwood Forest that is an important cultural resource and can be used for tourist attraction. The Crabwood Forest extends from Luri Creek to an area known as Bullet Tree. There is an agro-processing facility in the village which produces crabwood oil. However, crabwood seeds can only be collected in the dry seasons to make crabwood oil.	Coastal wetlands, forested areas	General population of Three Brothers **ES Linkages:** Mangroves, Socio/Economic	High	Moderate	**High**
Freshwater for Household Use	Provisioning	• The entire community depends on freshwater from the rivers and creeks for bathing, washing, cooking, and drinking. • There are no groundwater wells in the area and people depend on rain as a safe source of drinking water.	Coastal wetlands, river ecosystems	General population of Three Brothers **ES Linkages:** Aquatic Transportation	Essential	Moderate	**Critical**
Transportation	Provisioning	• Access to the community is only via boats through the river network.	Inland freshwater ecosystems	General population of Three Brothers **ES Linkage:** Socio/Economic	Essential	Low	**Critical**
River Defense and Erosion Regulation	Regulating	• The rivers are covered by extensive mangroves protecting the banks from the impacts of the motor boats and water currents.	Inland freshwater ecosystems	General population of Three Brothers **ES Linkages:**	Essential	Low	**Critical**

				Fishing, Aquatic Transportation			
Primary Productivity and Habitat Provision	Supporting	• There is a harpy eagle nesting area in the Luri Creek and villages believe the number of eagles in this convocation has increased. • Previously, various riverine and marine species were sighted by villagers but according to villagers these sightings have decreased due to more frequent movements of large vessels in the area. River dolphins are still seen when conditions are saline.	Coastal wetlands, Forested areas, Mangroves	General population of Three Brothers **ES Linkages:** Hunting/Trapping	High	Moderate	**High**
0109 Mabaruma Town Council – Population estimate 8,000 people							
Socio/Economic: Settlements	Provisioning	• Mabaruma is the only town among the communities which were surveyed in Region 1. It comprises of a main urban centre and six communities, some of which are only accessible by boat. • Mabaruma is the administrative centre of the region as the office of the Regional Democratic Council (RDC) is situated in the town. In addition, it is the administrative and commercial hub of the Mabaruma sub-district. The Township has a vibrant waterfront area at which vessels land and there are outdoor markets on Tuesdays and Saturdays. People from outlying communities and other communities in Region 1 visit this market to sell farm produce, fish catches and other products.	Administrative, commercial, residential	Residents of Mabaruma, nearby communities and vendors **ES Linkages:** Wharfs and Aquatic Transportation	Essential	Low	**Critical**
Socio/Economic: Wharfs and Aquatic Transportation	Provisioning	• The wharf at the Kumaka waterfront is the hub for commerce and transportation. The waterfront area is consistently becoming more active and the number of large, privately owned vessels (cargo boats and barges) that operate there are increasing. Venezuelan migrants and those who	Commercial, river banks	Residents of Mabaruma, nearby communities and vendors **ES Linkages:** Socio/Economic,	Essential	Moderate	**Critical**

		come to the Township to conduct business also land there. • In addition, there is a Government operated ferry service that arrives/departs from the Kumaka waterfront for connection with Georgetown every three weeks. • There are several plans in place to ease the congestion at the waterfront. The Regional Democratic Council (RDC) plans to construct a new wharf at Independence Road. In addition, the Town Council is attempting to relocate the municipal market from the waterfront area.		Fishing, Crabbing, Trapping/Hunting			
Socioeconomic, Sawmill. Lumberyard, and Boat Building/Repairs	Provisioning	• A sawmill and lumberyard are located in Mabaruma. • There is one boat builder located in the urban area of the Township. In outlying communities, boat building, boat repairs and engine repairs are common.	Commercial, residential	Local fisherfolk, boat owners	Moderate	Moderate	**Medium**
Fishing: Wild Caught Fish and Shellfish	Provisioning	• The fish market at the Kumaka waterfront is managed independent of the Town Council by a cooperative society. The co-op is based in Aruka Mouth but covers several communities within the sub-district. Currently, the fish market is congested and, in order to alleviate this challenge, a new wharf located behind the municipal market is being constructed for exclusive use by fishing vessels. • According to reports made to the Town Council, Venezuelan vessels also land their catch at the fish market and sell their produce to vendors at low prices. In turn, the prices at which vendors sell this produce outcompetes local fisherfolk. The co-op and the vendors sought compromise and agreed that local fisherfolk will sell only on the market days (Tuesdays and Saturdays) and	River banks, marine habitat	Local fisherfolk from Mabaruma and surrounding communities, fisherfolk from Venezuela, vendors **ES Linkages:** Crabbing	Essential	Moderate	**Critical**

		the vendors only will sell on the remaining four days. However, this agreement was breached and vendors continue to sell at the Kumaka market. The agreement between the co-op and vendors was struck independently of the Town Council.					
Crabbing	Provisioning	• Two types of crabs are commonly sold in the municipality namely the blue crabs (called bundari crabs) and red crabs. Both type of crabs are regularly caught throughout the year for sale at the Kumaka market and for export throughout the year (via the ferry). • During the July to September crabbing season, at least one person from most households in the township catch crabs for sustenance, recreation and occasionally, for sale. • Local interest in seasonal crabbing is so significant that it provides opportunities for other social programs. For example, in 2021, public vaccination programs for COVID-19 was planned to intersect with the crabbing season.	Mangroves	Local persons engaged in crabbing as a main livelihood activity and general population of Mabaruma	Essential	High	**High**
Agriculture: Cultivated Crops	Provisioning	• Almost all households in the Township are involved in agriculture for sustenance. In the outlying communities, about 60 percent of the populations are also involved in crop cultivation for sale. • Cassava and ground provisions are the main crops. Cash crop includes bananas, coconuts, fruits, vegetables, and vine crops. • Heavy rainfall in the previous years has significantly affected crop cultivation resulting in flooding, erosion and loss of harvest.	Cultivated lands	Local farmers and general population of Mabaruma	Essential	Moderate	**Critical**
Agriculture: Livestock	Provisioning	• There is large scale poultry rearing in the Township.	Residential areas	Local communities, private cattle farmers	Moderate	Moderate	**Medium**

		• Approximately 2 persons are engaged in pig farming and have constructed pens for this purpose. • Some persons own cattle that are allowed to freely graze and this is a concern to the Town Council. Residents have reported that cattle damage fences and crops, particularly in kitchen gardens. A few sheep and goats are also allowed to graze freely by their owners. The Township is exploring options for stray catching and pounding of animals so as to discourage uncontrolled grazing.					
Freshwater for Household Use	Provisioning	• Approximately 90 percent of the total population of the Township (including outlying communities) receives water supplied by GWI. • In areas where there is no connection, locals harvest rainwater, create shallow hand-dug wells or collect water from nearby rivers and creeks for domestic purposes including bathing, washing, cooking, and drinking.	Inland freshwater ecosystems	Local Communities	High	Moderate	**High**
Traditional Resource Use	Provisioning	• Traditional medicine is used by all locals. Whenever possible, medicinal plants are harvested from the beach area. • Morocut is caught in the freshwater rivers and is sold fresh or preserved (smoked or salted) at the Kumaka waterfront. • Warrau migrants from Venezuela are skilled in using local materials to make crafts including hammocks, chairs, tables, shoulder bags and ornaments. • Local crabbers also use local materials to make quakes.	Forested areas	Local people **ES Linkages:** Fishing, Tourism, Commerce	Essential	High	**High**

Trapping/Hunting: Wild Meat	Provisioning	• Several persons from the Township hunt wild game for sustenance and sale. Species commonly hunted include labba, agouti and wild ducks.	Mangroves, forested areas, shoreline	Local persons engaged in hunting for wild meat	High	High	**Medium**
Trapping/Hunting: Wildlife Trade	Provisioning	• Wildlife trade is actively practiced at the Kumaka waterfront on market days (Tuesdays and Saturdays). There are approximately two wildlife traders who are based in Mabaruma and purchase animals from persons from within and outside the Township (including from Venezuela) for export to Georgetown. Species captured include parrots, macaws, snakes (boas and anacondas) and anteaters among others. • According to the Town Council, the conditions in which wildlife is stored prior to sale is inhumane and several animals, particularly birds, are crowded into small cages. The Township is pursuing the development of ecotourism and is cognizant that the conditions under which wildlife are sold would create a negative perception to foreign tourists interested in a green, eco-friendly experience.	Mangroves, forested areas, shoreline	Local persons engaged in wildlife trade **ES Linkages:** Wharf and Aquatic Transportation	High	Moderate	**High**
Tourism and Recreation: Ecotourism	Cultural	• The Township is interested in reviving tourism and there are several natural attractions which are considered to be included in a tourism package including visits to Skull Island, the Kissing Rocks, Tiger Cave and the Hosororo Falls. Locals visit Waini Point and Shell Beach on Easter and on special occasions.	Inland freshwater ecosystems, riverine habitats	Local communities	Essential	High	**High**
River Defence and Erosion Regulation	Regulating	• Extensive mangroves forest cover the banks of the main rivers and the coastline offering valuable protection and stability.	Mangroves	Local communities	Moderate	Moderate	**Medium**

Primary Production and Habitat Provision	Supporting	• The town, particularly the outlying areas, has a high diversity of flora and fauna. • Rubber trees line the main road of the urban centre. These trees were imported from Asia and are widely considered to be part of the cultural heritage of the Township. • Numerous species of birds, fishes, mammals are found in the rivers and inland environment. Many birds are in the area but not caught for food or trade. Parrots and macaws can be seen in the evening sky with a bird roosting area close to the town.	Coastal wetlands, forested areas, inland freshwater ecosystems	Local people **ES Linkages:** Hunting, fishing, tourism	High	Moderate	**High**
0110 Aruka Mouth – Population estimate 320 people							
Fishing: Wild Caught Fish and Shellfish (Marine)	Provisioning	• Fishing is the main livelihood activity in the community and more than 80 percent of the households are engaged in fishing. • All fisherfolk conduct fishing trips at sea in the vicinity of Waini Point. Fishing trips last for 2 to 6 days and catch is landed fresh on ice. Catch includes snook, basha, bangamary, gillbacker, cuirass, queriman etc. • Most of the catch is sold at the Kumaka market on Tuesdays and Saturdays. Fisherfolk from Aruka Mouth and other communities that sell produce at the Kumaka waterfront have formed a cooperative society called SWMBAK Cooperative Society (SWMBAK – Shell Beach, Waini, Morawhanna, Barima, Aruka, Kumaka). Approximately 300 fisherfolk accounting for 70 to 80 fishing boats are part of the co-op. The current President of the co-op is a resident of Aruka Mouth.	Marine habitats	Commercial fishing along the coast	Essential	Moderate	**Critical**
Fishing: Wild Caught Fish and Shellfish (Freshwater)	Provisioning	• Freshwater fishing for sustenance in the vicinity of the community is rare. According to the community, the area is too busy, particularly with	Inland freshwater ecosystems	Commercial freshwater fishing	Moderate	Moderate	**Medium**

		the frequent passage of large vessels, to be conducive for fishing. • During the dry season, freshwater fishing in the Barima River and Waini River is common. Due to the high levels of salinity in these areas during the dry season, the same marine species are typically caught.					
Crabbing	Provisioning	• Two types of crabs are caught by villagers namely blue crabs (called bundari crabs) and red crabs. Approximately 25 to 30 persons regularly capture both types of crabs throughout the year as a main livelihood activity. Crabs are caught at Waini Point and in the riverine areas and sold at the market at the Kumaka waterfront (Mabaruma) on Tuesdays and Saturdays.	Mangroves	Persons engaged in crabbing as a main livelihood activity and the general population of Aruka Mouth	Essential	High	**High**
Agriculture: Cultivated Crops	Provisioning	• A total of 20 families have farms that are empoldered and provide food for the household. Cassava, plantains, and ground provisions are the main crops. The farm produce is sold at Kumaka on Tuesdays and Saturdays. • Over the last few years, farming has been significantly challenged by heavy rainfall and high tides which, combined, resulted in significant flooding and crop damage.	Cultivated lands	Local communities (general population)	Essential	Moderate	**Critical**
Agriculture: Livestock	Provisioning	• 60 persons, mainly women, are engaged in rearing chickens. • All households are involved in a community project which also supports the rearing of chicken. • More than six families are engaged in rearing ducks. • One resident is rearing layers for eggs.	Residential areas	General population of Aruka Mouth	Essential	Moderate	**Critical**

Traditional Resource Use	Provisioning	• Approximately two to three households cut cabbage stems for sale to AMCAR. According to local stakeholders, cabbage cutting is hard and dangerous work and most persons prefer livelihoods in fishing. • Most persons rely on traditional medicines. Mangroves are also used for various medicinal purposes to treat minor injuries and illnesses. • The crab catchers utilize forest products for the crab quakes. • Mangrove is used for building and in the farms and, to a limited extent, for firewood.	Coastal wetlands, forested areas, mangroves	General population of Aruka Mouth	High	Moderate	**High**
Freshwater for Household Use	Provisioning	• The village has a problem with access to safe drinking water. The entire community depends on freshwater surface water bodies for bathing, washing, cooking, and drinking. However, intensive use of the Aruka River for transportation has resulted in pollution that makes the water unsafe for consumption. • As a result, people harvest rainwater or collect water from a spring that is located some distance away from the main settlements. There are no groundwater wells in the area.	Inland freshwater ecosystems	General population of Aruka Mouth	Essential	Moderate	**Critical**
Trapping/Hunting: Wild Meat	Provisioning	• Approximately 10 persons hunt meat for sale at the Kumaka market. Wild birds are also caught in the season when they are plentiful.	Mangroves, forested areas	Persons hunting wild meat for sale	High	High	**Medium**
Trapping/Hunting: Wildlife Trade	Provisioning	• One person is engaged in trapping birds (parrots and macaws) for trade at the Kumaka market.	Mangroves, forested areas	Community member engaged in wildlife trade	Low	High	**Low**
Aquatic Transportation	Provisioning	• Access to the community is mainly via boats through the river network.	Inland freshwater ecosystems	Local People **ES Linkages:** Settlements, Agriculture	Essential	Low	**Critical**

River Defense, and Erosion Protection	Regulating	• The river banks are protected by extensive mangroves. The mangroves protect the river from the impacts of the motor boats and water current.	Coastal wetlands, river ecosystems	Transportation	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Numerous species of birds and fishes along with monkeys can be seen in the area. • River dolphins and otters are sighted in the Waini River during the dry season when waters are saline. • Significant roosting areas for birds along river.	Coastal wetlands, forested areas, mangroves	Local people **ES Linkages:** Hunting/Trapping	High	Moderate	**High**
0111 Morawhanna – Population estimate 85 people							
Social/Economic – Commercial	Provisioning	• Venezuelan trawlers visit the waterfront area to purchase catch from local vessels, also contribute to the local economy. Approximately 60 trawlers remain docked in the community for 1 to 2 weeks during which time they sell fuel to fishing boats and other vessels. About 30 of these trawlers only sell fuel to local vessels but do not purchase fish. • There are four shops in the village. • Previously, an ice plant was operational in Morawhanna but has not been operational for approximately 2 years.	commercial, administrative	Local people **ES Linkages:** Hunting, fishing, tourism	High	High	**Medium**
Fishing: Wild Caught Fish and Shellfish (Marine)	Provisioning	• One boat, with a crew of five persons from Morawhanna, conducts fishing trips at sea. The boat started operations earlier in 2022. • However, the Morawhanna waterfront area is a major hub for landing of large fishing vessels from other communities who land there to sell produce to approximately 30 trawlers from Venezuela.	Marine habitats	Local fisherfolk engaged in marine fisheries	Low	Moderate	**Low**
Crabbing	Provisioning	• Three families are engaged in crabbing throughout the year, in the Mora Passage, as a	Mangroves	Local persons engaged in crabbing	Moderate	Moderate	**Medium**

		main livelihood activity. Crabs are taken to the Kumaka waterfront for sale to hucksters who work on the ferry. • During the July to September crabbing season, at least one member of each household is engaged in crabbing for sustenance. Crabs are caught at Waini Point and in the riverine areas including Morawhanna.		as a livelihood activity and general population			
Agriculture: Cultivated Crops	Provisioning	• Approximately 13 families are engaged in crop cultivation. The main crops planted are plantains, bananas, ground provisions and cash crops. • Farming is significantly challenged by flooding associated with both heavy rainfall and spring tides. Previously, the Government had supported empoldering by creating dams to protect settlements and farms from spring-tides. However, the dams were not constructed of even height and water intrudes during spring tides. Drainage is also a challenge because there is no koker and drains around the community are shallow.	Cultivated lands	General population	Essential	High	**Critical**
Agriculture: Livestock	Provisioning	• Four families rear poultry (chicken and ducks) for sustenance and sale.	Residential areas	Local persons engaged in poultry rearing	Moderate	Moderate	**Medium**
Traditional Resource Use	Provisioning	• Mangroves are used for construction (bridges, walkways and posts). In addition, approximately 50 percent of residents use dry mangroves for firewood. Further, mangrove bark is harvested and exported to Georgetown to be used for leather tanning.	Coastal wetlands, forested areas	Local people **ES Linkages:** Hunting, fishing, tourism	High	High	**Medium**
Freshwater for Household Use	Provisioning	• There is a well in the community but the water extracted is brackish and is only used for washing and bathing.	Coastal wetlands	Local Communities	Essential	Moderate	**Critical**

		• Villagers harvest rainwater for other household purposes. Several persons also purchase bottled drinking water from Mabaruma.					
Aquatic Transportation	Provisioning	• Access to the community is mainly via boats through the river network.	Inland freshwater ecosystems	Local Communities **ES Linkages:** Settlements, Agriculture	Essential	Low	**Critical**
Biodiversity	Supporting	• The area has a roosting spot with scarlet ibises and egrets roosting for the night. Numerous species of other birds, fishes, mammals, and crabs are found in the rivers and mangrove forests.	Coastal wetlands, mangroves	Local communities	High	Moderate	**High**
0112 Smiths Creek – Population 363 people of which 67 are Venezuelan migrants							
Fishing: Wild Caught Fish and Shellfish (Marine)	Provisioning	• More than 100 male villagers are engaged in marine fisheries. There are approximately 15 to 20 small boats that conduct fishing trips to Waini Point and Kamwatta. Fishing trips last for up to 3 days. • Previously, there was a community boat which was communally owned and was used by almost all persons, on an alternating basis, to conduct fishing trips. However, this vessel is no longer active because the engine was stolen by pirates. • Most of the young persons from the community work on fishing boats that are owned by persons from outside the village that make trips to Waini Point, Kamwatta, Bruck Bush and in the Mora Passage. • Catch includes cuirass, snapper, gillbacker, butterfish, snook, shark, paggie and bangamary among others. Generally, catch is sold at Kumaka market on Tuesdays and Saturdays.	Marine environment; Mangroves; river ecosystem	Local people	Essential	Moderate	**Critical**

Fishing: Wild Caught Fish and Shellfish (Freshwater)	Provisioning	• All women in the village fish in Smith's Creek for freshwater fishes like yarrow and sunfish. Fishing trips are conducted in canoes and "stamp rods" with No. 12 and No. 14 hooks are used. Catch is used for sustenance and is also taken by the women to the Kumaka market for sale. • Previously, freshwater fishing was also conducted in the Barima River and the Mora Passage. However, Venezuelan trawlers spill fuel/oil into these waters and this has made fish scarce in areas close to the community.	Inland freshwater ecosystems	Commercial and subsistence fishing along the rivers, creeks and savannas	Essential	Moderate	**Critical**
Crabbing	Provisioning	• Most families are engaged in crabbing as a livelihood activity and all women catch crabs. Two species of crabs are caught weekly for sale at the Kumaka market. These are the blue crabs (called bundari crabs) and red crabs. Frequent crabbing grounds are located in Crab Dog, Macaw Point and the Mora Passage. • A crab processing facility was constructed in the community with the support of the government more than three years ago. However, this facility has never been operational.	Marine environment; Mangroves;	Waramuri villagers	Essential	Moderate	**Critical**
Agriculture: Cultivated Crops	Provisioning	• The entire community is engaged in crop cultivation and all households have one acre of land under cultivation. Crops cultivated include cassava, ground provisions, plantains and citrus fruits. • Cultivated lands are empoldered but flooding has been occurring frequently because of heavy rainfall and the impact of spring tides. The RDC has allocated resources for heavy machinery to enhance empoldering by increasing the height and width of the dams.	Cultivated lands	Local communities (general population)	Essential	Moderate	**Critical**

Agriculture: Livestock	Provisioning	• A few persons are rearing poultry (chickens and ducks) for sustenance and sale. • A community group (Layers Group) was established to provide pens and other resources to allow for egg production in the village.			Moderate	Moderate	**Medium**
Traditional Resource Use	Provisioning	• Generally, more than 40 persons cut cabbage stems for sale to AMCAR. This is considered to be a dangerous profession requiring persons to travel far from the village. As such, people prefer to conduct this activity during the dry seasons and in wet seasons, there is limited cabbage cutting. • Traditional medicines are widely used in the village. Noni is one of the main plants used to make medicines that treat several illnesses. Mangroves are also used for medicine. • Mangroves are used for construction and dried mangroves are used by most households in the village as firewood.	Coastal wetlands, Forested areas, Bush Islands	Local people **ES Linkages:** Hunting, fishing, tourism	High	Moderate	**High**
Social/Economic: Commercial	Provisioning	• The village has three fuel suppliers selling to villagers and other persons in the region. • In addition, there are three shops in the community. A community group, called a Shop Group, will be established to help to manage commercial activities conducted by these shops.	Commercial, Administrative	Local people **ES Linkages:** Hunting, fishing, tourism	High	High	**Medium**
Freshwater for Household Use	Provisioning	• The community depends on freshwater from surface water bodies for domestic purposes like bathing, washing, cooking, and drinking. Due to the pollution of the Barima River, villagers have to fetch water from Kariabo.	Coastal wetlands, river ecosystems	Local Communities ES Linkages: Fishing, Tourism, Transportation, Commerce	Essential	Moderate	**Critical**
Aquatic Transportation	Provisioning	• Access to the community is mainly via boats through the river network.	Rivers	Local People **ES Linkages:**	Essential	Low	**Critical**

		• In addition, there is an earthen road leading to Mabaruma but this is typically in poor condition.		Settlements, agriculture, and socioeconomic			
Trapping/Hunting: Wild Meat	Provisioning	• A few men hunt wild game, particularly deer and acouri, for sustenance. Hunting is done by groups of persons who have trained hunting dogs. No firearms are used.	Mangroves, shoreline, savannas, forest	Local people **ES Linkages:** Tourism, Commerce	High	High	**Medium**
Trapping/Hunting: Wildlife Trade	Provisioning	• More than 20 persons are engaged in wildlife trapping for trade. Species trapped include snakes, parrots, macaw, land turtles, red wing, yellow wing and toucans among others. Trapping in done in the back-dams of the community, at the mouth of the Waini River and in the Mora Passage. • Wildlife is taken to the Kumaka market for sale to wildlife traders.	Mangroves, shoreline, savannas, forest	Local people **ES Linkages:** Tourism, Commerce	Essential	Moderate	**Critical**
River Defense, Erosion Protection	Regulating	• The rivers are covered by mangroves protecting the banks from the impacts of the motor boats and water current. The mangroves also act as roosting habitats for many birds.	Coastal wetlands, river ecosystems	Transportation **ES Linkages:** Fishing, transport	High	Low	**Critical**
Primary Production and Habitat Provision	Supporting	• There are many species of birds, fishes, and mammals including jaguars, tapir, deer, and labba which are found in the rivers and forests.	Coastal wetlands, Forested areas, Bush Islands	Local people **ES Linkages:** Hunting, fishing, tourism	High	Moderate	**High**
0113 Imbotero – Population estimate 595 people, including Venezuelan migrants							
Socio/Economic: Settlements and Commerce	Provisioning Services	• Imbotero is located on the right bank of the Barima River. The community now has a significant migrant population from Venezuela that has settled along the Barima River banks (Warraus settlement). The migrant populations are nomadic and do not remain in the community for prolonged periods of time.	Residential	Local people **ES Linkages:** Recreation, Administration	Essential	Low	**Critical**

		• The main livelihood activities are fishing and crabbing. Commercial activities are limited in the village and consistently high fuel prices has impacted such activities which previously occurred. For example, previously vendors visited the community and bartered essential items like groceries and clothes for crabs. This is no longer occurring and has cause significant hardships in the village. • The village has a school but the capacity is not adequate to house all children in the village. There is a Health Post in the village. There is no grid connection for electricity or running water in the village.					
Fishing: Wild Caught Fish and Shellfish (Marine)	Provisioning	• There are 20 fishing boats each of which is operated with crews of 3 to 5 persons. Fishing trips are generally conducted at Waini Point and last for approximately one week. Women also participate in fishing trips offshore. • Catch includes cuirass, catfish, basha, gillbacker, pacu, bangamary and butterfish among others. Catch is landed fresh on ice but if there are ice scarcities, catch is dried, smoked or salted for sale. Catch is taken to the Kumaka market (Mabaruma) on Tuesdays and Saturdays for sale.	Marine habitats	Fisherfolk engaged in marine fisheries	Essential	Moderate	**Critical**
Fishing: Wild Caught Fish and Shellfish (Freshwater)	Provisioning	• The same fisherfolk are also engaged in freshwater fishing at the creek head. On most occasions, freshwater fishing occurs in Lion Creek and in Venezuela waters. Women also participate in freshwater fishing trips. • Species caught include yarrow, houri, blinka and cassi. Catch is also sold at Kumaka on market days.	Inland freshwater ecosystems	Fisherfolk and general population engaged in freshwater fisheries	Essential	Moderate	**Critical**

Crabbing	Provisioning Services	• Six types of crabs are caught by villagers namely, blue crabs (also called bundari crabs), red crabs, white crabs, sheriga crabs, boson crabs and jumbie crabs. The latter two are small crabs which are typically used for bait. Crabs are caught in the mangroves surrounding the village. • All households in the village are engaged in daily crabbing for sustenance and sale. Crabs are taken to Kumaka for sale but villagers face challenges of high costs of fuel to transport catches to the market. • According to villagers, crabbing is difficult and dangerous work as they are exposed to wild animals like snakes in the mangroves and to diseases like malaria.	Mangroves	General population of Imbotero	Essential	Moderate	**Critical**
Agriculture: Cultivated Crops	Provisioning Services	• Approximately 25 households are engaged in crop cultivation. A variety of crops are cultivated including the cassava (the staple crop), other ground provisions like eddoes and sweet potatoes, and cash crops and fruit like pumpkin, plantain, bananas, pepper and watermelon. Farmers have also successfully cultivated high-value crops like ginger and turmeric. • However, farming has been significantly challenged by flooding from heavy rainfall and high-tides which also caused salt water intrusion. Recurrent floods have discouraged farming activities. However, dams are being rebuilt and crop cultivation may resume.	Cultivated lands	Local farmers **ES Linkages:** Aquatic Transportation	Essential	Moderate	**Critical**
Agriculture: Livestock	Provisioning	• Six persons rear chickens for sustenance and sale. Layers are also reared and eggs are collected. • One person rears ducks for sustenance and sale.	Residential areas	Local persons engaged in livestock rearing	Moderate	Moderate	**Medium**

Trapping/Hunting: Wild Meat	Provisioning Services	• A few persons hunt wild game like labba and agouti. However, during the rainy season, water levels are too high for hunting and therefore, this only occurs in the dry season. • In addition, dogs are trained to hunt. However, jaguars killed all of the hunting dogs in the village.	Mangroves, Forested areas	Local persons engaged in hunting for wild gam	High	High	**Medium**
Trapping/Hunting: Wildlife Trade	Provisioning Services	• Birds including parrots, macaws, black headed parrots, rainbow parrots are trapped at Macaw Point. These birds are sold to wildlife traders. • However, bird trapping is a seasonal activity and persons are engaged in this activity part-time depending on demand for these species.	Mangroves, Forested areas	Local persons engaged in wildlife trapping **ES Linkages:** Tourism, Commerce	Moderate	High	**Low**
Freshwater for Household Use	Provisioning	• During the rainy seasons, villagers practice rainwater harvesting for household purposes like drinking and cooking. • During the dry seasons, water is collected from Lion Creek or some shallow hand-dug wells that produce black water. The water from the creek is not clean with the result that water-borne diseases like vomiting and diarrhoea are common in the village.	Inland freshwater ecosystems	General population of Imbotero	Essential	Low	**Critical**
Aquatic Transportation	Provisioning Services	• Access to the community is mainly via boats through the river network.	Inland freshwater ecosystems	General population of Imbotero **ES Linkages:** Settlements, Agriculture, Crabbing, Fishing	Essential	Low	**Critical**
Traditional Resource Use	Provisioning Services	• Traditional medicines are widely used in the village for a variety of ailments. These include noni, sweet broom, tobacco, crabwood seed, fegosa and dry leave among others. There are	Forested areas, mangroves	Local people	Essential	Moderate	**Critical**

		two reasons for the reliance on traditional medicines. Firstly, many locals believe on the efficacy of these medicines. Secondly, cost constraints to access traditional health care is a major issue associated with limited access to pharmaceuticals, high costs for some drugs and the high costs of fuel (for transportation) to attend Government clinics in Mabaruma. • All households in the village cut cabbage for sale to AMCAR. However, this is also a dangerous profession. • Mangroves are utilized for construction of houses and stellings in the village. Dried mangroves are used for firewood. Mangrove bark is also harvested for export to Georgetown. • Local materials like tibisiri, nibi and mocru are used to make crab quakes, traditional utensils like sifters and matapee, and a variety of craft items like baskets, hammocks, hats, dresses and purses.					
Tourism and Recreation	Provisioning Services	• In April 2022, the Imbotero Research Centre was commissioned. The Centre has accommodation for up to six research guests. • As part of the work executed by the Centre, training in drone operation and setting up camera traps were provided to young persons from the village. In addition, the Guyana Tourism Authority is also providing training in becoming tour guides and four young persons have already been trained. These opportunities are welcomed by the village and are expected to form the basis for developing an ecotourism package.	Residential areas	Local persons benefiting from the operations of the Imbotero Research Centre	Essential	High	**High**
Shoreline Protection	Regulating Services	• Mangroves cover Waini Point and Shell Beach protecting the coast from the ravages of the sea.	Mangrove Forests	Local communities	High	Moderate	**Medium**

		These areas are used by the fisherfolk in different seasons with some fishing camps onshore.		**ES Linkages:** Fishing, hunting, Erosion regulation			
Primary Production and Habitat Provision	Supporting Services	• There are numerous species of birds, fishes, and mammals including tapir, deer, acouri, and labba found in the rivers and forest. Many birds are seen but not hunted. The entire environment has rich biodiversity with numerous species. Many jaguars and black caimans are prowling the area with jaguars eating 30 hunting dogs from the village. The Warraus from Venezuela have cleared patches of mangrove and built houses along the river banks.	Mangroves, forested areas	Local communities **ES Linkages:** Hunting/Trapping, Tourism and Recreation	High	Moderate	**High**
0114 Almond Beach – Population estimate 25 people							
Social/Economic Settlements	Provisioning Services	• The entire community resides along the beach. However, in the previous few years, there has been severe erosion which commenced along the eastern boundary of Almond Beach. According to representatives of the Protected Areas Commission (PAC), approximately 3 to 10 meters of the shoreline on the eastern side is being eroded every month. • Erosion resulted in the closure of the school at Almond Beach. The RDC has identified Khan's Hill in Mabaruma for the resettlement of residents from Almond Beach. Since ESS-1, the population of the community has been halved and only three households remain.	Shoreline, beach	Residents of Almond Beach and PAC Rangers	High	Moderate	**High**
Fishing: Wild Caught Fish and Shellfish (Marine)	Provisioning Services	• All three households which remain on Almond Beach are engaged in fishing. Fishing trips are conducted at Waini Point because of its proximity to the village. Fishing trips are typically conducted twice per week so that catch can be taken to the Kumaka market (Mabaruma) on	Marine habitats, shoreline, beach	Locals engaged in marine fisheries	Essential	Moderate	**Critical**

		Tuesdays and Saturdays for sale. Catch includes gillbacker, cuirass, catfish and snapper among others. • Persons from outside the community also set their fishing camps on the western extent of the SBPA.					
Fishing: Wild Caught Fish and Shellfish (Freshwater)	Provisioning Services	• All three families are engaged in freshwater fishing in the swamps and creeks surrounding the community. Catch typically includes houri and patwa which is used for sustenance.	Inland freshwater ecosystems	Locals engaged in freshwater fisheries	Essential	Moderate	**Critical**
Crabbing	Provisioning Services	• All three households are engaged in crabbing. Crabs are caught throughout the year, twice per week. Crabs are also taken to Kumaka market (Mabaruma) on Tuesdays and Saturdays for sale.	Beach, mangroves	Locals engaged in crabbing	Essential	Moderate	**Critical**
Agriculture: Cultivated Crops	Provisioning Services	• All households have farms located on the beach. Cassava is the main food crop grown along with coconuts, vegetables and fruits. Produce is mainly used for sustenance and if there is surplus, it is taken to the Kumaka market for sale on market days. Cassava bread is also made to order by all households. • Previously, coconut was the main crop on the beach. Copra and both dried and water coconuts are sold at Kumaka. Water coconuts were also exported to Trinidad by barges. However, large swathes of coconut farms have eroded and these activities are no longer conducted.	Cultivated lands	Local farmers, residents	Essential	Moderate	**Critical**
Traditional Resource Use	Provisioning Services	• Traditional medicines are used by all villagers. Noni is most commonly used. Red mangroves are also used to treat diarrhea.	Beach, shoreline	Residents of Almond Beach	Essential	High	**High**

		• Villagers collect driftwood from the beach to be used as firewood. This is the main fuel for cooking.					
Hunting/Trapping: Wild Meat	Provisioning Services	• Iguanas are hunted seasonally, in March to April, for sale. Iguanas are not used for sustenance in the village. In addition, during the season, approximately 12 to 14 persons from as far as Georgetown venture to catch iguanas in the community. • According to representatives of the Protected Areas Commissions (PAC), villagers from the Moruca sub-district visit the beach to poach nesting turtles for meat and there is also poaching of turtle eggs by villagers of Almond Beach.	Mangroves, forested areas	Residents of Almond Beach and persons who visit the Beach from other parts of Guyana	High	Moderate	**High**
Aquatic Transportation	Provisioning Services	• Access to the community is mainly via boats through the river network.	Inland freshwater ecosystems and marine habitats	Residents of Almond Beach, visitors, PAC	Essential	Low	**Critical**
Primary Production and Habitat Provision	Supporting Services	• There are numerous species of birds, fishes, and mammals including agouti, tapir, deer, acouri, and labba found in the areas close to the beach. These animals are seen but not hunted. • Numerous iguanas are found on the beach. • Several species of sea turtle nest on the beach.	Coastal wetlands, forested areas	Residents of Almond Beach **ES Linkages:** Hunting, fishing, tourism	High	Low	**Critical**

APPENDIX C - ECOSYSTEM SERVICES AND PRIORITY RATINGS IN REGION 2

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
NDC 01 - Charity/Urasara – Population estimate 7,800 people (Increasing due to immigration from Venezuela)							
Crabbing	Provisioning	▪ Approximately 15 families who reside in the NDC are engaged in crabbing as a livelihood activity throughout the year. These persons frequently utilize crabbing grounds along the banks of the Pomeroon River and at the mouth of the River both of which are located outside the NDC district. Within the NDC, sections of the shoreline along the Atlantic Ocean are also used for crabbing. All crabbing grounds are accessed by boat by travelling north of the NDC along the Pomeroon River and the shoreline area by the canal located along the south-western NDC boundary (bordering the Somerset and Berks village). ▪ During the crabbing season (July to September), hundreds of persons throughout the NDC are engaged in crabbing primarily for sustenance or recreational purposes. ▪ Two species of crabs are caught by local communities namely, red crabs (commonly called bok crabs) and sheriga crabs. ▪ Generally, the intensity of crabbing has increased due to a rise in demand for crabs and crab meat in local markets and more particularly, for transport to markets in Parika and Georgetown. Export markets typically outcompete local markets because of the prices obtained.	Riverine habitat and Mangrove Forests	a) Local communities engaged in crabbing as a livelihood activity b) Seasonal crabbing for sustenance and recreational purposes **ES LINKAGES:** Mangroves, Hunting/Trapping	a) Essential b) Moderate	a) Moderate b) Low	**a) Critical** **b) High**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Fishing: Wild-Caught Fish and Shellfish	Provisioning	▪ The Big Bird and Sons Fish Port Complex located in Charity is the main landing area for large artisanal fishing vessels (inboard cruisers). The Complex also has a fish processing plant. Approximately 70 vessels routinely use this landing area. ▪ Fisherfolk purchase ice and other supplies required for fishing trips from the Complex and return after fishing trips to offload/sell hauls. The majority of the fish offloaded at the Complex is processed for international export. The export markets are outcompeting local markets because of the prices obtained. ▪ There are smaller landing areas in Charity for fewer than 10 inboard cruisers at the Mange Wharf, Rooster Wharf and Miley Wharf. Vessels may occasionally also land at a small wharf located close to the cemetery. ▪ Most families fish in the Pomeroon River and in creeks for sustenance using a variety of fishing gear. Frequently caught species include basha, lau lau, catfish, haimara and lukanani. Fishing for sustenance in the Pomeroon River also has cultural significance particularly for indigenous people. ▪ A few persons use cast nets to fish in canals in the NDC for sustenance and recreation. ▪ Waste and pollution of Pomeroon River has been one of the biggest challenges encountered by fisherfolk and local communities.	Riverine Ecosystems and Marine Habitats	a) Big Bird and Sons Fish Port Complex comprising a landing site for artisanal fishing vessels and a fish processing plant b) Artisanal fisherfolk using the smaller landing sites in Charity c) Local communities fishing in the Pomeroon River for sustenance d) Local communities using cast nets to fish in canals **ES LINKAGES:** Socio/Economic (Wharfs, Markets and Commerce), Aquatic Transportation	a) Essential b) High c) Essential d) Low	a) Low b) Moderate c) Moderate d) Moderate	**a) Critical** **b) High** **c) Critical** **d) Low**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Agriculture: Cultivated Crops	Provisioning	▪ There is cultivation of plantains, ground provisions (sweet potatoes and eddoes), fruit (watermelon) and cash crops on dams along the boundary of the NDC mainly at New Road, Somerset and Berks, and along the Cozier Canal.	Sea dams	Local communities (general population)	Moderate	High	**Low**
Hunting/Trapping: Wild Meat	Provisioning	▪ Seasonal hunting for wild meat in mangroves by a few persons for sale. Several different species of wild meat are caught including bush turkey, labba, watrush, iguana and several species of birds.	Mangroves	Local persons engaged in capture of wild meat **ES LINKAGES:** Crabbing, Fishing, Mangroves	High	Moderate	**High**
Aquatic Transportation: Passenger Travel	Provisioning	▪ Small privately owned vessels facilitate passenger transportation between Charity and the Upper Pomeroon, the Lower Pomeroon, indigenous villages accessed via tributaries of the Pomeroon River (Akawini and Wakapau) as well as to Santa Rosa in Region 1. ▪ The Charity Stelling is in disrepair and as a result, only a few passenger vessels dock there. Most vessels dock along hard sea defence structures in Charity. The Government has announced plans to rehabilitate the Charity Stelling and Wharf. ▪ Most households along the Pomeroon River own small vessels (canoes or powered by small engines) for transportation. Several households have small docks where boats are moored.	Riverine Ecosystems	a) Local communities utilizing passenger boats b) Small boats and docking areas used by households for personal transportation	a) Essential b) Essential	a) Low b) Moderate	**a) Critical** **a) Critical**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Socio/Economic: Wharfs	Provisioning	▪ The Charity Wharf is used to facilitate trade of cargo and produce. The Wharf is in disrepair and the Government has plans for its rehabilitation. Two smaller wharfs in Charity are also used to facilitate trade namely the McBull Wharf and the Rooster Wharf. ▪ The commonly traded items include fresh produce (plantains, bananas, ground provisions and other crops) transported by boat to Georgetown for sale. Seafood like blue crabs (commonly called bundari crabs), hassar and morocut are transported to from Region 1 to Charity for sale in the market.	River and Ocean	Local businesses utilizing the wharfs **ES Linkage:** Fishing	Essential	Low	**Critical**
Social/Economic: Markets and Commerce	Provisioning	▪ There is a daily market at the Charity waterfront where fresh produce, seafood and other goods (including local products like cassareep and cassava bread) are sold. ▪ Other commercial activities at the Charity waterfront include wholesale and retail enterprises, hotels, restaurants and entertainment venues among others.	River bank and lands used for commercial purposes	Businesses and consumers relying on the commercial activities at the Charity waterfront **ES Linkages:** Socio/Economic, Tourism/Recreation, Transportation	Essential	Low	**Critical**
Socio/Economic: Riverine Fuel Stations	Provisioning	▪ There are three fuel stations in Charity which provide fuel to vessels used for fishing, trade, passenger transportation and personal vessels. One of these stations is operated by GuyOil and the other two are privately owned.	River bank	Operators of fuel stations and local communities who purchase fuel to facilitate aquatic transportation **ES Linkages:** Socio/Economic, Transportation	Essential	Moderate	**Critical**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Socio/Economic: Sawmill	Provisioning	▪ There is a sawmill located along the right bank of the Pomeroon River that prepares lumber for sale in local markets and for export. Logs are delivered to the sawmill via the Pomeroon River.	River bank and riverine ecosystems	Sawmill operator and local loggers	High	Moderate	**High**
Socio/Economic: Housing	Provisioning	▪ Residential areas are located along both banks of the Pomeroon River.	River bank	Local communities residing on the banks of the Pomeroon River **ES Linkages:** Transportation	Essential	Low	**Critical**
Socio/Economic: Squatting	Provisioning	▪ Migrants from Venezuela and locals are squatting in the cemetery. The NDC has requested intervention from the Government to regularize the area and put measures in place to improve sanitation and garbage disposal. ▪ Previously, migrants also squatted along the Charity waterfront. However, the NDC engaged with international aid organizations that operate in Guyana to support the relocation of these persons.	Coastlands	Local communities squatting in the NDC	Moderate	High	**Low**
Non-Wood Fibers and Resins	Provisioning	▪ Wild bamboo is harvested by a few persons in the NDC.	Coastlands, sea dam	Local communities harvesting bamboo	Low	Moderate	**Low**
Religious/Ritual	Cultural	▪ Local Christian communities use the Pomeroon River for baptisms. ▪ Local Hindu communities use the Pomeroon River and occasionally, the canal bordering the Somerset and Berks village for religious purposes.	Riverine ecosystems and sea dams	a) Local communities using the Pomeroon River for religious purposes b) Local communities using the canal for religious purposes	a) Moderate b) Moderate	a) Moderate b) High	**a) Medium** **b) Low**
Tourism/Recreation	Cultural	▪ The Charity waterfront is used for recreational purposes and on weekends, there are parties and BBQs.	River bank and lands used for commercial purposes	Local communities using the Charity waterfront for recreation	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Global Climate Regulation	Regulating	▪ Mangrove cover along the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Hunting/Trapping	High	Moderate	**High**
Shoreline Protection and Erosion Regulation	Regulating	▪ Mangroves growing naturally along the shoreline helping to regulate erosion and support shoreline protection.	Mangroves and Mudflats	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Hunting/Trapping	High	Moderate	**High**
Primary Production and Habitat Provision	Supporting	▪ Mangrove forests along the shorelines provide habitats for birds, crabs, fishes and other wildlife.	Marine habitat and Mangrove Forests	Local communities **ES Linkages:** Global Climate Regulation, Shoreline Protection, Crabbing, Hunting/Trapping	High	Moderate	**High**
NDC 53 - Nile/Cozier – Population Estimate 1,299 people							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	▪ Most families fish in the Pomeroon River and in creeks for sustenance using a variety of fishing gear. Fishing for sustenance in the Pomeroon River also has cultural significance, particularly for indigenous people.	Riverine ecosystems	Local communities fishing in the Pomeroon River **ES Linkages:** Transportation	Essential	Low	**Critical**
Crabbing	Provisioning	▪ Crabbing is a livelihood activity for a few persons particularly during the July to September crab season. Crabbing grounds in the NDC are frequently used by locals.	Mangroves and riverine ecosystems	Local communities engaged in crabbing **ES Linkages:** Mangroves, Hunting/Trapping	Essential	Moderate	**Critical**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Agriculture: Cultivated Crops	Provisioning	▪ Large-scale coconut plantations on the right bank of the Pomeroon River. ▪ Several small and medium-scale coconut plantations are also located along the left bank of the Pomeroon River.	River banks and cultivated lands	Owners of coconut plantations and workers who are employed **ES Linkages:** Socio/Economic (Coconut Water Bottling)	Essential	Low	**Critical**
Hunting/Trapping: Wild Meat	Provisioning	▪ Seasonal hunting for wild meat in mangroves by a few persons for sale. Several different species of wild meat are caught including bush turkey, labba, watrush, iguana and several species of birds.	Mangroves	Local persons engaged in capture of wild meat **ES Linkages:** Mangroves, Crabbing	High	Moderate	**High**
Socio/Economic: Coconut Water Bottling Plant	Provisioning	▪ A coconut water bottling plant, operated by a large-scale coconut plantation owner, is situated on the left bank of the Pomeroon River.	River banks	Operator of coconut bottling plant and workers who are employed **ES Linkages:** Agriculture (Cultivated Crops)	High	Moderate	**High**
Socio/Economic: Housing and Social Services	Provisioning	▪ Several private residences are located along the banks of the Pomeroon River. ▪ Schools and the NDC Office are located on the left bank of the Pomeroon River.	River banks	Local communities residing along the Pomeroon River and benefitting from services offered by public institutions **ES Linkages:** Transportation	Essential	Moderate	**Critical**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Aquatic Transportation	Provisioning	▪ Most households located along the banks of the river have boats (canoes or boats equipped with small engines) to be used for personal transportation including transportation of students to school. Several households have constructed small wooden docks. ▪ Approximately one household has a wooden dock large enough to allow mooring of inboard cruisers.	River banks	Local communities in the Pomeroon River using small boats for transportation **ES Linkage:** Socio/Economic (Housing and Social Services)	Essential	Moderate	**Critical**
Global Climate Regulation	Regulating	▪ Mangrove growth along the banks of the Pomeroon River and along the shoreline supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Hunting/Trapping	High	High	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	▪ Mangroves growing naturally along the banks of the Pomeroon River and along the shoreline regulates erosion of the river banks.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Hunting/Trapping	High	High	**Medium**
Primary Production and Habitat Provision	Supporting	▪ Natural mangrove cover supports primary production and provides habitats for several species including birds and crabs.	Coastal Mangroves	Local communities **ES Linkages:** Global Climate Regulation, Shoreline Protection, Crabbing, Hunting/Trapping	High	High	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
NDC 54 - Kitty/Providence – Population Estimate 367 people							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	▪ Most families fish in the Pomeroon River and in creeks for sustenance using a variety of fishing gear. Fishing for sustenance in the Pomeroon River also has cultural significance, particularly for indigenous people.	Riverine ecosystems	Local communities fishing in the Pomeroon River **ES Linkages:** Transportation	Essential	Low	**Critical**
Crabbing	Provisioning	▪ Crabbing is a livelihood activity for a few persons particularly during the July to September crab season. Crabbing grounds in the NDC are frequently used by locals.	Mangroves and riverine ecosystems	Local communities engaged in crabbing **ES Linkages:** Mangroves, Hunting/Trapping	High	Moderate	**High**
Agriculture: Cultivated Crops	Provisioning	▪ Large-scale coconut plantations on the right bank of the Pomeroon River. ▪ Several small and medium-scale coconut plantations are also located along the banks of the Pomeroon River.	River banks and cultivated lands	Owners of coconut plantations and workers who are employed **ES Linkages:** Socio/Economic (Coconut Water Bottling)	Essential	Low	**Critical**
Hunting/Trapping: Wild Meat	Provisioning	▪ Seasonal hunting for wild meat in mangroves by a few persons for sale. Several different species of wild meat are caught including bush turkey, labba, watrush, iguana and several species of birds.	Mangroves	Local persons engaged in capture of wild meat **ES Linkages:** Mangroves, Crabbing	High	Moderate	**High**
Socio/Economic: Coconut Water Bottling Plant	Provisioning	▪ A coconut water bottling plant, operated by a large-scale coconut plantation owner, is situated on the left bank of the Pomeroon River.	River banks	Operator of coconut bottling plant and workers who are employed **ES Linkages:** Agriculture (Cultivated Crops)	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Socio/Economic: Housing and Social Services	Provisioning	▪ Several private residences are located along the banks of the Pomeroon River. ▪ Schools, teachers' accommodation and a health hut are located on the right bank of the Pomeroon River.	River banks	Local communities residing along the Pomeroon River and benefitting from services offered by public institutions **ES Linkages:** Transportation	Essential	Moderate	**Critical**
Aquatic Transportation	Provisioning	▪ Most households located along the banks of the river have boats (canoes or boats equipped with small engines) to be used for personal transportation including transportation of students to school. Several households have constructed small wooden docks. ▪ Approximately two households have wooden docks large enough to allow mooring of inboard cruisers.	River banks	Local communities in the Pomeroon River using small boats for transportation **ES Linkage:** Socio/Economic (Housing and Social Services)	Essential	Moderate	**Critical**
Global Climate Regulation	Regulating	▪ Mangrove growth along the banks of the Pomeroon River and along the shoreline supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Hunting/Trapping	High	High	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	▪ Mangroves growing naturally along the banks of the Pomeroon River regulates erosion of the river banks.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Hunting/Trapping	High	High	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Primary Production and Habitat Provision	Supporting	▪ Natural mangrove cover supports primary production and provides habitats for several species including birds and crabs.	Mangroves	Local communities **ES Linkages:** Global Climate Regulation, Shoreline Protection, Crabbing, Hunting/Trapping	High	High	**Medium**
NDC 55 - Moruka/Phoenix Park – Population Estimate 1,644 people							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	▪ The mouth of the Pomeroon River is frequently utilized by artisanal fisherfolk using gill nets (with a range of mesh sizes). Artisanal vessels from communities along the Essequibo Coast and in the Pomeroon visit these grounds for fishing. ▪ Smaller artisanal vessels practice pin seine fishing in the mouth of the Pomeroon River. ▪ Most families fish in the Pomeroon River, in creeks and around the mouth of the Pomeroon River for sustenance using a variety of fishing gear. Fishing for sustenance in the Pomeroon River also has cultural significance, particularly for indigenous people.	River ecosystems and marine habitats	a) Artisanal fisherfolk who use gillnets for fishing in the mouth of the Pomeroon River b) Artisanal fisherfolks who fish with pin seines and pole seines in the mouth of the Pomeroon River c) Local communities fishing for sustenance **ES Linkages:** Transportation, Crabbing	a) High b) Moderate c) Essential	a) Low b) Moderate c) Low	**a) Critical** **b) Medium** **c) Critical**
Crabbing	Provisioning	▪ Mangroves located close to the mouth of the Pomeroon River are widely utilized by local communities for crabbing. ▪ Persons from outside the NDC (as far south-west as the Charity Urasara NDC) travel to these areas for crabbing throughout the year.	Mangroves and riverine ecosystems	Local communities engaged in crabbing **ES Linkages:** Mangroves, Hunting/Trapping	Essential	Low	**Critical**
Agriculture: Cultivated Crops	Provisioning	▪ Several small- and medium-scale coconut plantations are located along the banks of the Pomeroon River. Additional coconut plantations are being developed.	River banks and cultivated lands	Operators of coconut plantations	High	Low	**Critical**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Hunting/Trapping: Wild Meat	Provisioning	▪ Seasonal hunting for wild meat in mangroves by a few persons for sale. Several different species of wild meat are caught including bush turkey, labba, watrush, iguana and several species of birds.	Mangroves	Local persons engaged in capture of wild meat **ES Linkages:** Mangroves, Crabbing	High	Moderate	**High**
Aquatic Transportation	Provisioning	▪ Most households located along the banks of the river have boats (canoes or boats equipped with small engines) to be used for personal transportation including transportation of students to school. Several households have constructed small wooden docks.	River banks	Local communities in the Pomeroon River using small boats for transportation **ES Linkage:** Socio/Economic (Housing and Social Services)	Essential	Moderate	**Critical**
Socio/Economic: Housing and Social Services	Provisioning	▪ Several private residences are located along the banks of the Pomeroon River. ▪ Schools and the NDC Office are located on the banks of the Pomeroon River.	River banks	Local communities residing along the Pomeroon River and benefitting from services offered by public institutions **ES Linkages:** Transportation	Essential	Moderate	**Critical**
Tourism/Recreation	Cultural	▪ A privately owned resort (Adel's Resort) is accessed via a tributary of the Pomeroon River. ▪ Bird habitats at the mouth of the Pomeroon River provide opportunities for bird watching tours.	River bank	Local communities and tourists who visit the resort **ES Linkages:** Mangroves, Hunting/Trapping	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Global Climate Regulation	Regulating	▪ Extensive mangrove cover along the banks of the Pomeroon River and the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Hunting/Trapping	Moderate	Moderate	**Critical**
Shoreline Protection and Erosion Regulation	Regulating	▪ Mangroves growing naturally along the banks of the Pomeroon River and along the shoreline helping to regulate erosion and support shoreline protection.	Coastal vegetation	Local communities **ES Linkages:** Global Climate Regulation, Shoreline Protection, Crabbing, Hunting/Trapping	Moderate	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	▪ Extensive mangrove forests along the banks of the Pomeroon River and along the shorelines provide habitats for birds, crabs, fishes and other wildlife.	Marine habitat and Mangrove Forests	Local communities **ES Linkages:** Global Climate Regulation, Shoreline Protection, Crabbing, Hunting/Trapping	Essential	Low	**Critical**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
NDC 02 - Evergreen/Paradise – Population estimate 3,984 people (Increasing due to immigration from Venezuela)							
Crabbing	Provisioning	▪ More than ten persons from the NDC catch crabs on a weekly basis as a primary livelihood activity. These crabbers typically use mangroves in Evergreen, and Somerset and Berks. ▪ During the July to September crab season, persons from the NDC as well as crabbers from other areas of the Essequibo Coast come to the mangroves in Evergreen, and Somerset and Berks for crabbing. In addition, crabs are also caught for sustenance purposes during the crab season. ▪ Generally, the demand for crab and crab meat has significantly increased and most of the crabs caught in the NDC are sold to vendors in Georgetown.	Mangroves	a) Local persons engaged in crabbing as a primary livelihood. b) Seasonal crabbing for sale and sustenance **ES Linkages:** Mangroves, Trapping/Hunting	a) High b) High	a) Low b) Moderate	**a) Critical** **b) High**
Fishing: Wild-Caught Fish and Shellfish	Provisioning	▪ Landing site at Andrews Koker used by approximately 15 artisanal fishing vessels. ▪ Landing site in Jib to Paradise used by approximately 20 artisanal fishing vessels. ▪ Landing sites at Dartmouth and Westbury are used by approximately with three vessels on an alternating basis, depending on accessibility. ▪ Landing sites at Eliza and Unity Park are used by two artisanal fishing vessels on an alternating basis, depending on accessibility. ▪ Landing site at Perth used by approximately six artisanal fishing vessels. ▪ Pin seine fishing is practiced along the shoreline of Paradise and Jib. Hauls are retrieved by fisherfolk using catamarangs.	Ocean and River Ecosystems	a) Fisherfolks landing at Andrews Koker b) Fisherfolks landing at Paradise and Jib c) Fisherfolks landing at Dartmouth and Westbury d) Fisherfolks landing at Eliza and Unity Park e) Fisherfolks landing at Perth f) Pin seine fishing at Paradise	a) Essential b) Essential c) Low d) Low e) Moderate f) Moderate	a) Moderate b) Moderate c) Moderate d) Moderate e) Moderate f) Moderate	**a) Critical** **b) Critical** **c) Low** **d) Low** **e) Medium** **f) Medium**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Agriculture: Cultivated Crops	Provisioning	▪ In Paradise, approximately 10 families utilize the sea defence reserves along the seawall for crop cultivation and subsistence farming. Cash crop cultivation was attempted in other areas along the shoreline but arbors constructed using damaged seines reportedly trap animals that grazed on the dams and cultivation was discontinued in these areas. As such, there is limited cultivation of cash crops along the shoreline. ▪ In La Resource, rice cultivation is practiced immediately adjacent to the shoreline.	Sea dam and cultivated lands	a) Local communities (general population) b) Local rice farmers	a) High b) Moderate	a) Low b) Moderate	**a) Critical** **b) Medium**
Agriculture: Livestock Grazing	Provisioning	▪ Along the sea defense walls, approximately seven households utilize the land for grazing, primarily cows, for livelihoods in Andrews and Perth to Dartmouth. ▪ Cows, sheep, and goats are grazed by approximately five persons along the shoreline of Evergreen to La Resource.	Sea dam, mangroves, shoreline	a) Local communities (general population) in Andrews and Perth to Dartmouth b) Local communities in Evergreen to La Resource	a) High b) Moderate	a) High b) Moderate	**a) Medium** **b) Medium**
Trapping/Hunting: Wild Meat	Provisioning	▪ Iguanas are caught in the mangroves in La Resource for sustenance and for sale by a few persons. The iguanas are sold in the NDC or out of the NDC to popular restaurants on the Essequibo Coast. ▪ Shore birds are also caught for both sustenance and sale. Some persons hunt large lizards (salipenters) for meat. ▪ Dry land camoudi are also trapped for sale to traders.	Mangroves	Local communities **ES Linkages:** Mangroves, Crabbing	High	Moderate	**High**
Socio/Economic: Rice Storage Bond	Provisioning	▪ A rice buying and storage facility was established along the seashore in La Resource.	Lands used for commercial purposes	Operator of the facility	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Socio/Economic: Housing	Provisioning	▪ Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Tourism/Recreation	Cultural	▪ The seawall and beach in Paradise is used daily for recreation and relaxation by more than 20 persons. ▪ The Andrews seawall is used daily by more than 10 persons for relaxation and recreation. ▪ The seawall behind Unity Park is used for recreational purposes and on weekends there are frequently cook-outs. However, Unity Park is currently not accessible to the public as there is a land ownership dispute. ▪ The Dartmouth seawall is used for recreational purposes. On weekends, young people participate in various recreational activities including games of dominoes, cricket and football; beach parties and BBQs.	Coastal and Marine	Local communities using seawalls and/or beaches in Paradise, Andrews, Dartmouth and Unity Park **ES Linkage:** Fishing, Religious/Ritual	High	High	**Medium**
Religious/Ritual	Cultural	▪ The seashore areas throughout the NDC that are accessible are used by local Hindu communities for religious purposes. The most frequently used areas are Paradise, Jib, Andrews, Bounty Hall and Dartmouth.	Shoreline, sea defences	Local Hindu communities using shoreline areas **ES Linkage:** Fishing, Tourism/Recreation	High	High	**Medium**
Global Climate Regulation	Regulating	▪ Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local community. **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Hunting/Trapping	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Shoreline Protection and Erosion Regulation	Regulating	▪ Mangroves growing naturally along the shoreline supports the regulation of erosion and contributes to shoreline protection. ▪ NAREI plans to install bamboo groynes along the Better Success shoreline to support mud accumulation and mangrove growth.	Coastal vegetation	Local communities. **ES Linkages:** Global Climate Regulation, Habitat Provision, Crabbing, Hunting/Trapping	Moderate	Moderate	**High**
Primary Production and Habitat Provision	Supporting	▪ Mangroves provide habitats for birds, crabs, fishes and other wildlife.	Marine habitat and Mangrove Forests	Local communities **ES Linkages:** Global Climate Regulation, Shoreline Protection, Crabbing, Hunting/Trapping	Essential	Low	**Medium**
NDC 03 - Aberdeen/Zorg-en-Vlygt – Population estimate 7,870 people (Increasing due to Venezuelan immigration)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	▪ Landing site for approximately two boats at the kokers in Capoey and La Union. The vessels land alternately at either site depending on tidal conditions and accessibility. There is significant siltation in the channels leading to both kokers. However, the area is still accessible by fishing boats. ▪ Fishing using pin seines along the shoreline has significantly reduced due to the accumulation of mud flats associated with mangrove growth. A few persons in Columbia and Zorg-en-Vlygt practice pin seine fishing for sustenance and for sale. ▪ Generally, there has been a decline of fishing activities in the NDC and many fisherfolk have sought alternative employment. Some former fisherfolk visit landing sites in other districts to purchase fish which they vend in the NDC.	Shoreline and kokers	a) Fisherfolks using landing sites in Capoey and La Union b) Fisherfolks practicing pin seine fishing along the shoreline	a) Low b) Low	a) Moderate b) Moderate	**a) Low** **b) Low**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Crabbing	Provisioning	▪ Approximately 25 persons are engaged in crabbing year-round as a primary livelihood activity. Crabbing is common throughout the NDC but the main crabbing grounds are located in Aberdeen, Affiance and Zorg-en-Vlygt. ▪ During the crabbing season, the number of persons engaged in crabbing significantly increases. Many persons also catch crabs for sustenance use during the crab season. ▪ Overall, crabbing has significantly increased throughout the shoreline of the NDC due to the proliferation of mangroves. Currently, several former fisherfolks are engaged in crabbing as a primary livelihood activity.	Mangroves	a) Local communities engaged in crabbing as a primary livelihood b) Local communities engaged in seasonal crabbing **ES Linkages:** Mangroves, Trapping/Hunting	a) Essential b) High	a) High b) Moderate	**a) High** **b) High**
Agriculture: Livestock Grazing	Provisioning	▪ Approximately 20 families utilize sea defence reserves for grazing cattle and goats in Aberdeen to Affiance, and in Zorg-en-Vlygt. ▪ Approximately two persons graze sheep on sea defence reserves in Queenstown. ▪ There are cattle rearing camps close to the seashore in Hoff Van Aurich and La Union. The number of heads of cattle has increased particularly in La Union. ▪ Two chicken pens have been established in proximity to the seashore, one each in Affiance and Zorg-en-Vlygt.	Sea defence reserves, sea dam	a) Local communities (general population) from Aberdeen to Affiance and Zorg-en-Vlygt b) Local communities in Queenstown b) Local communities in/around Hoff-Van-Aurich and La Union d) Operators of chicken pens **ES Linkage:** Agriculture (Crop Cultivation)	a) Moderate b) Low c) High d) Moderate	a) Moderate b) Moderate c) Moderate d) Moderate	**a) Medium** **b) Low** **c) High** **d) Medium**
Trapping/Hunting: Wild Meat	Provisioning	▪ Approximately 60 to 70 persons hunt iguanas in mangroves daily for sale throughout the NDC. ▪ Occasionally, large mammals (acouri) are also captured in areas where mangroves are dense.	Mangroves	Local communities hunting in mangroves **ES Linkage:** Mangroves, Crabbing	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Agriculture: Crop Cultivation	Provisioning	▪ Cash crops are cultivated by a few persons along the sea defence reserves in La Union and Zorg-en-Vlygt. ▪ Some farmers are also cultivating rice, on a trial basis, on the sea defence reserves in Zorg-en-Vlygt.	Sea defence reserves, sea dam	a) Local communities engaged in crop cultivation in Zorg-en-Vygt b) Local communities engaged in crop cultivation in La Union **ES Linkage:** Agriculture (Livestock Grazing)	a) Moderate b) Moderate	a) Moderate b) Moderate	**a) Medium** **b) Medium**
Socio/Economic: Boat Repairs	Provisioning	▪ Boat repairs are conducted along the sea dam in La Union and Hoff Van Aurich.	Sea dam	Local communities in La Union and Hoff Van Aurich.	Low	Moderate	**Low**
Socio/Economic: Housing	Provisioning	▪ Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Socio/Economic: Squatting	Provisioning	▪ Squatting on the sea defence reserves by one household in Queenstown and two households in Zorg-en-Vlygt.	Sea Defence Reserves	Local communities squatting on sea defence reserves	Low	High	**Low**
Religious/Ritual	Cultural	▪ Cremation site at La Union is the only crematorium on the Essequibo Coast and is used by local populations throughout the Essequibo Coast. The NDC plans to fence the area to prevent cattle from grazing around the site. ▪ Hindu communities use the sea dam at La Union and Capoey for religious and ritual purposes. ▪ Local stakeholders have expressed interest in establishing a small temple along the shoreline of Zorg-en-Vlygt for Hindu rituals and prayers.	Coastal areas; ocean	a) Local population throughout the Essequibo Coast use the cremation site b) Local Hindu population **ES Linkage: Fishing**	a) Essential b) Moderate	a) Low b) Moderate	**a) Critical** **b) Medium**

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Tourism/Recreation	Cultural	▪ Bacchus Park and the immediately adjacent shoreline area are used by approximately 100 people daily for recreation, including people from outside the NDC district. The Park is more actively used on weekends and holidays. ▪ Many persons use the sea walls in Queenstown for recreation purposes. There is a playground close to the sea wall where young people play games of football, basketball and cricket. ▪ The NDC has engaged the Government to support the construction of a playground along the sea defences reserves in Zorg-en-Vlygt.	Seawall	a) Local communities utilizing Bacchus Park and the adjacent shoreline b) Local communities using the seawalls in Queenstown	a) Essential b) Moderate	a) Low b) Moderate	**a) Critical** **b) Medium**
Global Climate Regulation	Regulating	▪ Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Hunting/Trapping	Moderate	Moderate	**High**
Shoreline Protection and Erosion Regulation	Regulating	▪ Mangroves growing naturally along the shoreline regulate erosion and contribute to shoreline protection. ▪ NAREI installed bamboo groynes along the shoreline in Aberdeen and Columbia but these groynes washed away in 2021. NAREI is reinstalling the groynes to support to support mud accumulation and mangrove growth.	Coastal vegetation	Local communities **ES Linkages:** Global Climate Regulation, Habitat Provision, Crabbing, Hunting/Trapping	Moderate	Moderate	**High**
Primary Production and Habitat Provision	Supporting	▪ Mangroves have grown extensively along most of the shoreline of the NDC. These mangroves have provided habitats for iguanas, crabs, and new species of birds in the area.	Marine habitat and Mangrove Forests	Local communities **ES Linkages:** Global Climate Regulation, Shoreline Protection, Crabbing, Hunting/Trapping	Essential	Low	**High**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
NDC 04 - Anna Regina Town Council – Population estimate 19,000 people (Increasing due to immigration from Venezuela)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	▪ Landing site for more than 30 artisanal fishing vessels at kokers in Hampton Court and Windsor Castle. The number of vessels using this landing site has increased because vessels relocated from landing sites in Sparta and Anna Regina due to mangrove proliferation. ▪ Landing site for approximately six artisanal fishing vessels at the koker in Devonshire Castle. ▪ Landing site for approximately 10 artisanal fishing vessels at the koker in Lima. ▪ Landing site for approximately eight artisanal fishing vessels at the koker in Anna Regina. The number of vessels landing at Anna Regina has declined due to proliferation of mangroves at the site. ▪ Fishing for sustenance along the shoreline (using pin seines and cast nets) is rare and it is limited by the proliferation of mangroves along the shoreline and the associated accumulation of mud.	Marine environment; beach; mooring locations	a) Fisherfolk utilizing the landing site at Hampton Court and Windsor Castle b) Fisherfolk utilizing the landing site at Devonshire c) Fisherfolk utilizing the landing site at Lima d) Fisherfolk utilizing the landing site at Anna Regina e) Local communities fishing for sustenance along the shoreline	a) Essential b) Moderate c) High d) Moderate e) Low	a) Low b) Moderate c) Moderate d) Moderate e) Moderate	**a) Critical** **b) Medium** **c) High** **d) Medium** **e) Low**
Crabbing	Provisioning	▪ Crabbing has increased significantly in the municipality as a result of extensive mangrove growth. Approximately 40 persons catch crabs in the mangroves throughout the year as a primary livelihood activity. ▪ During the crabbing season, hundreds of people catch crabs for sale and for sustenance. ▪ Crabs are sold at the municipal market in Anna Regina. In addition, demand for crabs and crab meat has significantly particularly from external markets in Georgetown.	Mangroves	a) Local communities engaged in crabbing as a primary livelihood b) Local communities engaged in crabbing during the crab season **ES Linkages:** Mangroves	a) Essential b) High	a) Low b) Low	**a) Critical** **b) Critical**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Agriculture: Cultivated Crops	Provisioning	▪ Cash crops, coconuts, bananas and plantains are cultivated along the sea dams in Hampton Court.	Cultivated lands	Local communities (general population)	Moderate	Moderate	**Medium**
Agriculture: Livestock Grazing	Provisioning	▪ Cattle, goats and sheep are grazed along the shoreline where there is access particularly in Richmond to Three Friends.	Sea dam, shoreline	Local communities (general population) using sea dam for grazing	Moderate	Moderate	**Medium**
Trapping/Hunting: Wild Meat	Provisioning	▪ Young people (particularly young men) hunt wild birds, especially wild ducks, and iguanas in the mangroves in Danielstown for sustenance and for sale. This activity is increasing due to the increase in mangrove coverage.	Mangroves	Local communities hunting in mangroves **ES Linkage**: Mangroves	Low	High	**Low**
Apiculture	Provisioning	▪ Wild bees have established hives in the mangroves in some areas. A few persons in Anna Regina collect honey from these hives for sustenance and, depending on the volume harvested, for sale.	Mangroves	Local communities harvesting honey from wild bee hives **ES Linkage**: Mangroves	Low	Moderate	**Low**
Socio/Economic: Housing	Provisioning	▪ Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Socio/Economic: Squatting	Provisioning	▪ A few persons are squatting in proximity to the sea dam and drainage canal in Lima and Reliance.	Sea dam	Local communities squatting on the sea dams	Low	High	**Low**
Socio/Economic: Markets and Commerce	Provisioning	▪ Municipal commercial district including wholesale and retail enterprises, restaurants and entertainment venues are included in the Study Area. ▪ There is a weekly market every Thursday in Anna Regina where fresh produce (vegetables and fruits), meat, clothing and other items are sold.	Residential and commercial areas	Local communities benefitting from commercial activities in Anna Regina	Essential	Low	**Critical**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Religious/Ritual	Cultural	▪ A few persons from local Hindu communities in Lima, Hampton Court, Anna Regina and Three Friends conduct religious practices and rituals where there is access to the shoreline. ▪ Previously, the shoreline throughout the municipality was widely used by local populations for rituals and prayers. However, the proliferation of mangroves has rendered such activities virtually non-existent. According to local stakeholders, nuisances like pests (sand flies mosquitoes and wild bees) hinder religious/ritual activities. In addition, there are significant security concerns associated with criminals being hidden in the foliage. ▪ As such, most Hindus travel to beaches out of the municipality, such as Perseverance beach, to for this purpose. This is a significant inconvenience and incurs high costs for travel.	Sea dam and shoreline	Local Hindu Communities using sea dams in Lima and Anna Regina	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Tourism/Recreation	Cultural	▪ Several persons visit the Henrietta Hotel on a daily basis for relaxation. ▪ More than 15 persons use the park and playground in Danielstown on a daily basis for relaxation and recreation. ▪ There are three playgrounds located close to the shoreline in the Town Council. These playgrounds are used by young persons for games of cricket. Prior to the COVID-19 pandemic, competitive matches were also hosted at these playgrounds. ▪ The use of the sea walls and beaches in the municipality for tourism and recreation has almost ceased due to the proliferation of mangroves along the shoreline. Recreational use of the shoreline is limited by pests presence in the mangroves (sand flies, mosquitoes and wild bees) as well as by risks to personal security as criminals hide in the foliage. Most people visit areas outside the municipality (mainly Bacchus Park) for recreation.	Sea walls, beaches, shoreline	a) Local communities visiting the Henrietta Hotel b) Local communities using the park in Danielstown c) Local communities using the playgrounds in Anna Regina	a) Low b) Moderate c) Moderate	a) Moderate b) Moderate c) Moderate	**a) Low** **b) Medium** **c) Medium**
Global Climate Regulation	Regulating	▪ Extensive mangrove cover along the shoreline of the municipality supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Hunting/Trapping	Moderate	Moderate	**Critical**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Shoreline Protection and Erosion Regulation	Regulating	▪ Mangroves growing naturally along the shoreline supports the regulation of erosion and contributes to shoreline protection.	Coastal vegetation	Local communities **ES Linkages:** Global Climate Regulation, Habitat Provision, Crabbing, Hunting/Trapping	Moderate	Moderate	**Medium**
Primary Production and Habitat Provision	Supporting	▪ Mangroves provide habitats for birds, crabs, fishes and other wildlife.	Marine habitat and Mangrove Forests	Local communities **ES Linkages:** Global Climate Regulation, Shoreline Protection, Crabbing, Hunting/Trapping	Essential	Low	**Critical**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
NDC 05 - Annandale/Riverstown – Population estimate 10,400 people (Increasing due to immigration from Venezuela)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	▪ Landing site at Adventure and Johanna Cecilia used by approximately two artisanal fishing vessels on an alternating basis. ▪ Landing site at Golden Fleece and Zorg used by approximately five artisanal fishing vessels. ▪ Landing site at Riverstown used by approximately one artisanal fishing vessel. This landing site is infrequently used and the right bank of the canal (in Pomona in the neighbouring NDC) is an active wharf for sand and aggregate. ▪ Landing site in Abram's Zuil (also referred to as Cullen) used by approximately 20 artisanal vessels. These vessels typically use Chinese seines to target shrimp. Recently, a Chinese owned processing plant installed a container and drying floor at the landing site. Most landed hauls are sold to this plant for export purposes. ▪ A few persons use pin seines to fish along the shoreline in Zorg for sustenance and recreation.	Marine environment; beach; mooring locations	a) Fisherfolks using landing sites at Adventure and Johanna Cecilia b) Fisherfolks using the landing sites at Golden Fleece and Adventure c) Fisherfolk using the landing at Riverstown d) Fisherfolk using the landing site at Abram's Zuil (Cullen) e) Fisherfolks using pin seines along the shoreline	a) Low b) Low c) Low d) Essential e) Low	a) High b) High c) High d) Moderate e) High	**a) Low** **b) Low** **c) Low** **d) Critical** **e) Low**
Agriculture: Livestock Grazing	Provisioning	▪ Cattle, sheep and goats are grazed along the shoreline throughout the NDC. In every village in the NDC, there are approximately 7 to 10 persons who use sea dams and sea defence reserves to graze animals.	Sea dam and sea defence reserves	Local communities (general population)	High	Moderate	**High**
Agriculture: Crop Cultivation	Provisioning	▪ Several persons are engaged in small-scale crop cultivation on sea dams throughout the NDC.	Sea dam	Local communities	Low	Moderate	**Low**
Socio/Economic: Housing	Provisioning	▪ Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Socio/Economic: Squatting	Provisioning	▪ A few persons are squatting in proximity to the shoreline in Cullen and in Golden Fleece to Johanna Cecilia. In Cullen, several small structures (shacks) have been erected on the beach to accommodate approximately 100 persons. Most of the squatters are Venezuelan migrants but there are also a few Guyanese.	Sea defence reserves, beach	Local communities squatting on the sea defence reserves and beach	Low	High	**Low**
Aquatic Transportation: Migration	Provisioning	▪ The Uno Creek in Abram's Zuil is used as a landing area for Venezuela migrants. Most vessels carrying migrants reportedly land at nights.	Sea dam	Venezuelan migrants **ES Linkage:** Fishing	Low	High	**Low**
Religious/Ritual	Cultural	▪ Hindus conduct religious activities throughout the NDC in areas where there is easy and safe access to the shoreline. Areas commonly used are the Cullen Beach and the shoreline of Golden Fleece to Johanna Cecilia.	Coastal areas; ocean	Local Hindu communities using the shoreline for religious purposes **ES Linkages:** Fishing, Tourism/Recreation	High	High	**Medium**
Tourism/Recreation	Cultural	▪ More than 50 persons use the beaches for recreation purposes including games of cricket, football as well as parties and BBQs on weekends. ▪ The main areas used are Zorg, Golden Fleece, Cullen and Suddie. The use of the Perseverance beach has declined because of significant erosion.	Coastal areas	Local communities using beaches in the NDC for recreation purposes **ES Linkages:** Fishing, Religious/Ritual	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
NDC0 6 - Good Hope/Pomona – Population estimate 5,540 people (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	▪ Landing site for approximately 15 artisanal fishing vessels at Vilvoorden. ▪ Several artisanal fishing boats also land at Supenaam throughout the week. ▪ Several persons who live close to the seashore often engage in near shore fishing (mainly pin seines) using small boats. This is a common practice throughout the shoreline from Good Hope to Fairfield. ▪ Fishing for recreation and sustenance, using nets and hooks, is popular on Tiger Island. Recreational fishing at the riverside is also popular throughout the NDC because of the wharves and the Supenaam ferry stelling.	Marine environment; shoreline	a) Fisherfolk using the landing site at Vilvoorden b) Fisherfolk landing vessels at Supenaam c) Fisherfolk using pin seines along the shoreline for sale and sustenance d) Local communities fishing along the shoreline of the NDC (including Tiger Island) for recreation and sustenance **ES Linkage:** Socio/Economic	a) Essential b) Moderate c) Moderate d) Moderate	a) Low b) Moderate c) Moderate d) High	**a) Critical** **b) Medium** **c) Medium** **d) Low**
Crabbing	Provisioning	▪ Crabbing is popular during the July to September crabbing season throughout the NDC. Some people also set crab traps along the sea dam throughout the NDC.	Marine habitats and Mangrove Forests	Crabbing along the coasts of the NDC **ES Linkages:** Mangroves, Trapping/Hunting	Moderate	Moderate	**Medium**
Agriculture: Livestock Grazing	Provisioning	▪ There is grazing of animals along the seashore throughout the NDC in vacant areas.	Sea defence reserves	Local communities (general population)	Moderate	Moderate	**Medium**
Agriculture: Crop Cultivation	Provisioning	▪ Cash crops are cultivated on sea dams and along sea defence reserves from Pomona to Aurora. Rice is cultivated close to the seashore in Hibernia, Huist'Dieren and Aurora. ▪ Large scale cash crop farming and rice cultivation on Tiger Island.	Sea defence reserves, sea dam, cultivated lands	a) Local communities engaged in crop cultivation on the Essequibo Coast b) Local communities engaged in crop cultivation on Tiger Island	a) High b) Essential	a) Moderate b) Low	**a) High** **b) Critical**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Trapping/Hunting: Wild Meat	Provisioning	▪ Approximately 20 persons from the NDC are engaged in hunting of wild meat for sale and sustenance. The most frequently captured animals are iguanas, labba and watrush. Most hunting occurs in the mangroves on Tiger Island. In addition, iguanas are also caught in sections of the NDC on the Essequibo Coast where there is mangrove cover along the shoreline.	Mangroves	Local communities engaged in hunting in the mangroves **ES Linkages:** Mangroves, Crabbing	Low	Low	**Medium**
Social/Economic: Sawmills	Provisioning	▪ There are two sawmills located along the shoreline of the NDC. These sawmills utilize river defense area to transport logs to the mill.	Shoreline, commercial areas	Sawmill owners, workers	Moderate	Moderate	**Medium**
Social/Economic: Markets and Commerce	Provisioning	▪ There is a bustling market at the Supenaam waterfront. Commercial activities comprise wholesale and retail enterprises and restaurants among others.	Commercial areas	Vendors, local communities and tourists **ES Linkage:** Aquatic Transportation	Essential	Low	**Critical**
Social/Economic: Housing	Provisioning	▪ Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Social/Economic: Squatting	Provisioning	▪ A few persons are squatting on the sea defence reserves in Fairfield.	Sea defence reserves	Local communities squatting on sea defence reserves	Low	High	**Low**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Socio/Economic: Ports and Wharfs	Provisioning	▪ There are approximately 10 wharfs in the NDC most of which are privately operated. Generally, these wharfs are linked to medium- to large-scale business enterprises that are also located close to the shoreline. The privately operated wharfs include 1 in Pomona for quarry material and sand; 2 in Vilvoorden for rice and fuel; 3 in Fairfield used for cargo and rice; 2 in Spring Garden used for fuel and lumber and 1 in Good Hope used for cargo. ▪ The docking area in Vilvoorden is also used to facilitate transportation of cattle from the Essequibo Coast (same location as the fishing landing site in Vilvoorden).	Commercial areas on wharf	Owners and operators of private wharfs **ES Linkage:** Fishing	Essential	Low	**Critical**
Aquatic Transportation: Stellings	Provisioning	▪ The Transport and Harbours Department operates a wharf in Good Hope which is used mainly by the ferry to transport passengers and cargo between Parika (Region 3) and the Essequibo Coast. ▪ The Supenaam waterfront is a major area for passenger transportation using small vessels. Most vessels are called “speed boats” and used for return passenger transportation to Parika. Passenger vessels from islands in the Essequibo River also land at Supenaam.	Passenger stellings	a) Passengers and business people using the ferry service b) Passenger transportation at the Supenaam waterfront **ES Linkages:** Socio/Economic, Tourism/Recreation	a) Essential b) Essential	a) Low b) Low	**a) Critical** **b) Critical**
Religious/Ritual	Cultural	▪ There are religious activities on the seashore throughout the NDC.	Beaches, shoreline	Local communities who utilize the seashore for religious purposes	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Tourism/Recreation	Cultural	▪ Beaches are used for recreation purposes at Vilvoorden and Tiger Island. ▪ The boulevard at the Supenaam waterfront is used by local communities and tourists for recreational purposes.	Beaches	a) Local communities on Essequibo Coast b) Local communities visiting Tiger Island c) Local communities and tourists who use the boulevard **ES Linkages:** Aquatic Transportation	a) Moderate b) High c) High	a) Moderate b) Moderate c) Moderate	**a) Medium** **b) High** **c) High**
Historical Landmark	Cultural	▪ Dutch Chimney and the Big Wheel are important landmarks.	Tourism	Tourists, Residents	Low	Low	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	▪ Tiger Island, which serves as a barrier, is a critical sea defense for the NDC from erosion and flooding since there is no manmade or natural mangroves along several sections of the shoreline. ▪ Generally, there has been significant and rapid erosion along the shoreline of the NDC and there are several areas in need of critical intervention including Dry Shore, Spring Garden, Good Intent and Good Hope.	Shoreline	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Hunting/Trapping	Essential	Low	**Critical**
Global Climate Regulation	Regulating	▪ Extensive mangrove cover along the shoreline of the municipality supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Global Climate Regulation, Habitat Provision, Crabbing, Hunting/Trapping	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on stakeholder input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low-Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Primary Production and Habitat Provision	Supporting	▪ Mangroves provide habitats for birds, crabs, fishes and other wildlife.	Marine habitat and Mangrove Forests	Local communities **ES Linkages:** Global Climate Regulation, Shoreline Protection, Crabbing, Hunting/Trapping	Essential	Low	**Critical**

APPENDIX D – ECOSYSTEM SERVICES AND PRIORITY RATINGS IN REGION 3

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
NDC 07 – Wakenaam - Population 3,200 – Stable (Due to immigration of indigenous people from the Pomeroon River and North West District + emigration of native Islanders)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately 5 artisanal fishing vessels at Zeelandia. • Landing site for approximately 4 artisanal fishing vessels at Melville. • Landing site for approximately 5 artisanal fishing vessels at Domburg. These vessels typically target both shrimp and fish. • Landing site for approximately 3 artisanal fishing vessels at Maria's Pleasure. The vessels at this landing site target white belly shrimp and only operate during the shrimp season (dry seasons in Guyana). According to local fisherfolk, this landing site has not been operational for more than a year because prolonged inclement conditions resulted in low shrimp catch. • Fishing grounds at the mouth of the Essequibo, both east and west of the Island, are commonly used by local fisherfolk. In addition, the fishing area is shared with fisherfolk from Leguan, Hogg Island and the West Coast of Demerara. • Freshwater intake from the Essequibo River (primarily for irrigation of rice fields) contributes to inland fisheries in canals. Tilapia and hassar are caught for sustenance and for sale. "Blackwater" fishing in canals is also a common recreational activity. • Approximately 100 persons are fish for recreation along the Wakenaam shoreline. Recreational fishing is done on special holidays and is especially popular during the Christmas	River dam, river habitat, mangroves	a) Fisherfolk utilizing the landing site at Zeelandia b) Fisherfolk utilizing the landing site at Melville c) Fisherfolk utilizing the landing site at Domburg d) Fisherfolk utilizing the landing site at Maria's Pleasure e) Local communities engaged in inland fishing for sustenance and sale f) Local communities fishing for recreation along the shoreline and inland **ES Linkage:** Transportation, Tourism and Recreation	a) Moderate b) Moderate c) Moderate d) Low e) High f) Moderate	a) Moderate b) Moderate c) Moderate d) Moderate e) High f) High	**a) Medium** **b) Medium** **c) Medium** **d) Low** **e) Medium** **f) Low**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		holidays. Catches are used for sustenance and are not typically sold.					
Crabbing	Provisioning	• Approximately 10 persons are engaged in crabbing during the July to September crab season for sale. The most common crabbing area is in “More Farm” (located in Maria’s Pleasure). • A few persons catch crabs for recreation throughout the year as well as during the crab season.	Mangroves	Local communities engaged in crabbing **ES Linkages:** Mangroves, Recreation	High	Moderate	**High**
Agriculture: Cultivated Crops	Provisioning	• Plantains and coconuts are cultivated on the sea defence reserves in “More Farm” (Maria’s Pleasure). In addition, small scale cultivation of cash crops is along done on the sea defences of Fredricksburg. • More than 100 families cultivate cash crops, fruits and plantains along the river dam bordering their private residences. • Rice cultivation continues on the Island but currently only about 50 percent of available lands are cultivated. The main challenge is marketing and the high cost of transportation. Currently, the Government (through the Transport and Harbours Department) subsidizes approximately 70 percent of the transport cost but this does not provide enough incentive for farmers to increase cultivation. • Privately owned coconut plantations in Friendship and Bankhall. • Farmers from Wakenaam also cultivate on the other islands in the Essequibo River including Tiger Island, Hogg Island, Truli Island, and Karia.	Sea defence reserves, Cultivated lands	a) Farmers utilizing the sea defence reserves in “More Farm” (Maria’s Pleasure) b) Cultivation of cash crops on sea defences in Fredricksburg c) Local communities cultivating cash crops, fruits and plantains on privately owned lands d) Farmers engaged in rice cultivation e) Owner(s) and workers of private coconut plantations in Friendship and Bankhall **ES Linkage:** Transportation	a) High b) Low c) Essential d) High e) High	a) Moderate b) High c) Low d) Moderate e) Moderate	**a) High** **b) Low** **c) Critical** **d) High** **e) High**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Agriculture: Livestock Grazing	Provisioning	• Cattle, goats and sheep are grazed along the sea defence reserves and in pasturelands for livelihood. Livestock are grazed throughout the shoreline area but is most common in Friendship, Zeelandia and Maria's Pleasure.	River defenses and pasture lands	Local communities (general population) grazing livestock in: a) Maria's Pleasure b) Friendship or Zeelandia	a) High b) Moderate	a) Moderate b) Moderate	**a) High** **b) Medium**
Hunting/Trapping: Wild Meat	Provisioning	• A few persons hunt labba in farmlands. This activity is rare and meat is typically used for sustenance. • In the July to September dry season, iguanas caught for recreation and sustenance.	Mangroves, cultivated lands	Persons hunting wild meat on the Island **ES Linkages:** Mangroves, Recreation, Crop Cultivation	Low	High	**Low**
Non-Wood Fibers and Resins: Bamboo	Provisioning	• Most persons in Wakenaam harvest wild bamboo from the sea defence reserves to be used for crop cultivation (mainly as "plantain poles") and religious purposes (to construct tents and other temporary structures).	River defence reserves	Local communities (general population) harvesting wild bamboo **ES Linkages:** Livestock Farming, Crop Cultivation, Religious/Ritual	High	Moderate	**High**
Socio/Economic: Shrimp Processing	Provisioning	• Approximately 10 persons use the sea defences in Fredricksburg to dry white belly shrimp during the dry season. The NDC is seeking support from the Government to construct a drying floor to be used for this purpose.	River Defences,	Fisherfolk and local communities drying shrimp on sea defences **ES Linkages:** Fishing, Crop Cultivation	Moderate	Low	**High**
Socio/Economic: Rice Mill	Provisioning	• Privately owned rice mill located close to the sea defences in Friendship.	Commercial and housing areas	Owner and workers of rice mill **ES Linkage:** Crop Cultivation	High	Moderate	**High**
Socio/Economic: Rice Paddy Drying Tarmac	Provisioning	• A paddy drying tarmac constructed at Caledonia with support from the Guyana Rice Development Board. The land on which the tarmac is situated by donated by private businessman, Mr. Toolsie Persaud.	Commercial areas, cultivated lands	Rice farming using the drying tarmac **ES Linkage:** Crop Cultivation	High	Moderate	**High**
Socio/Economic: Sawmill	Provisioning	• Sawmill in San Souci utilizes the Essequibo River to transport logs to the mill. The sawmill	River dam, commercial and housing areas	Sawmill owner, workers and local communities (general population)	Low	Moderate	**Low**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		operates based on orders and recently, has produced only “form boards”.		**ES Linkage:** Transportation			
Socio/Economic: Solar PV Farm	Provisioning	• Guyana Power and Light (GPL) has commenced construction of a solar farm in New Friendship. The contract for project construction has been tendered.	Commercial and housing area	Local communities (general population)	High	Low	**Critical**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Aquatic Transportation: Passenger Commute and Cargo	Provisioning	• Two speedboat landing areas in Arthurville for passenger transportation between Wakenaam and Parika. The speedboat service has two main operators, each of whom have 3 boats. Other small privately owned boats may use these landings to facilitate passenger transportation to Parika or to other Islands in the Essequibo River. • Ferry Stelling located in New Friendship used for transportation of passengers and cargo between Wakenaam and Parika. The Transport and Harbours Department has two ferries that operate this route namely, the MV Malali and the MV Sandaka. • Passenger speedboats to Supenaam (Essequibo Coast) use the Ferry Stelling as a main landing area. Two speedboats operate this route. • Commercial wharf at Good Success allows docking of approximately 15 ships that are used for the transportation of fuel, and other products that are shipped from or imported to the Island. • Commercial wharf at Melville where three ships are docked. According to local stakeholders, these ships have been docked at Melville for approximately two years. In addition, the commercial wharf at Sans Souci is defunct.	Commercial areas on river dam	a) Passengers and speedboat operators using the landing areas in Arthurville b) Passengers and business persons using the Ferry Stelling c) Commercial wharf in Good Success d) Commercial wharf in Melville e) Private ship docking in Zeelandia f) Farmers utilizing the docking area in Melville g) Farmers utilizing small wooden private docks **ES Linkages:** Fishing, Crop Cultivation	a) Essential b) Essential c) Essential d) Low e) Low f) Essential g) High	a) Moderate b) Low c) Low d) Moderate e) Moderate f) Moderate g) High	**a) Critical** **b) Critical** **c) Critical** **d) Low** **e) Low** **f) Critical** **g) Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Private docking for a ship was observed in Zeelandia. • Docking area in Melville for more than 15 small boats used by farmers to travel to farmlands that are not located on Wakenaam and to transport produce to the Parika market. • Several households have small wooden docking areas for farm boats that are used mainly to transport produce to Parika.					
Freshwater: Irrigation Livestock Watering	Provisioning	• Farmers depend on freshwater from the Essequibo River for irrigation of rice fields and other crops. • Livestock also drink the water that flows in the irrigation channels.	Essequibo River	Farmers and local communities utilizing freshwater for agriculture **ES Linkages:** Crop Cultivation, Livestock Farming	Essential	Moderate	**Critical**
Freshwater: Household Use	Provisioning	• Households use freshwater from the Essequibo River for many household purposes including gardening and livestock.	Essequibo River	Local communities (general population) using freshwater for small-scale agriculture **ES Linkages:** Crop Cultivation, Livestock Farming	High	Moderate	**High**
Religious/Ritual	Cultural	• The shoreline area of Melville is used by local Hindu communities in October for Teerat observances. During these periods, temporary tents are constructed along the river defences to support prayers and offerings. • Local Christian communities use the shoreline are in San Souci to conduct baptisms.	River, river defense	a) Local Hindu population using the Melville shoreline b) Local Christian populations conducting baptisms at San Souci	a) High b) Moderate	a) Moderate b) Moderate	**a) High** **b) Medium**
Tourism and Recreation	Cultural	• There is a large beach at “More Farm” (Maria’s Pleasure) but this area is rarely used because of the poor condition of the access dam. The NDC has requested support from the Government to construct an access road (approximately 1.6 kilometers [1 mile]) leading to the beach.	Beaches and mangroves	Local communities using the beach at Maria’s Pleasure for recreation	Low	Low	**Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• The beach in Wakenaam Point has significantly eroded and is no longer used for recreation.					
Global Climate Regulation	Regulating	• Mangrove cover along some sections of the Wakenaam shoreline supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing, Transportation	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Mangrove forests protect local communities from the impacts of the sea. According to the NDC, mangroves are eroding at Concordia (Wakenaam Point) and Palmyra because of the draft produced when ferries and ships pass offshore. • Several sections of the shoreline are protected by hard sea defence structures. In Domburg and Melville, hard structures were rehabilitated and into high seawalls (approximately 1.4 meters high).	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing, Socio/Economic (Shrimp Drying), Transportation	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	High	Moderate	**High**
NDC 08 – Leguan - Population 2,500 (Decreasing due to migration to Region 3 and North America)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately 10 artisanal fishing vessels in Richmond Hill. • Landing site for approximately 5 artisanal fishing vessels at Canefield. • Landing site for approximately 3 artisanal fishing boats at La Bagatelle. • Landing site for approximately 10 fishing boats at Waterloo. • Landing site for approximately 3 artisanal fishing vessels at Success.	Marine habitat, river habitat, mangroves	a) Fisherfolk utilizing the landing site at Richmond Hill b) Fisherfolk utilizing the landing site at Canefield c) Fisherfolk utilizing the landing site at La Bagatelle d) Fisherfolk utilizing the landing site at Waterloo e) Fisherfolk utilizing the landing site at Success	a) High b) Moderate c) Moderate d) High e) Moderate f) Low g) High	a) Moderate b) Moderate c) Moderate d) Moderate e) Moderate f) High g) High	**a) High** **b) Medium** **c) Medium** **d) High** **e) Medium** **f) Low** **g) Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Landing site for 1 artisanal fishing boat at Endeavour. • Landing site for 1 artisanal fishing boat at Blenheim. • Fishing grounds at the mouth of the Essequibo, both east and west of the Island, are commonly used by local fisherfolk. In addition, the fishing area is shared with fisherfolk from Wakenaam, Hogg Island and the West Coast of Demerara. • Freshwater intake from the Essequibo River (primarily for irrigation of rice fields) contributes to inland fisheries in canals. Species caught included hassar, houri, patwa, wabrey, tilapia, etc. Approximately 25 persons fish in canals as a livelihood activity and 100 persons fish for sustenance daily. • According to the NDC, coastal fishing has significantly declined because of high levels of mortality of the target species. This challenge has been reported to the Fisheries Department, Ministry of Agriculture.		f) Fisherfolk utilizing the landing sites at Endeavour and Blenheim g) Local communities engaged in inland fishing for sustenance and sale **ES Linkage:** Transportation			
Crabbing	Provisioning	• During the July to September crabbing season, all households are engaged in crabbing for recreation and sustenance. Persons from Wakenaam and West Coast Demerara also visit Leguan for crabbing seasonally. • Approximately 3 persons are engaged in crabbing throughout the year as a livelihood activity. • The most common crabbing areas are Canefield, Richmond Hill and Doorn Haag.	Mangroves, beaches, shoreline	a) Persons engaged in seasonal crabbing b) Persons engaged in crabbing throughout the year for livelihoods **ES Linkages:** Mangroves, Recreation	a) Essential b) Low	a) Moderate b) Moderate	**a) Critical** **b) Low**
Agriculture: Cultivated Crops	Provisioning	• Farmers utilize land along the river defense wall for crops and subsistence farming. Coconuts, bananas, plantains, and cash crops are among the main crops cultivated.	Cultivated lands	Local communities (general population) cultivating crops at on sea dams and river defences	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Crop cultivation on sea dams and river defences occurs in Success, Phoenix and Doorn Haag.					
Agriculture: Livestock Grazing	Provisioning	• Households utilize dams and river defence reserved throughout Leguan for grazing of cows, goats and sheep. The NDC wishes to control these activities and is exploring the use of stray catchers for this purpose.	River defense reserves, sea dam and mangroves	Local communities (general population) grazing livestock	Moderate	Moderate	**Medium**
Hunting/Trapping: Wild Meat	Provisioning	• Approximately 50 percent of the Leguan population captures iguana for sustenance and sale. The name Leguan is derived from the Dutch word “leguaan” which translates into iguana. As such, iguana dishes are of special significance on the island. • Other animals hunted include wild ducks and watrush. Hunting of these animals is rare and is only done by a few persons for sustenance.	Mangroves, Cultivated Lands	a) Local communities (general population) hunting iguana b) Local communities (general population hunting other wildlife	a) Essential b) Low	a) Moderate b) Moderate	**a) Critical** **b) Low**
Aquatic Transportation: Passenger Commute and Cargo	Provisioning	• Stelling (operated by the Transport and Harbours Department) in Enterprise used for transportation of passengers and cargo between Leguan and Parika. • The ferry service, also operated by Transport and Harbours Department, provides daily trips between Parika and Leguan. • Approximately 16 boats offer passenger transportation services to between Parika and Leguan. These speedboats depart from and arrive at the Leguan Stelling. • Other large cargo vessels, including fuel vessels, utilize the Stelling for discharge and docking. • Speedboats and fishing boats are available for private hires to other areas including Wakenaam, Hogg Island, Supenaam, etc.	River & river defense dam	a) Passengers and businesses using the Leguan Stelling b) Businesses using the commercial wharfs	a) Essential b) High	a) Low b) Low	**a) Critical** **b) Critical**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Two commercial wharfs at Maryville used for the transportation of construction materials (sand and aggregate) and other cargo. • Landing area at Waterloo (same as the fishing landing site) is also used by 2 vessels to transport livestock to Bartica and 1 to transport building materials.					
Socio/Economic: Renewable Energy	Provisioning	• The Government of Guyana has earmarked a site in Oakum for development of a solar PV farm and a site in Cornelia for potential development of a wind farm.	Shoreline, Commercial and Housing Areas	Local communities (general population)	High	Low	**Critical**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Freshwater: Irrigation and Livestock Watering	Provisioning	• Farmers depend on freshwater from the Essequibo River for irrigation of rice fields and other crops. • Livestock also drink the water that flows in the irrigation channels.	Essequibo River	Farmers and local communities utilizing freshwater for agriculture **ES Linkages:** Crop Cultivation, Livestock Farming	Essential	Moderate	**Critical**
Freshwater: Household Use	Provisioning	• Households use freshwater from the Essequibo River for many household purposes including gardening and livestock.	Essequibo River	Local communities (general population) using freshwater for small-scale agriculture **ES Linkages:** Crop Cultivation, Livestock Farming	Essential	Low	**Critical**
Religious/Ritual	Cultural	• Hindus conduct religious activities along the river and on the river defense. Areas with good access to the river are preferred such as in Belfield, Canefield, Endeavour and Uniform. • Cremations are conducted on the beach in Uniform. However, a new cremation site is being developed farther inland and when active, this will stop cremations on the beach. • A 52-foot murti (statue) of the Hindu deity, Lord Hanuman has been constructed at the Leguan	Shoreline, river defence reserves	a) Local Hindu communities using the shoreline and river defences b) Local communities conducting cremations on the Uniform beach c) Persons visiting the Hanuman murti for worship	a) High b) Essential c) Moderate	a) Moderate b) Low c) Moderate	**a) High** **b) Critical** **c) Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		temple. This is of significance to local Hindu communities as well as Hindu communities from other areas in Guyana who visit Leguan to worship at this murti.		**ES Linkage:** Tourism and Recreation			
Tourism and Recreation	Cultural	• Approximately 15 persons utilize beaches in Canefield, Success and Thierens daily for recreation and relaxation. On weekends and special holidays (like Easter), hundreds of persons use these beaches. • Benches for recreation and relaxation are installed along the river defence dams in Endeavour and Blenheim. • The beach at Uniform was popular previously but this area is eroding and it is no longer widely used for recreation.	River, Coastal and Marine	a) Local communities using beaches for recreation and relaxation b) Benches on river defence dams in Endeavour and Blenheim **ES Linkage:** Religious/Ritual	a) Moderate b) Moderate	a) Moderate b) Moderate	**a) Medium** **b) Medium**
Historical Landmark	Cultural	• The St. Peters Anglican Church is located in Enterprise and was consecrated in 1855. This Church is recognized as a Heritage Site by the National Trust of Guyana and is the only heritage site on Leguan.	Coastlands	Patrons visiting the St. Peter's Anglican Church	Moderate	Moderate	**High**
Global Climate Regulation	Regulating	• Mangrove cover along some sections of the Leguan shoreline supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing, Transportation	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Mangrove forest protects the local communities from the impacts of the sea. According to the NDC, erosion increased along the western shoreline in Uniform and from Richmond Hill to Henrietta. However, erosion decreased on the south particularly in Cornelia to Canefield. • Several sections of the shoreline are protected by hard sea defence structures. New hard sea defences were being are being constructed on	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing, Transportation	Essential	Moderate	**Critical**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		the east of the Island, starting in Uniform, where erosion is accelerating.					
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	High	Moderate	**High**
NDC 09 - Mora/Parika - Population 15,000 (Increasing due to migration to the NDC including by Venezuela migrants)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately 10 artisanal fishing vessels at the Parika Fish Port Complex. According to the NDC, the number of boats which routinely operate at this landing site has decreased because of low productivity of fishing trips. • Landing site for approximately 7 artisanal fishing vessels at the Parika outfall. • Landing site and docking area for approximately 10 artisanal fishing vessels at the Big Kiss Marine Service Station and Ice Plant. • A few persons, mainly squatters, use “juk” seines to fish for sustenance along the shoreline in the vicinity of the Parika outfall.	Marine habitat, river habitat	a) Fisherfolk utilizing the landing site at the Parika Fish Port Complex b) Fisherfolk utilizing the landing site at the Parika outfall c) Fisherfolk utilizing the landing site at the Big Kiss Marine Service Station d) Local communities fishing for sustenance along the shoreline **ES Linkages:** Transportation, Socio/Economic, Recreation	a) High b) Moderate c) High d) Low	a) Moderate b) Moderate c) Moderate d) Moderate	**a) High** **b) Medium** **c) High** **d) Low**
Agriculture: Cultivated Crops	Provisioning	• Small-scale cultivation of coconuts and bananas on sea defence reserves in Parika Sea Dam and Salem for sustenance by a few persons.	Sea defence reserves	Local communities cultivating crops on sea defence reserves **ES Linkages:** Socio/Economic (Squatting)	Low	High	**Low**
Agriculture: Livestock Grazing	Provisioning	• Fewer than 30 heads of livestock (cattle, goats and sheep) are grazed along the shoreline of the district. • Generally, grazing along the shoreline has decreased for two reasons. First, most waterfront areas are privately owned and local communities cannot access these areas for livestock grazing. In addition, the NDC is	Sea defence reserves	Local communities grazing livestock on sea defence reserves	Low	Moderate	**Low**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		actively discouraging grazing along the sea dams because livestock, particularly cattle, damage the parapets and cause erosion.					
Aquatic Transportation: Passenger Commute and Cargo	Provisioning	• Parika Stelling is operated by the Transport and Harbours Department. There are daily or weekly ferry services for the transportation of passengers and cargo to Supenaam, Leguan, Bartica, Wakenaam and Fort Island. The ferry service is also operated by the Transport and Harbours Department. Hundreds of people use the ferry services daily. • Approximately 200 passenger speedboats depart daily to different parts of the country. A similar number of vessels are estimated to arrive into the district daily. • Cargo vessels (fuel and other supplies) arrive daily at the Parika outfall and the Big Kiss Marine Service Station. In addition, there are 7 other private wharf areas in the NDC that facilitate docking of vessels including large ships, tugs and barges with various types of cargo including building materials (sand, timber, laterite and aggregate). • Farm boats with crops from islands in the Essequibo River arrive daily at the Parika outfall and the Parika Stelling. • This NDC is significantly reliant on aquatic transport services and related economic activities.	Shoreline	a) Passengers, boat operators and ferry service operating from the Parika Stelling b) Wharf owners and business persons transporting cargo c) Farmers transporting produce to the Parika market **ES Linkages:** Tourism, recreation and socioeconomic	a) Essential b) Essential c) Essential	a) Low b) Low c) Moderate	**a) Critical** **b) Critical** **c) Critical**
Social/Economic: Sawmills	Provisioning	• There are 4 sawmills located along the waterfront area of the district with direct access to the Essequibo River. The sawmills use the River to transport logs to the mill.	Essequibo River	Sawmill owners, workers and communities in Region 3 (general population) **ES Linkage:** Transportation	High	Low	**Critical**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Socio/Economic: Marine Service Stations and Ice Factories	Provisioning	• There are three privately owned marine service stations where vessels can be refueled and docked for maintenance. At two of these locations, there are also ice factories. These are operated by the Big Kiss Marine Service Station and Ice Plant, and the Two Brothers Marine Service Station and Ice Factory. These facilities provide services to fishing boats as well as to larger vessels. • A marine service station, ice factory and fish processing plant at the Parika Fish Port Complex. Services provided to landed fishing boats include the purchase of catches, refueling and purchases of ice for fishing trips.	Shoreline	Operators of the facilities and beneficiaries (fisherfolk, ship owners business persons, etc.) **ES Linkages:** Transportation, Fishing	Essential	Low	**Critical**
Socio/Economic: Boat Building and Boat Houses	Provisioning	• There are 5 operations that provide services for building and repairs of various types of vessels are constructed including fishing boats, speedboats, farm boats and iron boats to facilitate transportation of cargo. These are services typically occur at the wharf/docking areas including the Parika Stelling, vicinity of the Parika Outfall, Big Kiss Marine Service Station, at the Feidtkou Wharf and in Hyde Park. • Four privately owned boat houses are located in the district.	Shoreline	a) Operators and beneficiaries of boat building and repairs services b) Operators of boat houses **ES Linkages:** Transportation, Fishing	a) Essential b) Moderate	a) Moderate b) Moderate	**a) Critical** **b) Medium**
Socio/Economic: Markets and Commerce	Provisioning	• Commercial activities in Parika comprising small vendors, wholesale and retail enterprises, restaurants and entertainment among others.	River bank and lands used for commercial purposes	Businesses and consumers relying on the commercial activities in Parika **ES Linkages:** Tourism, Transportation	Essential	Low	**Critical**
Socio/Economic: Parking	Provisioning	• There are two privately parking lots where vehicles can park for a fee.	Commercial areas, Parika Stelling	a) Owners and persons using the privately operated parking facilities	a) Moderate b) Moderate	a) Low b) Moderate	**a) High** **b) Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Privately operated taxis (cars and buses) are allowed temporary parking on the Parika Stelling to facilitate onward overland travel for arriving passengers.		b) Taxi drivers and general population **ES Linkages:** Tourism, Transportation			
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Socio/Economic: Squatting	Provisioning	• Squatting at Parika Sea Dam with approximately 15 structures. • Squatting in Parika (close to the Parika Fish Port Complex) with approximately 20 structures. • Squatting in the NDC has reduced and the NDC has removed structures in Namryck and from the Parika Sea Dam.	Sea defence reserves	Local communities squatting on the sea defence reserves **ES Linkage:** Crop cultivation	Moderate	High	**Low**
Freshwater: Household Use	Provisioning	• Local communities that squat along the shoreline use the fresh water from the Essequibo River for some household purposes.	Freshwater	Local communities squatting along the shoreline **ES Linkage:** Socio/Economic (Squatting)	Moderate	Low	**High**
Religious/Ritual	Cultural	• Shoreline behind the Big Kiss Marine Service Station is used by local Hindu communities for worship and offering. The Big Kiss facility also has a benab that may be rented for religious functions. • A murti (statue) of the Hindu deity, Lord Hanuman has been constructed at Parika Sea Dam. This is of significance to local Hindu communities as well as Hindu communities from other areas in Guyana who visit Parika to worship at this murti.	River dam	a) Local Hindu communities using Big Kiss facility b) Hindu communities worshipping at the Hanuman murti **ES Linkages:** Transportation, Fishing, Tourism and Recreation	a) Moderate b) Moderate	a) Moderate b) Moderate	**a) Medium** **b) Medium**
Tourism and Recreation	Cultural	• The Big Kiss facility is used by residents of the NDC and persons from outside the NDC district for recreation and relaxation. In addition, several persons visit this area for photoshoots	Shoreline	Persons using the Big Kiss facility for recreation and relaxation	a) Moderate b) Moderate	a) Low b) Low	**a) High** **b) High**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		especially for special occasions weddings, birthdays, etc. • Private tour operator, Odyssey Tours, provides tour packages to various locations in the Essequibo River including Bartica, Aruwai Resort, Essequibo Coast, etc.		**ES Linkages:** Transportation, Fishing, Religious/Ritual			
Primary Production and Habitat Provision	Supporting	• Locals protect two small islands that are roosting areas for hundreds of birds including scarlet ibis and wild ducks in the Essequibo River. The birds are not hunted due to the actions of the community. However, these islands are becoming smaller and mangroves along the shoreline are eroding.	Biodiversity, Culture	Local communities engaged in conservation **ES Linkages:** Tourism	Essential	Moderate	**Critical**
NDC 10 - Hydronie/Good Hope - Population 4,445 (Increasing due to Venezuelan migrants who are not included in the NDC's population estimate)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately 6 artisanal fishing vessels at the Ruby Koker. • Landing site for approximately 2 fishing boats along the shoreline in Orangestein. • A few persons occasionally fish along the shoreline for sustenance, wherever there is access, using cast nets, seines and lines.	Marine habitat, river habitat, shoreline	a) Fisherfolk utilizing the landing site at Ruby Koker b) Fisherfolk utilizing the landing site at Orangestein c) Local persons fishing along the shoreline	a) Moderate b) Low c) Low	a) Moderate b) Moderate c) Moderate	**a) Medium** **b) Low** **c) Low**
Agriculture: Livestock Grazing	Provisioning	• Cattle, goats and sheep are grazed on sea defence reserves and sea dams in Le Destin to Orangestein, and Ruby by a few persons.	Sea dam, sea defence reserves	Local communities grazing livestock	Low	Moderate	**Low**
Hunting/Trapping: Wild Meat	Provisioning	• Approximately 2 young persons hunt iguanas along the shoreline for sustenance and sale within the NDC throughout the year.	Sea defence reserves, shoreline	Young persons engaged in hunting iguanas	Low	Moderate	**Low**
Non-Wood Fibers and Resins: Bamboo	Provisioning	• Several persons harvest wild bamboo from the sea defence reserves to be used for use in kitchen gardens, construction and religious purposes.	River defence reserves	Local communities (general population) harvesting wild bamboo **ES Linkages:** Crop Cultivation, Religious/Ritual	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Aquatic Transportation: Passenger Transportation and Cargo	Provisioning	• Two wharfs are located along the shoreline for the transportation of building materials (sand, loam, aggregate and crusher run). A third wharf is being developed. • Cattle is transported from the Essequibo Islands (Leguan and Wakenaam) and offloaded at the Ruby Koker (same site as the fishing landing site). • Occasionally, passenger speedboats from Leguan allow passengers to disembark at the Ruby koker.	Sea dam, riverine habitat, shoreline	a) Owners of wharfs and business persons in the Region c) Farmers engaged in the transportation of livestock d) Speedboat operators and passengers using the Ruby koker for disembarkation	a) High b) Moderate c) Low	a) Low b) Moderate c) High	**a) Critical** **b) Medium** **c) Low**
Social/Economic: Industrial Site	Provisioning	• Industrial site along the shoreline operated by KARES Engineering.	Sea dam, beach, shoreline	Commercial activity for Region 3 and 4 and local businesses at Kares Engineering	High	Moderate	**High**
Socio/Economic: Boat Building and Repairs	Provisioning	• Building of wooden boats for fishing and transportation of crops by 2 families on the sea dam in Orangestein. • Boat building and repairs is done by 1 person at the Bushy Park beach.	Sea dam	Local boat builders and beneficiaries	Moderate	Moderate	**Medium**
Socio/Economic: Vessel Docking	Provisioning	• Private docking area for two ships in Orangestein.	River dam	Private docking area for ships	Moderate	Moderate	**Medium**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Socio/Economic: Squatting	Provisioning	• Squatting in Hydronie by more than 50 structures (connected to the squatting area located close to the Parika Fish Port Complex in the Parika/Mora NDC). • Squatting by 2 persons at Bushy Park and 1 person in Orangestein.	Sea dam	Local communities squatting on the sea defence reserves	Moderate	High	**Low**
Religious/Ritual	Cultural	• Local Hindu communities, from within and outside the NDC district, use the Bushy Park beach for religious purposes.	Beach, sea dam	a) Hindu communities using the Bushy Park beach	a) High b) Low	a) Moderate b) Moderate	**a) High** **b) Low**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Hindu persons living along the shoreline areas use the beach for religious purposes. The main areas for these activities are the Orangestein beach and the Ruby koker.		b) Local Hindu communities using the Orangestein beach and the Ruby koker **ES Linkage:** Tourism and Recreation, Fishing, Transportation			
Tourism and Recreation	Cultural	• The Bushy Park Beach is a popular tourist attraction for locals and people from other parts of the country, with approximately 50 people visiting daily. On weekends and special occasions hundreds of people visit the beach and there are frequently public beach parties. The use of the beach for parties was stopped during the COVID-19 pandemic but these activities are resuming. • Persons who live in proximity frequently visit the Orangestein Beach for recreation and relaxation.	Beach	a) Local communities, Regions 3 and 4 using the Bushy Park beach b) Local communities using the Orangestein beach **ES Linkage:** Religious/Ritual	a) Essential b) Moderate	a) Low b) High	**a) Critical** **b) Low**
NDC 11 – Greenwich Park/Vergenoegen – Population – 12,000 people (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately 10 artisanal fishing boats at the Vergenoegen outfall. • Landing site for approximately 5 artisanal fishing vessels (inboard cruisers) at Greenwich Park. Occasionally, these vessels offload their catch at Parika but dock along the Greenwich Park shoreline. • Several persons use seines to fish for sustenance along the shoreline. This is practiced throughout the NDC by locals who live in proximity to the shoreline.	Marine habitat, river habitat	a) Fisherfolk utilizing the landing site at the Vergenoegen outfall b) Fisherfolk utilizing the landing site at Greenwich Park c) Local communities fishing for sustenance along the shoreline	a) High b) Moderate c) Moderate	a) Moderate b) Moderate c) Moderate	**a) High** **b) Medium** **c) Medium**
Agriculture: Cultivated Crops	Provisioning	• Large-scale crop cultivation on the sea dam in Philadelphia. Crops include bananas, cash crops and several permanent crops like coconuts.	River defense reserves and sea dam	a) Local communities cultivating crops on the Philadelphia sea dam	a) High b) Low c) Low	a) Moderate b) High c) High	**a) High** **b) Low** **c) Low**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Coconuts and cash crops are cultivated on the sea dams and sea defence reserves in Barnwell and Greenwich Park. Small scale cash crop cultivation, coconuts and fruits on sea defence reserves in Vergenoegen.		b) Local communities cultivating coconuts on sea dams and sea defence reserves in Barnwell and Greenwich Park c) Local communities cultivating cash crops on reserves in Vergenoegen			
Agriculture: Livestock Grazing	Provisioning	• Fewer than 10 heads of cattle are grazed on seawall and on the sea defence reserves in Vergenoegen. • Cattle, sheep and goats are grazed along the seawall in Barnwell by a few persons.	Sea defence reserves	a) Local communities grazing livestock in Vergenoegen b) Local communities grazing livestock in Barnwell	a) Low b) Moderate	a) High b) Moderate	**a) Low** **b) Medium**
Socio/Economic: Fish Processing	Provisioning	• Drying racks are established on the sea defence reserves in Greenwich Park for air drying salted fish by one family. • Fish to be dried is typically purchased in bulk at the Meadowbank Wharf (Region 4) on a weekly basis. Salted fish is sold to a few supermarkets in Region 3 or to miners for transportation to the interior.	Sea defence reserves	Local communities drying salted fish in Greenwich Park	Moderate	Moderate	**Medium**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Socio/Economic: Squatting	Provisioning	• Squatting on sea defence reserves in Greenwich Park with more than 20 structures. • Squatting on sea defence reserves in Vergenoegen by approximately 10 structures.	Sea defence reserves	Local communities squatting on the sea defence reserves	Moderate	High	**Low**
Religious/Ritual	Provisioning	• Local Hindu communities use the shoreline throughout the NDC for religious purposes on a daily or weekly basis. • Local Christian communities use the Verenoegen shoreline to conduct baptisms.	Shoreline, beach	a) Local Hindu communities b) Local Christian communities	a) Moderate b) Low	a) Moderate b) Moderate	**a) Medium** **b) Low**
Tourism and Recreation	Provisioning	• Vergenoegen Seawall, which is used by approximately 20 persons daily to exercise, relax or socialize. There is a low-tide beach at	Sea defence reserves, sea	a) Local Communities using seawalls and beaches in Vergenoegen and Philadelphia	a) High b) Moderate	a) Moderate b) Moderate	**a) High** **b) Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		Vergenoegen which is used for games of football and cricket. The use of this area for recreational purposes had sharply declined due to the COVID-19 pandemic but the intensity of use is returning. • Philadelphia Seawall, which is used by up to 20 persons daily for recreation. There is also a low-tide beach along the Philadelphia shoreline which is occasionally use for cricket games. • The seawalls in Barnwell and Greenwich Park are also used for recreational purposes particularly on special holidays like Easter.	wall, beach, shoreline	b) Local communities using the seawalls in Barnwell and Greenwich Park			
NDC 12 – Tuschen/Uitvlugt – Population more than 30,000 (Increasing because new housing schemes are being developed)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately 25 artisanal fishing vessels at Boeraserie. • Landing site for approximately 30 artisanal fishing vessels at Meten-Meer-Zorg. • Landing site for approximately 20 vessels at Zeeburg (docked along the shoreline and at the Zeeburg koker). Most vessels at this landing site target white belly shrimp. • Landing site at Zeelugt koker for 1 artisanal fishing vessel. • Landing site for approximately 3 artisanal fishing vessels in Uitvlugt. • A few persons fish along the shoreline for sustenance and recreation using lines, nets and occasionally, fishing rods.	Marine habitat, river habitat	a) Fisherfolk utilizing the Boeraserie landing site b) Fisherfolk utilizing the Meten-Meer-Zorg landing site c) Fisherfolk utilizing the Zeeburg landing site d) Fisherfolk utilizing landing sites at the Zeelugt koker and Uitvlugt e) Local communities fishing along the shoreline for sustenance and recreation **ES Linkages:** Tourism and Recreation, Religious/Ritual	a) Essential b) Essential c) Essential d) Low e) Low	a) Moderate b) Moderate c) Moderate d) Moderate e) High	**a) Critical** **b) Critical** **c) Critical** **d) Low** **e) Low**
Agriculture: Cultivated Crops	Provisioning	• Small scale cultivation of cash crops and fruits on sea defence reserves in Zeelugt.	Se defence reserves	Local communities cultivating crops on reserves **ES Linkages:** Tourism and Recreation, Religious/Ritual	Low	High	**Low**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Agriculture: Livestock Grazing	Provisioning	• Fewer than 20 heads of cattle, sheep and goats are grazed along the seawall in Utivlugt. Approximately 5 horses are also grazed in this area. • A few persons also graze livestock along the seawall in Meten-Meer-Zorg, Zeelugt and Tuschen. • Previously, cattle was grazed along in the seawall in Kastev (Meten-Meer-Zorg) but this activity was stopped because of deterioration of the access bridge leading to the shoreline area.	Sea defence reserves, seawall	Local communities grazing livestock on sea defence reserves **ES Linkages:** Fishing, Tourism and Recreation, Religious/Ritual	Moderate	Moderate	**Medium**
Socio/Economic: Shrimp Processing	Provisioning	• Shrimp processing at Zeeburg and a drying floor has been constructed on the sea defence reserves immediately adjacent to the landing site.	Sea defence reserves	Local communities and fisherfolk engaged in shrimp processing **ES Linkage:** Fishing	High	Moderate	**High**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Socio/Economic: Squatting	Provisioning	• Squatting in Tuschen with more than 25 structures on the sea defence reserves. • Squatting in Meten-Meer-Zorg with more than 20 structures on the sea defence reserves. • Squatting in Zeelugt with more than 10 structures on the sea defence reserves. • Squatting in Bush Dam (Uitvlugt) by approximately 2 structures on the sea dam.	Sea dam, sea defence reserves	Local communities squatting on the sea dam and sea defence reserves	Moderate	High	**Low**
Religious/Ritual	Provisioning	• Local Hindu communities use the shoreline areas throughout the NDC, daily, for prayer and other ritual purposes.	Shoreline	Local Hindu communities	High	Moderate	**High**
Tourism and Recreation	Cultural	• The Cinderella Park in Zeelugt is used by approximately 40 persons daily and more than 150 persons on weekends. • The seawall in Zeelugt is used by approximately 20 people daily for recreation and relaxation. During special holidays like	Seawall, sea defense reserves	a) Local communities in the NDC and Region 3 visiting Cinderella Park. b) Local communities using sea walls in Zeelugt and Uitvlugt	a) High b) High	a) Moderate b) Moderate	**a) High** **b) High**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		Easter, hundreds of people visit the sea wall for picnics and kite flying. • The seawall in Ocean View, Uitvlugt is used by approximately 35 people daily for recreation and relaxation. During special holidays like Easter, hundreds of people visit the sea wall for picnics and kite flying. • The seawall in Kastev (Meten-Meer-Zorg) was previously used by about 10 people daily but this has almost stopped because of deterioration of the access bridge.		**ES Linkage:** Fishing, Livestock Grazing, Religious/Ritual			
NDC 13 - Stewartville/Cornelia Ida – Population – 30,000 people (Increasing because new housing schemes are being developed)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately 24 artisanal vessels at Leonora koker. Most of the vessels at this landing site target white belly shrimp. However, 6 vessels use Cadell lines and one uses drift seines. • Landing site at Anna Caterina for approximately 4 vessels. These vessels typically offload catch at Anna Region but travel to the Leonora landing site to be docked. • Landing site for approximately 3 artisanal fishing vessels in Cornelia Ida. • A few persons use pin seines to fish for sustenance along the shoreline in Leonora and Anna Catherina. Several persons use lines and cast nets, daily, to fish for recreation and sustenance throughout the shoreline of the NDC.	Marine habitat, river habitat	a) Fisherfolk utilizing the landing site at the Leonora koker b) Fisherfolk utilizing the landing site at Anna Catherina c) Fisherfolk utilizing the landing site at Cornelia Ida d) Local communities fishing along the shoreline for recreation and sustenance **ES Linkages:** Tourism and Recreation	a) Essential b) Low c) Low d) Low	a) Low b) High c) Moderate d) High	**a) Critical** **b) Low** **c) Low** **d) Low**
Agriculture: Livestock Grazing	Provisioning	• Cattle, sheep and goats are grazed along the seawalls in Stewartville and Anna Catherina. A few horses are also grazed in Anna Catherina. • Pens for rearing pigs and ducks on sea defence reserves in Leonora.	Seawall, sea defence reserves	a) Local communities grazing livestock in Stewartville and Anna Catherina b) Local communities rearing livestock in Leonora	a) Low b) Moderate	a) High b) Moderate	**a) Low** **b) Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				ES Linkage: Fishing, Tourism and Recreation			
Social/Economic: Shrimp Processing	Provisioning	• Shrimp processing at Leonora. Three persons (who are also fisherfolk) have constructed drying floors and storage facilities on the sea defence reserves. Some smaller operators occasionally dry shrimp on the seawall. • Shrimp processing at Anna Catherina by one person. The seawall is used for drying shrimp.	Sea defence reserves, sea wall	a) Fisherfolk and local communities engaged in shrimp processing in Leonora b) Local person and workers engaged in shrimp processing in Anna Catherina **ES Linkages:** Fishing, Livestock Grazing, Tourism and Recreation	a) High b) Low	a) Low b) Moderate	**a) Critical** **b) Low**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Socio/Economic: Squatting	Provisioning	• Squatting in Anna Catherina with approximately 20 structures on the sea defence reserves. • Squatting in Cornelia Ida by five persons who have migrated from Venezuela.	Sea dam, sea defence reserves	Local communities squatting on the sea dam and sea defence reserves	Moderate	High	**Low**
Religious/Ritual	Cultural	• The seawalls in Stewartville, Leonora and Anna Catherina are each used by more than 10 persons daily for Hindu prayers or rituals. • There is a temple (shrine) located along the seawall in Cornelia Ida. This area is used by at least 20 persons daily for Hindu religious prayers or rituals. • Local Christian communities conduct baptisms along the shoreline throughout the NDC. • Rituals by Jordanites to connect with the water are also conducted along the shoreline between Leonora and Anna Catherina.	Seawall, beach, reserves	a) Local Hindu communities using the seawalls in Stewartville, Leonora and Anna Catherina b) Local Hindu communities using the temple and seawall in Cornelia Ida c) Local communities of Christians and Jordanites using the shoreline area between Leonora and Anna Catherina **ES Linkages:** Fishing, Tourism and Recreation	a) Moderate b) High c) Low	a) Moderate b) Moderate c) High	**a) Medium** **b) High** **c) Low**
Tourism and Recreation	Cultural	• Seawalls in Leonora and Anna Catherina are used by almost 20 persons daily for recreation and religious purposes. Both areas also have	Seawall, beach	a) Local communities using seawalls in Leonora and Anna Catherina	a) High b) Low	a) Moderate b) Moderate	**a) High** **b) Low**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		low-tide beaches where young people play cricket. On special holidays like Easter, hundreds of people use these seawalls. • Seawalls in other areas of the NDC are used by fewer than 10 persons daily for recreation and relaxation.		b) Local communities using seawalls in other areas of the district **ES Linkages:** Fishing, Tourism and Recreation			
NDC 14 - Hague/Blankenburg - Population - 4,200 people (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately 16 artisanal fishing boats at Hague. All vessels use Cadell lines for fishing. • Approximately 10 persons use lines, seines, cast nets, or fishing rods to catch fish for sustenance and recreation Hague and Blankenburg.	Seawall, shoreline	a) Fisherfolk utilizing the landing site at Hague b) Local communities fishing for sustenance and recreation along the shoreline **ES Linkage:** Religious/Ritual, Tourism and Recreation	a) Essential b) Low	a) Moderate b) Moderate	**a) Critical** **b) Low**
Agriculture: Livestock Grazing	Provisioning	• Grazing of fewer than 30 heads of cattle along the seawall throughout the NDC. • Grazing along the sea walls and on sea defence reserves has decreased and the NDC is actively discouraging grazing in these areas because livestock, particularly cattle, damage the parapets and cause erosion.	Sea dam, reserves	Local communities grazing livestock along the sea walls **ES Linkage:** Religious/Ritual, Tourism and Recreation	Low	High	**Low**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government and by private developers.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Ritual/Religious	Cultural	• Religious activities conducted daily at Hague seashore by local Hindu communities.	Seawall, shoreline	Local Hindu communities	Moderate	Moderate	**Medium**
Tourism and Recreation	Cultural	• Sea defences and shoreline area throughout the NDC used for recreation. In each village, more than 20 people visit the shoreline area (particularly on weekends) to relax, exercise, and socialize. These areas are also used daily by a few persons.	Seawall, shore	Local communities using the shoreline areas in the NDC	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
NDC 15 - La Jalousie/Nouvelle Flanders - Population estimate 10,000 people (Increasing due to migration of Venezuelans)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately 12 artisanal fishing vessels at the Windsor Forest koker. The Windsor Forest landing site is well-known on the West Coast of Demerara for the gillbacker stalls at which four vendors sell almost daily. Gillbacker is one of the most expensive fish species in Guyana. • Several persons use "juk" seines and lines to fish along the shoreline for sustenance and recreation. This is most common on weekends along the shoreline in Windsor Forest and La Jalousie.	Marine habitats, shoreline	a) Artisanal fisherfolk utilizing the Windsor Forest landing site and Vendors operating the gilbacker stalls b) Local communities fishing along the shoreline **ES Linkage:** Tourism and Recreation	a) Essential b) Low	a) Moderate b) High	**a) Critical** **b) Low**
Agriculture: Livestock Grazing	Provisioning	• Grazing of sheep and goats along the sea defense reserve from in Nouvelle Flanders and La Union by a few persons. • Grazing along the sea walls and on sea defence reserves has decreased and the NDC is actively discouraging grazing in these areas because livestock, particularly cattle, damage the parapets and cause erosion.	Sea defense reserves	Local communities grazing livestock on sea defence reserves	Low	Moderate	**Low**
Agriculture: Crop Cultivation	Provisioning	• Rice cultivation is done close to the shoreline in Rotterdam and Harlem.	Cultivated lands	Local communities cultivating rice	High	Moderate	**High**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Socio/Economic: Restaurant	Provisioning	• A restaurant and bar were constructed on the sea defence reserves in La Jalousie. In addition, another restaurant is being constructed in this area.	Sea defence reserves	Owner, workers and patrons of the restaurant in La Jalousie	High	High	**Medium**
Ritual/Religious	Provisioning	• Religious activities conducted daily at seashore in Windsor Forest, Ruimzeight and Wallers Delight by local Hindu communities.	Sea defence reserves, shoreline	a) Local Hindu communities using the shoreline areas in the NDC b) Communities in Regions 3 and 4 using the cremation site	a) High b) Essential	a) High b) Moderate	**a) Medium** **b) Critical**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• The Kaashi Dam Hindu Cremation Site located in Ruimzeigt utilized daily by people from Regions 3 and 4.		**ES Linkage:** Tourism and Recreation			
Tourism and Recreation	Cultural	• Beaches at Wallers Delight and La Union used weekly by persons who live in proximity to the shoreline. In addition, a few persons use the shoreline area in Wallers Delight where benches have been installed for relaxation. • During special holidays like Easter, hundreds of persons use the seawalls for picnics and kite flying particularly in Windsor Forest and La Union. • Previously, a new beach was being formed at Harlem but this has eroded. • A boardwalk with benches is being constructed on the sea defence reserves in La Jalousie and Windsor Forest as part of the First Lady's National Beautification Project.	Sea defence reserves, shoreline	a) Local communities using beaches and river defences in Windsor Forest, Wallers Delight and La Union b) New boardwalk in La Jalousie **ES Linkages:** Fishing, Ritual/Religious	a) Moderate b) Moderate	a) Moderate b) Low	**a) Medium** **b) High**
NDC 16 - Best Klien/Pouderoyen – Population – 34,800 people (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately 6 artisanal fishing boats at Vreed-en-Hoop. • Landing site for approximately 2 artisanal fishing vessels at Phoenix Park (referred to as "Cogland Dam" locally). • Landing site for 3 artisanal fishing boats at the Jetty (Plastic City). Fisherfolk from this landing site use a variety of fishing gear including pin seines to fish along the shoreline. • Landing site for 4 artisanal fishing vessels in Crane. Fisherfolk in this area commonly use a variety of seine types including pin seines to fish along the shoreline. When pin seines are used, catamarangs are utilized to retrieve the catch.	Marine habitat, riverine habitats	a) Fisherfolk utilizing the landing site at Vreed-en-Hoop b) Fisherfolk utilizing the landing site at Phoenix Park c) Fisherfolk utilizing the landing site at Jetty d) Fisherfolk utilizing the landing site at Crane **ES Linkage:** Crabbing, Socio/Economic, Hunting/Trapping	a) Moderate b) Low c) Low d) Low	a) Moderate b) Moderate c) Moderate d) Moderate	**a) Medium** **b) Low** **c) Low** **d) Low**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Crabbing	Provisioning	• Approximately 4 persons in Crane are engaged in crabbing along the shoreline throughout the year. Fisherfolk and crabbers are the same persons. According to a local fisherfolk, during the July to September crab season, some fisherfolk use their fishing boats to travel to the mouth of the Pomeroon River (Region 2) for crabbing. • Approximately five persons catch crabs at the Jetty and in Pouderoyen throughout the year. In the non-seasonal crab period, most crabbing is done based on orders from customers. A few more persons catch crabs seasonally in these areas for livelihoods.	Mangroves, beach, shoreline	a) Local communities engaged in crabbing throughout the year b) Local communities engaged in crabbing seasonally **ES Linkage:** Fishing, Socio/Economic, Hunting/Trapping, Mangroves	a) Moderate b) Moderate	a) Low b) Moderate	**a) High** **b) Medium**
Agriculture: Livestock Grazing	Provisioning	• Grazing of cattle and sheep along on the sea defence reserves in Crane by 3 persons. • Grazing of approximately 30 heads of cattle and sheep on the sea dam in Best Village. In addition, 2 persons rear pigs on the sea dam in Best Village.	Sea dam, sea defence reserves	a) Local communities grazing livestock in Crane b) Local communities grazing livestock and rearing pigs in Best Village **ES Linkages:** Fishing, Tourism and Recreation	a) Low b) Moderate	a) Moderate b) Moderate	**a) Low** **b) Medium**
Hunting/Trapping: Wild Meat	Provisioning	• A few persons catch iguanas, waterbirds and on occasion, river turtles for sale.	Mangroves	Local communities (general population) hunting in the mangroves **ES Linkage:** Crabbing, Socio/Economic, Hunting/Trapping	Low	Moderate	**Low**
Socio/Economic: Sawmill	Provisioning	• Sawmill in Pouderoyen utilizes the Demerara River to transport logs to the mill.	River dam, commercial and housing areas	Sawmill owner, workers and local communities (general population) **ES Linkage:** Transportation	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Socio/Economic: Wharfs	Provisioning	• GPL Wharf used to transport key supplies including fuel to the power station in Vreed-en-Hoop.	River dam	GPL, GPL customers relying on the power station	Essential	Low	**Critical**
Socio/Economic: Shore Base Facility	Provisioning	• New shore base facility to service the offshore oil and gas sector to be developed along the shoreline of Crane to Vreed-en-Hoop. According to the NDC, the developer is in the process of obtaining required regulatory approvals.	Shoreline, mangroves	Private developer, offshore oil and gas companies, local communities	Essential	Low	**Critical**
Aquatic Transportation: Passenger Commute	Provisioning	• Vreed-en-Hoop Stelling is used daily by thousands of passengers for transportation between Regions 3 and 4 by small privately owned vessels called “speed boats”. • There are approximately 75 registered speed boats that work on a rotational system with about 50 vessels working per day.	River dam, shoreline	Local communities using speed boats	Essential	Low	**Critical**
Socio/Economic: Boat Building and Repairs	Provisioning	• Boat building and repairs by one group on the river dam in Vreed-en-Hoop. This group works on wooden vessels to be used as fishing boats or speed boats.	River dam	Boat builders, fisherfolk and speed boat operators	High	Low	**Critical**
Socio/Economic: Markets and Commerce	Provisioning	• Commercial activities in Vreed-en-Hoop (including in the Vreed-en-Hoop stelling) comprising small vendors, wholesale and retail enterprises, restaurants and entertainment among others.	River bank and lands used for commercial purposes	Businesses and consumers relying on the commercial activities in Vreed-en-Hoop **ES Linkages:** Tourism, Transportation	Essential	Low	**Critical**
Socio/Economic: Parking	Provisioning	• Small vehicles can be parked in the Vreed-en-Hoop Stelling for a fee. This service is used by approximately 50 persons daily.	River bank	Commuters paying for parking in the Stelling **ES Linkage:** Aquatic Transportation	High	Low	**Critical**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Socio/Economic: Squatting	Provisioning	• Squatting in the mangroves at Plastic City with 11 structures. According to the NDC, the number of structures and persons in Plastic City has declined following public consultations pertaining to establishment of a shore base facility to support the oil and gas sector along the shoreline. Ultimately, construction of this facility will require relocation of all squatters who reside in Plastic City. • In addition, there is squatting on the sea defence reserves between Best Village and Vreed-en-Hoop. • Squatting on the sea dam in Plantain Walk by approximately 4 structures. • Squatting on the sea defence reserves in Crane by more than 20 structures.	River defence reserves, sea dam, mangroves	Local communities squatting on the sea dam and sea defence reserves	Moderate	High	**Low**
Mangrove Materials	Provisioning	• A few households harvest mangroves for construction of fences and for fishing, primarily in squatting areas. According to the NDC, this activity has declined because there are visible gaps in mangrove cover when harvested and moreover, harvesting mangroves is prohibited in the NDC.	Forests	Local communities (general population) harvesting mangroves	Low	High	**Low**
Ritual/Religious	Cultural	• Local Hindu communities use the shoreline throughout the NDC for religious activities. Shoreline areas in Crane and Pouderoyen are used daily by several persons for prayers. • Local Christian communities use the shoreline area in Pouderoyen for baptisms.	Sea, river, beach, reserve	a) Local Hindu communities in Crane b) Local Hindu and Christian communities in Pouderoyen	a) High b) Low	a) Moderate b) Moderate	**a) High** **b) Low**
Tourism and Recreation	Cultural	• Persons living in Plastic City visit the Jetty daily for relaxation and bird watching. • A few persons use the sea defence reserves in Crane daily and on weekends for recreation and relaxation. The beach at Crane is used by young people for games of cricket. In addition,	Coastal mangroves and shoreline	Local communities and tourists	Medium	Medium	**Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		hundreds of people visit this area on special holidays like Easter.					
Historical Landmark	Cultural	• Historical object (locally called “First Baby”) located in the mangroves behind Plastic City. This object is not catalogued as having heritage importance by the National Trust Guyana.	Mangroves	Tourists, Residents	Low	Low	**Medium**
Global Climate Regulation	Regulating	• Mangrove cover shoreline supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Mangrove forest supports hard sea defence structures to protect the local communities from the impacts of the sea. According to the NDC, mangroves growth is increased along the Crane shoreline.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing,	Essential	Moderate	**High**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for several species of birds, crabs monkeys, raccoons, wild ducks. According to the NDC, residents of Crane and Plastic City have also reported sightings of manatees and dolphins immediately offshore and in the Demerara River.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	High	Moderate	**High**

APPENDIX E – ECOSYSTEM SERVICES AND PRIORITY RATINGS IN REGION 4

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Georgetown City, Population 132,000 (Increasing due to new suburban housing areas)							
Social/Economic: Ports and Wharfs	Provisioning	• The Port Georgetown comprising independent pier operators that are either privately owned or public corporators. Port facilities are used by more than 30 ocean-going vessels daily to support local and international trade.	River and ocean	Operators of pier facilities in the Port of Georgetown **ES Linkages:** Transportation	Essential	Low	**Critical**
Socio/Economic: Shore base Facilities	Provisioning	• Shore base facilities to support Guyana's offshore oil and gas sector.	River and ocean	Companies providing services at shore base facilities.	Essential	Low	**Critical**
Aquatic Transportation: Cargo and Passenger Commute	Provisioning	• Ferry ports facilitate commute from Georgetown to Region 1 used by thousands of passengers monthly. • Georgetown Stelling used daily by thousands of passengers for transportation between Regions 3 and 4 by small privately owned vessels called "speed boats".	River and ocean	a) Local communities and businesses using the Region 1 ferry for commute and movement of goods b) Local communities using "speed boats" **ES Linkages:** Tourism and Recreation,	a) Essential b) Essential	a) Moderate b) Low	**a) Critical** **b) Critical**
Social/Economic: Markets and Commerce	Provisioning	• Stabroek Market situated on the eastern bank of the Demerara River. The market has been operational since 1881. • Commercial activities in Georgetown comprising wholesale and retail enterprises, restaurants and entertainment among others.	River bank and lands used for commercial purposes	Businesses and consumers relying on the commercial activities in Georgetown **ES Linkages:**	Essential	Low	**Critical**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				Tourism and Recreation, Transportation			
Socio/Economic: Health	Provisioning	• The Ocean View International Hotel was converted to the National Infectious Diseases Hospital and is located adjacent to the Lilliendaal shoreline.	State lands	Guyanese population benefiting from public health services	Essential	Low	**Critical**
Socio/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government or by private developers.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Fishing landing and docking area for industrial fishing vessels (trawlers). Fish processing plant is located adjacent to vessel docking areas. • Landing site for approximately 120 artisanal fishing vessels at the Meadowbank Wharf. • Landing site for approximately 20 artisanal fishing vessels at Liliendaal. The use of this landing site has increased as a result of increased mangrove growth, coupled with heavily silted channels at several other landing sites in Region 4. • Artisanal fishing vessels occasionally utilize the Kingston outfall for landings. • Individuals fish with nets and lines along the shoreline, particularly the Kingston jetty, the beach located behind the Marriott Hotel, the Kingston seawall (stretch of the seawall running	River and ocean	a) Industrial fishing operators b) Artisanal fisherfolk utilizing the Meadowbank landing site c) Artisanal fisherfolk utilizing the Liliendaal landing site d) Recreational or subsistence fishing along the shoreline **ES Linkages:** Tourism and Recreation, Religious/Ritual	a) High b) Essential c) Moderate d) Moderate	a) High b) Low c) Low d) High	**a) Medium** **b) Critical** **c) High** **d) Low**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		parallel to Carifesta Avenue) and the abandoned site of Celina's restaurant.					
Tourism/Recreation	Cultural	• Two of the main hotels, Guyana Marriott Hotel and Pegasus Hotel Guyana, are located adjacent to the shoreline, with hundreds of guests per week and approximately 200 employees combined. The Pegasus hotel is expanding to include new suites and corporate office space. • White sand beach developed behind the Guyana Marriott Hotel used by more than 50 people daily for recreation and relaxation. • The First Lady's National Beautification Project is constructing a boardwalk and rehabilitating the bandstand area. Currently, hundreds of people frequent this area on weekends and special holidays. The area is also used for exercise. • The Kingston seawall is used by hundreds during mornings, evenings and weekends. Thousands visit this area on special holidays such as Easter and Mashramani. Restaurants, bars and mobile food carts have been established on the reserve areas and operate mainly during the evening. The seawall is also used for exercise. • Newly developed area in Turkeyen and Cummings Lodge used by hundreds on	Seashore, sea defence reserves	a) International guests and local communities utilizing service provided by the hotels b) International guests and local communities using the white sand beach behind the Marriott c) Local communities using the boardwalk, bandstand area and Kingston seawall. d) Local communities using the recreation area in Turkeyen to Cummings Lodge **ES Linkages:** Fishing, Religious/Ritual	a) Essential b) Moderate c) Essential d) High	a) Low b) Low c) Low d) Moderate	**a) Critical** **b) High** **c) Critical** **d) High**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		weekends for recreation including picnics.					
Religious/Ritual	Cultural	• Religious activities at the Kingston shoreline with access provided via the white sand beach behind the Marriott Hotel. The use of this area for Hindu religious activities has increased due to the proliferation of mangroves and poor sanitary conditions along the shoreline of other Region 4 communities. • Religious activities along the seashore in the Turkeyen to Cummings Lodge area.	Seawall, shore, beach	Local communities using religious areas at: a) Kingston shore b) Turkeyen to Cummings Lodge **ES Linkages:** Fishing, Tourism and Recreation	a) High b) High	a) Moderate b) Moderate	**a) High** **b) High**
Shoreline Protection and Erosion Regulation	Regulating	• The coastland is at risk to erosion, although protected by concrete defence. Beaches and mud banks forming along the seawall are contributing to this effort.	Sea defence	Local communities **ES Linkages:** Fishing	High	Moderate	**High**
NDC 17 – Industry/Plaisance - Population – 25,000 people (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Fishing landing site at the Ogle Koker where approximately 40 artisanal fishing boats dock. Landed hauls comprise of fishes and shrimps. Fisherfolks have constructed sheds on the reserves for storage of equipment and supplies (seines and engines). • Fishing for sustenance and recreation using seines, nets and lines by a few people along the shoreline. • Recreational fishing is typically a family activity and is most common during the	Marine habitats, river habitats and mangroves	a) Artisanal fisherfolks utilizing the Ogle landing site b) Local communities fishing with seines, nets and lines for sustenance and recreation at Ogle/ Industry and Plaisance	a) Essential b) Low	a) Low b) Moderate	**a) Critical** **b) Low**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		July/August school holidays and Christmas season. Common recreational fishing methods including “beat the water” and “feeling for fish”.					
Trapping/Hunting: Wild Meat	Provisioning	• Seasonal capture of wild ducks and birds by a few people in Plaisance. Birds hunted including the Scarlet Ibises in the summer months when the birds are plentiful in the area.	Seashore, mangroves	Local communities in Plaisance **ES Linkage:** Mangroves	Low	High	**Low**
Agriculture: Cultivated Crops	Provisioning	• A few people planted trees and cash crops along the sea defence reserves in Ogle. The dominant crops are coconuts and bananas.	Sea defence reserves	Local communities	Low	High	**Low**
Agriculture: Livestock Grazing	Provisioning	• Grazing of livestock (sheep and goats) on sea dams and sea defence reserves particularly in Ogle.	Sea defence reserves	Local communities	Low	Moderate	**Low**
Socio/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Social/Economic: Squatting	Provisioning	• Squatting occurring in close proximity to the sea defence at Plaisance. The number of structures has not changed but the number of people living in the squatting area has increased over the last two years.	Sea defence reserves	Local communities in Plaisance	Moderate	High	**Low**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Tourism and Recreation	Cultural	• The proliferation of mangroves throughout the NDC has reduced the use of seawalls for exercise and recreation. Fewer than 25 families visit on weekends. • Garbage is dumped illegally over the seawall and becomes trapped in the mangroves. This results in unsanitary conditions and malodours further decreasing recreational use.	Sea wall, reserves	Local communities using seawalls throughout the NDC	Low	Moderate	**Low**
Religious/Ritual	Cultural	• The Ogle koker was used by Jordanites to conduct baptism and twice per year there are African Libation Ceremonies. However, these activities were not conducted recently and this may be due to the COVID-19 pandemic. • The Plaisance koker was previously used for religious activities by Hindus and practitioners of traditional African religions. However, this has declined significantly due to the proliferation of mangroves and unsanitary conditions associated with illegal garbage disposal.	Sea defence, reserves	Local communities using a) Ogle koker and b) Plaisance koker for religious purposes	a) Low b) Low	a) Moderate b) Moderate	**a) Low** **b) Low**
Global Climate Regulation	Regulating	• Mangrove cover gain has occurred along the shoreline of the NDC resulted in the expansion of mudflats and regulation of many natural factors, contributing to pollination of crops and adding to carbon sequestration.	Mangroves	Local communities **ES Linkages:** Fishing, Shoreline Protection and Erosion Regulation, Habitat Provision	High	Moderate	**High**
Shoreline Protection and Erosion Regulation	Regulating	• Mangroves and coastal vegetation play a critical role in maintaining coastal	Mangroves	Local communities	High	Moderate	**High**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		stability and preventing flooding. Mangroves also offer shoreline protection which complements hard sea defence structures.		**ES Linkages:** Fishing, Global Climate Regulation, Habitat Provision			
Primary Production and Habitat Provision	Supporting	• The NDC has a large area covered by new growth mangroves with rich biodiversity.	Mangroves	Local communities **ES Linkages:** Fishing, Shoreline Protection and Erosion Regulation, Global Climate Regulation	High	Moderate	**High**
NDC 18 – Better Hope/La Bonne Intention – Population – 50,000 (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Proliferation of mangroves has blocked access to the Montrose landing site resulting in relocation of these vessels to the Ogle landing site. Few vessels access the landing site at Montrose for repairs. Sheds which were constructed by fisherfolks for storage of equipment and supplies remain in place. • Landing site at La Bonne Intention (LBI) for approximately six artisanal vessels. Fisherfolk have constructed sheds on reserve lands for storage of equipment and supplies.	Marine habitats, river habitats and mangroves	a) Fisherfolk using the Montrose landing site b) Fisherfolk using the LBI landing site **ES Linkages:** Tourism and Recreation, Religious/Ritual	a) Low b) High	a) Moderate b) Moderate	**a) Low** **b) High**
Crabbing	Provisioning	• Seasonal crabbing (July to August) by a few persons. Crabbing has significantly declined because increased mangrove cover along the shoreline has reduced ease of access to crabbing areas.	Mangroves, shoreline	Local communities engaged in seasonal crabbing **ES Linkages:** Hunting/Trapping, Mangroves	Low	Moderate	**Low**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Agriculture: Livestock Grazing	Provisioning	• One person operates a pig pen (rearing approximately 5 pigs) along the sea dam in Better Hope. The Industry/Plaisance NDC is trying to relocate this operation due to complaints from residents within the area. • Fewer than 10 people utilize land along the sea wall in Vryheid's Lust and Montrose for grazing of goats and sheep. • Approximately two persons graze horses and sheep along the sea dams at LBI.	Sea defence reserves, mangroves	Local communities in: a) Better Hope b) Vryheid's Lust to Montrose c) LBI	a) Low b) Moderate c) Low	a) High b) Moderate c) High	**a) Low** **b) Medium** **c) Low**
Agriculture: Crop Cultivation	Provisioning	• One person is engaged in the cultivation of cash crops on the sea dam at Better Hope.	Sea defence reserves	Local community in Better Hope	Low	High	**Low**
Trapping/Hunting: Wild Meat	Provisioning	• Lulu, egrets and plover birds are caught by a few people particularly young people. Hunting of wild birds has increased since the previous study and plover is the most popularly captured species for sale in local markets.	Mangroves	Local communities (particularly young people) throughout the NDC **ES Linkages:** Crabbing, Mangroves	Moderate	Moderate	**Medium**
Socio/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Socio/Economic: Squatting	Provisioning	• More than 20 people are squatting along the sea dam in Success and Chateau Margot. The Government is believed to be in the process of addressing this situation either by	Sea defence reserves	Local communities squatting in Success and Chateau Margot	Moderate	Moderate	**Medium**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		regularizing the area or moving the squatters.					
Tourism and Recreation	Cultural	• The use of the seawalls for recreational purposes (relaxation, socializing and exercise) has sharply declined due to mangrove proliferation. • The seawall in LBI extending to communities outside of the NDC (like Beterverwagting) is used by a few persons for exercise. • Increased mangrove cover has raised security concerns as well as attacks from pests like sandflies. Garbage is dumped illegally over the seawall and becomes trapped in the mangroves resulting in unsanitary conditions and malodours. • A shed on the Montrose seawall is used almost daily for recreation including playing dominoes. • The NDC is considering the development a recreation area on the GUYSUCO reserve close to the sea defences in Vryheid's Lust to Montrose. Lands still have to be acquired.	Seawall, shore	Local communities using the seawalls in: a) LBI b) Montrose **ES Linkages:** Fishing, Religious/Ritual	a) Low b) Moderate	a) Moderate b) High	**a) Low** **b) Low**
Religious/Ritual	Cultural	• Mangrove proliferation along the shoreline has significantly reduced Hindu religious activities. • The shoreline area of LBI is mainly used, with limited activities still occurring on sea dam at Montrose.	Sea defence reserves	Local communities in: a) LBI b) Montrose **ES Linkages:** Fishing, Tourism and Recreation	a) Moderate b) Low	a) Low b) Moderate	**a) High** **b) Low**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Global Climate Regulation	Regulating	• Mangrove cover gain along the shoreline of the NDC resulted in the expansion of mudflats and regulation of many natural factors, contributing to pollination of crops and adding to carbon sequestration.	Mangroves	Local communities **ES Linkages:** Fishing, Shoreline Protection and Erosion Regulation, Habitat Provision	High	Moderate	**High**
Shoreline Protection and Erosion Regulation	Regulating	• The coastland is at risk of erosion and much of the shore is protected by concrete defence. The mangroves help to defend the coast against flooding. Prior to the growth of mangroves, areas close to the seawall in Better Hope, Kersaint Park and LBI routinely flooded during spring tide events. However, flooding has not occurred since mangroves cover has expanded. • Mangroves are growing naturally at the seashore due to the increases in mud/silt deposits.	Coastal vegetation	Local communities **ES Linkages:** Fishing, Global Climate Regulation, Habitat Provision	High	Moderate	**High**
Primary Production and Habitat Provision	Supporting	• The NDC has a large area covered by new growth mangroves with rich biodiversity. People use this area for increased hunting of plovers for meat.	Coastal Mangroves	Local communities **ES Linkages:** Fishing, Shoreline Protection and Erosion Regulation, Global Climate Regulation	High	Moderate	**High**
NDC 19 – Beterverwagting/Triumph - Population - 7,000 people (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Approximately 5 persons use the mudflats in Beterverwagting for pin seine fishing. Increased mangrove cover along the shoreline has reduced	Ocean, mudflats, mangroves	Local fisherfolks engaged in pin seine fishing	Moderate	Moderate	**Medium**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		the number of persons practicing pin seine fishing. These fisherfolk have created a path through the mangroves to access mudflats to set seines and return with their catch. • The landing site for artisanal fishing vessels at the Triumph koker is no longer operational because of increased mangrove cover.		**ES Linkage:** Mangroves			
Agriculture: Livestock Grazing	Provisioning	• A few goats and cows are grazed along the shoreline throughout the NDC. However, grazing is constrained because there are few available lands.	Sea dam, Mangroves, reserves	Local communities	Low	Moderate	**Low**
Socio/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government and private developers. • There are two new housing developments in Triumph North located relatively close to the shoreline including a NDC housing scheme with 21 lots and a privately developed housing scheme with about 18 lots.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Socio/Economic: Squatting	Provisioning	• One person is squatting on the sea dam in Triumph.	Sea defence reserves	Individual squatting on the sea dam	Low	High	**Low**
Tourism and Recreation	Cultural	• Recreational uses along the Triumph seawall have significantly declined as a result of the following two reasons. • Firstly, the main public access road that leads to the seawalls has been incorporated into the fenced area of a privately owned hardware store. When the gates are locked, persons from the	Sea wall, reserves	Local communities **ES Linkages:** Mangroves, Religious/Ritual	Low	Low	**Medium**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		local communities are denied entrance to access the seawall. The NDC is currently engaged in discussions with the developer to come to an amicable resolution because these roads are under the NDC's purview. • Secondly, illegal dumping of garbage over the seawall has resulted in poor sanitation which makes the area unsuitable for recreational use.					
Religious/Ritual	Cultural	• Religious activities along the shoreline and sea dam at Triumph by local Hindu communities has virtually stopped due to mangrove proliferation which has limited all accesses to the shoreline within this area. • Most Hindus travel to Georgetown (Kitty seawall or the Marriott beach) to access the shoreline for religious purposes. This was noted to be very challenging to persons within the area due to transportation cost and commute times.	Sea defence reserves, shore	Local Communities **ES Linkages:** Mangroves, Tourism and Recreation	Low	Low	**Medium**
Global Climate Regulation	Regulating	• Mangrove cover gain along the shoreline of the NDC has continued, resulted in the expansion of mudflats and regulation of many natural factors, contributing to pollination of crops and adding to carbon sequestration.	Mangroves	Local communities **ES Linkages:** Fishing, Shoreline Protection and Erosion Regulation, Habitat Provision	High	Moderate	**High**
Shoreline Protection and Erosion Regulation	Regulating	• The coastland is at risk of erosion and much of the shore is protected by	Coastal vegetation	Local communities **ES Linkages:**	High	Moderate	**High**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		concrete defence which help to defend against flooding. • Mangroves are growing naturally at the seashore due to the increases in mud/silt deposits. .		Fishing, Global Climate Regulation, Habitat Provision			
Primary Production and Habitat Provision	Supporting	• The NDC has a large area covered by new growth mangroves with rich biodiversity.	Coastal Mangroves	Local communities **ES Linkages:** Fishing, Shoreline Protection and Erosion Regulation, Global Climate Regulation	High	Moderate	**High**
NDC 20 – Mon Repos/La Reconnaissance - Population - 40,000 (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site at Good Hope/ Mon Repos used by approximately 20 artisanal fishing vessels. • Landing site at Annadale/Lusignan used by approximately 25 artisanal fishing vessels. According to local fisherfolk, activities at the landing site have significantly declined due to reduced catches being experienced by fisherfolk. • Mangrove proliferation led to the establishment of a mud bank at the landing site in Django Town (Mon Repos). The use of this landing site stopped since 2020 with some fisherfolks relocating to the Liliendaal landing site and some fisherfolks seeking alternative livelihoods. • Approximately 75 to 100 people catch fish and shrimp along the shoreline	Ocean & River ecosystems	a) Fisherfolks utilizing the Good Hope/ Mon Repos landing site b) Fisherfolks utilizing the Annadale/ Lusignan landing site c) Local communities catching fish and shrimp along the shoreline **ES Linkage:** Ritual/Religious	a) Essential b) Essential c) Moderate	a) Low b) Low c) Moderate	**a) Critical** **b) Critical** **c) Medium**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		using lines and nets. Pacu is caught among the rocks of sea defences using lines.					
Crabbing	Provisioning	• Approximately 10 to 15 persons, mainly young people, are engaged in seasonal crabbing. This activity increased throughout the NDC due to mangrove growth.	Mangroves	Local communities, especially young people, engaged in crabbing **ES Linkages:** Mangroves, Trapping/Hunting	Low	Moderate	**Low**
Fishing: Aquaculture	Provisioning	• A private developer leased lands in Annadale (just south of the seawall) to establish an aquaculture farm. However, the project did not advance because of land use conflicts with squatters. • Another developer has agreed to acquire the land and subsequently, to develop the project.	Sea dam, seawall	Private developers, local communities	Moderate	Low	**High**
Agriculture: Livestock Grazing	Provisioning	• Grazing of goats in mangrove areas throughout the NDC. • Pig pen is located on the sea defence reserves in Lusignan.	Mangroves, Sea defence reserves	Local Communities engaged in livestock rearing: a) Throughout the NDC b) Lusignan	a) Low b) Low	a) Moderate b) High	**a) Low** **b) Low**
Trapping/Hunting: Wild Meat	Provisioning	• Wild ducks and shore birds are caught seasonally and used for sustenance by a few families. • Hunting of wild birds is not a livelihood activity and is typically for recreational purposes. However, recreational hunting is also discouraged due to	Sea shore, Mangroves	Local communities **ES Linkages:** Mangroves, Crabbing	Low	High	**Low**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		safety concerns associated with firearm use.					
Social/Economic: Boat Building and Repairs	Provisioning	• Boat building and repairs (artisanal fishing vessels) in Mon Repos. There is also a small boat repairs enterprise in Lusignan. • Local stakeholders at Mon Repos indicated that there has been a downturn in orders for new boats due to the low productivity being experienced by fisherfolks.	Sea dam, beach, residential areas	Local communities benefitting from boat building enterprises in: a) Mon Repos b) Lusignan	a) Essential b) Moderate	a) Moderate b) Moderate	**a) Critical** **a) Medium**
Social/Economic: Leather Tannery	Provisioning	• Mangrove barks are utilized by three tanneries to colour leather. This activity was discouraged because harvesting mangrove barks stunts the growth of the mangroves. • The tanneries relied on barks from red mangroves. However, in an effort to discourage mangrove harvesting, only black mangroves are planted by NAREI.	Mangroves	Local leather tanners	Moderate	High	**Low**
Social/Economic: Heliport and Hotel	Provisioning	• A heliport and a hotel are under construction by Orindiuk Investments close to the sea defence area in Lusignan. • Project completion has been delayed and is now on schedule to be completed in August 2022.	Sea Defences	Private developers, Local communities	High	Moderate	**High**
Socio/Economic: Plans for Infrastructural Development	Provisioning	• Orinduik Investments is developing a training school for the oil and gas sector east of the helipad.	Sea dam and sea defences	Private developers, Local communities	High	Moderate	**High**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• These private developers have also expressed interest in establishing a deep-water harbour in Lusignan.					
Social/Economic: Coconut Packaging and Processing	Provisioning	• A private developer was interested in developing a coconut processing plant close to the shoreline in Annadale. • The land which was earmarked for the project is under the control of the Ministry of Public Works and permission to use the area is yet to be granted. As such, plant construction is on hold. However, the developer is engaged in packaging coconuts for export.	Sea shore	Private developers, Local communities	Moderate	High	**Low**
Socio/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government or by private developers.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Socio/Economic: Squatting	Provisioning	• There has been a significant increase of squatting on sea defence reserves. The squatters are mainly Venezuelan migrants who have no alternative housing.	Sea defence reserves	Local communities	Moderate	High	**Low**
Tourism and Recreation	Cultural	• Recreation at Lusignan and Annandale where people living in close proximity and others frequent the seawall, particularly for exercise. The use of the seawall for recreational purposes has declined due to mangrove growth. • There are two playgrounds located in proximity to the seashore. One is in Marshon (Annadale) which is being rehabilitated by a Management	Sea wall, Beach	Local Communities using: a) Lusignan and Annandale seawall for exercise b) Community playgrounds at Annandale and Mon Repos	a) Moderate b) Moderate	a) High b) Moderate	**a) Low** **b) Low**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		Committee. The second is in Mon Repos (North) which was previously under control of NAREI but has been handed over to Community Development Council (CDC).					
Religious/Ritual	Cultural	• Hindu religious activities are concentrated at a Sea Shore Temple built on the sea dam at Mon Repos. • The use of the shoreline areas for religious purposes has declined significantly due to the proliferation of mangroves and unsanitary conditions associated with illegal garbage disposal including dumping of animal carcasses. As such, many people travel outside of the NDC including to the beach behind Marriott Hotel or to the Unity Beach. • The Good Hope Crematorium is used by local communities in Region 4.	Sea dam, beach	Local communities using: a) Mon Repos Temple b) Shorelines throughout the NDC c) Crematorium **ES Linkage:** Fishing	a) High b) Low c) Essential	a) Moderate b) High c) Low	**a) High** **b) Low** **c) Critical**
Global Climate Regulation	Regulating	• Mangrove cover gain along the shoreline of the NDC resulted in the expansion of mudflats and regulation of many natural factors, contributing to pollination of crops and adding to carbon sequestration.	Mangroves	Local communities **ES Linkages:** Fishing, Shoreline Protection and Erosion Regulation, Habitat Provision	High	Moderate	**High**
Shoreline Protection and Erosion Regulation	Regulating	• Mangrove cover has increased throughout the NDC due to natural regeneration particularly in Annadale/Lusignan, Good Hope and Mon Repos. • NAREI will be implementing a new mangrove restoration project from	Mangroves	Local communities **ES Linkages:** Fishing, Global Climate Regulation, Habitat Provision	High	Moderate	**High**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		Annadale to Friendship. The project will use geotextile groynes to aid in sediment accumulation for mangrove planting.					
Primary Production and Habitat Provision	Supporting	• The NDC has a large area covered by new growth mangroves with rich biodiversity. People use this area for increased hunting of plovers for meat.	Coastal Mangroves	Local communities **ES Linkages:** Fishing, Shoreline Protection and Erosion Regulation, Global Climate Regulation	High	Moderate	**High**
NDC 21 – Buxton/Foulis – Population – 7,000 people (Increasing due to squatting)							
Agriculture: Livestock Grazing	Provisioning	• Grazing of goats, sheep and cattle occurs along the shoreline throughout the NDC. In particular, approximately five to six people graze goats in Buxton, one person grazes sheep and goats in Vigilance and four persons graze goats, sheep and cattle between Coldingen and Melanie Damishana.	Natural vegetation	Local communities using the shoreline for livestock grazing	Moderate	Moderate	**Medium**
Agriculture: Crop Cultivation	Provisioning	• Cultivation of cash crops, coconuts and bananas on sea defence reserves throughout the NDC.	Sea defence reserves	Local communities	Low	High	**Low**
Trapping/Hunting: Wild Meat	Provisioning	• Wild ducks and birds are caught and eaten by few families for sustenance. This is mainly recreational and is rarely done.	Sea shore, Mangroves	Local communities	Low	High	**Low**
Socio/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government or by private developers.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Socio/Economic: Squatting	Provisioning	• Significant increase in squatting on reserves at Coldingen Pump Road where there are more than 50 structures on the reserve lands. • Vending and other commercial activities have also increased on sea dams particularly in Vigilance and Strathspey. • The increases in squatting and vending are associated with economic hardships caused by the COVID-19 pandemic and Venezuelan migrants who have no alternative accommodations and employment sources.	Sea dams	Local communities squatting and vending on sea defence reserves	Moderate	Moderate	**Medium**
Tourism/Recreation	Cultural	• Buxton/Friendship seawall is used daily for exercise purposes. Local athletes also utilize the seawall for practice. On weekends, this area is used by more than 50 people for recreation and there are frequently games of cricket or football. • Melanie Damishana/Non Pariel Seawall is used daily in the afternoons for exercise or relaxation by a few families. The use of the seawall in the mornings for exercise and in the afternoons for relaxation has declined since mangrove growth created security concerns as well as increased pests (sand flies).	Sea wall, shore	Local Communities at: a) Buxton/Friendship Seawall b) Melanie/Non Pariel Seawall **ES Linkages:** Livestock Grazing, Religious/Ritual, Mangroves	a) Moderate b) Moderate	a) Low b) Moderate	**a) High** **b) Medium**
Religious/Ritual	Cultural	• Religious activities by Hindus and Rastafarians between Coldingen Koker and Cinema Road (Melanie	Sea shore, sea dam	Local communities	Essential	Moderate	**Critical**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		Damishana) on Sundays. Approximately20 to 30 families visit the area for religious activities.		**ES Linkages:** Livestock Grazing, Tourism and Recreation, Mangroves			
Primary Production and Habitat Provision	Supporting	• Birds, insects and some small mammals pollinate certain flora species, including some agricultural crops grown along the coast.	Cultivated lands	Local communities **ES Linkages:** Fishing, Global Climate Regulation, Habitat Provision	High	Moderate	**High**
Shoreline Protection and Erosion Regulating	Regulating	• NAREI plans to establish new plots for mangrove restoration in Annadale to Friendship. More than 2,000 seedlings will be planted in Friendship and geotextile tubes will be used to support sediment collection. • Natural growth of mangroves was observed from Strathspey to Foulis. • Mangrove growth was being promoted by NAREI at the Coldingen/Non-Pariel seawall where geotextile tubes were installed to aid mud accumulation. • Although mangroves are important to support shoreline protection, their growth has adversely impacted livelihoods in the NDC particularly the artisanal fishing sector. In particular, artisanal fishing activities in Strathspey, Non Pariel, Melanie and Paradise have been discontinued because of mangrove growth.	Sea shore, Mangroves	Local communities **ES Linkages:** Fishing, Shoreline Protection and Erosion Regulation, Habitat Provision	High	Moderate	**High**
Global Climate Regulation	Regulating	• Mangrove cover gain along the shoreline of the NDC resulted in the expansion of mudflats and regulation of	Mangroves	Local communities **ES Linkages:**	High	Moderate	**High**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		many natural factors, contributing to pollination of crops and adding to carbon sequestration.		Fishing, Shoreline Protection and Erosion Regulation, Habitat Provision			
NDC 22 – Unity/Vereeniging - Population in excess of 9,000 (Increasing due to Venezuelan migration)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site for 30 artisanal vessels at the Riverview landing site in Unity. • Approximately five small boats docks at Unity shoreline and used for fishing in Mahaica Creek and along the shoreline. • Landing sites at the Helena Koker and Old Mahaica Bridge are used by approximately 15 vessels on an alternating basis. • Fishing for sustenance, with sale of surplus, by a few people in the Mahaica River.	River &sea	a) Artisanal fisherfolks using the Riverview landing site b) Artisanal fisherfolk using the Unity shoreline c) Artisanal fisherfolks using the landing sites at Helena Koker and Old Mahaica Bridge d) Fishing for sustenance in the Mahaica River	a) Essential b) Moderate c) High d) Low	a) Low b) Moderate c) Moderate d) Moderate	**a) Critical** **b) Medium** **c) High** **d) Low**
Crabbing	Provisioning	• Seasonal crab catching is a popular livelihood activity.	Mangroves	Local communities engaged in seasonal crabbing **ES Linkage:** Mangroves	Moderate	Moderate	**Medium**
Agriculture: Livestock Grazing	Provisioning	• Grazing of cows, horses, and goats is done along the Unity shore by more than 15 persons.	Beach, vegetation	Local communities **ES Linkages:** Fishing, Socio/Economic, Religious/Ritual, Tourism and Recreation	Essential	Moderate	**Critical**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Agriculture: Crop Cultivation	Provisioning	• Two coconut estates are located in proximity to the shoreline (Boodhoo Estate and Rajnarine Estate).	Cultivated lands, sea defence reserves	Coconut estate owners and workers	High	Moderate	**High**
Socio/Economic: Boat Repairs	Provisioning	• Unity beach and shoreline are used for repairs of artisanal fishing vessels.	Beach, shoreline	Artisanal fisherfolks engaged in boat repairs at Unity **ES Linkages:** Livestock Grazing, Fishing, Religious/Ritual, Tourism and Recreation	Essential	Low	**Critical**
Socio/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Socio/Economic: Market and Commerce	Provisioning	• There is a daily market in Mahaica comprising of retail businesses and restaurants.	River bank	Local communities utilizing the market in Mahaica	High	Moderate	**High**
Mangrove Materials	Provisioning	• Some harvesting of mangroves for firewood and poles, but this is limited to a few individuals in Unity.	Mangroves	Few individuals in Unity **ES Linkage:** Mangroves	Low	High	**Low**
Tourism and Recreation	Cultural	• Unity beach is frequented for swimming, exercise, recreation and socializing by 20 to 30 people daily. More than 100 persons visit the Unity beach on weekends. • Hundreds of people visit the Unity Beach during special holidays like Easter.	Seawall, sea defence reserves	Local communities, Region 4 **ES Linkages:** Livestock Grazing, Fishing, Socio/Economic, Religious/Ritual	High	Moderate	**High**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Religious/Ritual	Cultural	• Unity Beach is the main area in the NDC for religious activity and it is used daily. Over 300 persons use this are on Sundays and thousands on Hindu religious days. People from other communities and other NDC districts visit Unity Beach for religious purposes. • Crematorium at Unity Foreshore is utilized but not regularly.	Seawall reserves, shore, beach	Local Communities, Region 4 using: a) The Unity Beach b) Unity Beach and Crematorium **ES Linkages:** Livestock Grazing, Fishing, Socio/Economic, Tourism and Recreation	a) Essential b) Low	a) Moderate b) Moderate	**a) Critical** **b) Low**
Ecotourism: Bird Tours	Cultural	• Bird seeing tours are offered by private operators in the Mahaica River to spot numerous bird species including the Canjie Pheasant. • The COVID-19 pandemic has affected the frequency with which tours are offered.	River ecosystem, Biodiversity	Local Guides, Tourists	High	Low	**Critical**
Aesthetic Value of Natural Landscapes	Cultural	• Views of natural landscapes and landscape features, including the ocean and its shore, are highly valued by local communities and visitors. The Canjie Pheasant is highly valued and attracts daily tours to the area.	River, ocean, beach	Local communities **ES Linkages:** Tourism and Recreation, Ecotourism	Moderate	Low	**High**
Shoreline Protection and Erosion Regulation	Regulating	• The concrete sea defence is supported by natural vegetation including mangroves, coconuts and fruits.	Sea defence & reserves	Local communities **ES Linkages:** Fishing, Global Climate Regulation, Habitat Provision	High	Moderate	**High**
Primary Production and Habitat Provision	Supporting	• Birds, insects, and some small mammals pollinate certain flora species, including some agricultural	Cultivated lands	Local communities **ES Linkages:**	High	Moderate	**High**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		crops grown along the coast. The area has some tracts of mangrove and mixed vegetation that allow for such services.		Fishing, Shoreline Protection and Erosion Regulation, Habitat Provision			
Global Climate Regulation	Regulating	• Mangrove cover gain along the shoreline of the NDC resulted in the expansion of mudflats and regulation of many natural factors, contributing to pollination of crops and adding to carbon sequestration.	Mangroves	Local communities **ES Linkages:** Fishing, Shoreline Protection and Erosion Regulation, Habitat Provision	High	Moderate	**High**
NDC 23 Haslington/Grove – Population – 22,000 people (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site used by approximately 20 to 25 artisanal fishing vessels at Bee Hive/ Greenfield. • Landing site used by approximately 6 artisanal fishing vessels at Cove and John/ Victoria. • Landing site used by approximately 30 to 35 boats at the Hope Canal. The use of Hope Turn as a landing site for artisanal vessels has stopped. Fish vendors still operate stalls at Hope Turn. • Mangrove growth has hindered access to the fishing landing site at Haslington and most vessels have relocated to the landing site at the Enmore koker. • Approximately 10 people fish along the shoreline of Haslington to Victoria and at Hope Canal using seines and at kokers using cast net and lines for sale, sustenance and recreation.	Ocean, Mudflats, shore	a) Artisanal fisherfolk using the Bee Hive/ Greenfield landing site. b) Artisanal fisherfolk using the Cove and John landing site c) Artisanal fisherfolk using the Hope Canal landing site d) Along other kokers; catamaran operators and users of cast nets and lines e) Fishing in swamps and flood basins f) Fish vendors at Hope Turn	a) Essential b) Moderate c) Essential d) Moderate) e) Moderate f) Low	a) Moderate b) Moderate c) Moderate d) Moderate e) Moderate f) High	**a) Critical** **b) Medium** **c) Critical** **d) Medium** **e) Medium** **f) Low**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		Catamarangs used to access seines via the mudflats. • The locals catch fishes in the swamps but one of the swamp areas in Cove and John is overgrown with grass. Tilapia is caught in flood basins of the mangroves.					
Crabbing	Provisioning	• Seasonal crabbing at Cove and John and Hope Canal for sale.	Mangroves	Local communities engaged in crabbing at Cove and John and Hope Canal	Moderate	Moderate	**Medium**
Apiculture	Provisioning	• Beekeeping is done in the mangrove area with 1 beekeeper in Golden Grove and 3 beekeepers in Cove and John. • When honey is available, approximately 4 gallons are harvested daily. • The “Honey House” is no longer operational.	Mangroves	Local beekeepers	High	Moderate	**High**
Agriculture: Livestock Grazing	Provisioning	• Grazing of cows, goats and sheep by approximately 15 people throughout the shoreline of the NDC.	Sea dam, reserves, mangroves	Local communities **ES Linkage:** Tourism and Recreation	High	Moderate	**High**
Agriculture: Cultivated Crops	Provisioning	• Crops and fruits planted on the defence reserves at Haslington, Golden Grove and Nabaclis. • Approximately half of the coconut estate in Greenfield was sold. These lands were converted to private housing.	Sea defence reserves	a) Local farmers planting on sea and river defence reserves b) Coconut estate	a) Moderate b) Moderate	a) Moderate b) Moderate	**a) Medium** **b) Medium**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Trapping/Hunting: Wild Meat	Provisioning	• Iguanas are caught along the shoreline in Nabaclis by a few people for sustenance.	Mangroves	Local communities **ES Linkages:** Crabbing, Mangroves	Low	High	**Low**
Socio/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Socio/Economic: Squatting	Provisioning	• Squatting at Golden Grove, Nabaclis and Nooten Zuil on the sea defence reserves.	Sea defence, mangroves	Local communities	High	High	**Medium**
Tourism and Recreation	Cultural	• The Victoria seawall is one of the main recreational areas. There are weekend parties including “pool parties” where above ground pools are taken to the area. • The Nooten Zuil/ Hope seawall and beach is popular for relaxation, socialization and exercise, particularly during weekends. • Mangroves are being lost at the Hope Beach and this increases the likelihood of this site being used for recreational purposes again.	Seawall, beach, shore	Local communities using: a) Victoria seawall b) Nootenzuil seawall **ES Linkages:** Religious/Ritual	a) High b) High	a) Moderate b) Moderate	**a) High** **b) High**
Religious/Ritual	Cultural	• The Cove and John Ashram, which houses multiple Hindu temples is used by Hindus within the community and throughout Guyana. The Ashram is located close to the shoreline at Cove and John. Thousands of worshippers visit the temple on special religious days like Shivratri.	Beach, seashore	Local communities Guyana using: a) Cove & John b) Greenfield, Nooten Zuil and Hope **ES Linkage:** Tourism and Recreation	a) Essential b) Moderate	a) Moderate b) Moderate	**a) Critical** **b) Medium**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Religious activities at Greenfield, Nooten Zuil/Hope.					
Ecotourism	Cultural	• The NAREI mangrove reserve has over 70 species of birds. However, the COVID-19 pandemic has stopped all school tours as well as collaborations with UG students. • Tours are still ongoing but are mainly for international guests who visit in small groups. Approximately one tour is conducted every 2 to 3 months. • The Benab at the Victoria/ Cove and John seawall is used for special photography, for example wedding photography, and also for short documentaries.	Biodiversity, Mangroves	Tour operators, tourists and local communities using the Benab **ES Linkages:** Mangroves	Moderate	Moderate	**Medium**
Primary Production and Habitat Provision	Supporting	• The NAREI Mangrove Reserve facilitates mangrove conservation, apiculture, bird watching tours, and mangrove tours. • Birds, insects, and some small mammals pollinate certain flora species, including some agricultural crops grown along the coast.	Mangroves	Local communities including beekeepers **ES Linkages:** Fishing, Shoreline Protection, Global Climate Regulation	High	Moderate	**High**
Shoreline Protection and Erosion Regulation	Regulating	• Mudflats are naturally being built on the coast in the NDC that protects the sea defence structures and promotes the growth of mangroves. Mangroves are monitored; as such, there is no hunting of wildlife or harvesting of mangroves. • Mangroves on the increase due to planting and natural growth.	Mangroves	Local communities **ES Linkages:** Fishing, Shoreline Protection and Erosion Regulation, Global Climate Regulation	High	Moderate	**High**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Global Climate Regulation	Regulating	• Mangrove cover gain along the shoreline of the NDC resulted in the expansion of mudflats and regulation of many natural factors, contributing to pollination of crops and adding to carbon sequestration.	Mangroves	Local communities **ES Linkages:** Fishing, Shoreline Protection and Erosion Regulation, Habitat Provision	High	Moderate	**High**
NDC 24 Enmore/Hope – Population – Approximately 18,000 people (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site at Enmore koker used by approximately 16 artisanal fishing vessels. • Pin seine fishing is also practiced by 2 to 3 persons using catamarang to access to fishing grounds. • Shrimp is caught by persons dragging seine along the shoreline. People fish with line and nets in the area for sustenance. • Tilapia is caught in the flood reservoir.	Ocean, reservoir	a) Artisanal fisherfolk using the landing site at Enmore Koker b) Pin seine fishing c) Fishing and shrimping along the shoreline for sustenance c) Tilapia fishing in flood reservoir. **ES Linkages:** Tourism and Recreation, Religious/Ritual	a) Essential b) Moderate c) Moderate d) High	a) Moderate b) Moderate c) Moderate d) Low	**a) Critical** **b) Medium** **c) Medium** **d) Critical**
Agriculture: Livestock Grazing	Provisioning	• Grazing of cows, goats and sheep occurs along the sea defence reserve throughout the NDC. More people in the NDC are involved in rearing animals and many prefer grazing grounds around sea defence reserves to other pasture areas.	Sea defence reserves	Local communities	High	Moderate	**High**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Agriculture: Crop Cultivation	Provisioning	• Crops and fruits planted on the sea and river defence reserves close to the Enmore Pump Station by one person.	Sea defence reserves	Local farmers	Low	High	**Low**
Trapping/Hunting: Wild Meat	Provisioning	• Some birds such as the plover birds are caught seasonally (June to August) along the shoreline using wire.	Mangroves	Local communities **ES Linkage:** Mangroves	Low	High	**Low**
Socio/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Tourism and Recreation	Cultural	• Enmore seawall and areas west thereof are relatively clear of mangrove growth and are used daily by a few people for exercise. • Some young people visit the beach to play cricket on weekends.	Seawall, beach	Local Communities **ES Linkages:** Fishing, Religious/Ritual	Moderate	Moderate	**Medium**
Religious/Ritual	Cultural	• Enmore shoreline is a popular place for worshipers. The cleanliness of the area is encouraging its use and people from other communities also visit for religious purposes. • The area is also being popularly used during special Hindu holidays like the annual festival of Kartik Snan or Teerat. On this day, some worshippers erect tents and conduct day-long prayers and bathe in the water.	Seashore, sea dam, reserves	Local Communities **ES Linkages:** Fishing, Tourism and Recreation	High	Moderate	**High**
Primary Production and Habitat Provision	Supporting	• The NDC has an area covered by mangroves with rich biodiversity of birds, fishes, and crabs. New mangrove growth on the shore is increasing and contributing to carbon sequestration.	Mangroves	Local communities **ES Linkages:** Trapping/Hunting, Shoreline Protection,	High	Moderate	**High**

Service	Type of Service	Description of Services Along the Shoreline of the Study Area	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				Global Climate Regulation			
Global Climate Regulation	Regulating	• Mangrove cover gain along the shoreline of the NDC resulted in the expansion of mudflats and regulation of many natural factors, contributing to pollination of crops and adding to carbon sequestration.	Mangroves	Local communities **ES Linkages:** Trapping/Hunting, Shoreline Protection and Erosion Regulation, Habitat Provision	High	Moderate	**High**
Shoreline Protection and Erosion Regulation	Supporting	• Mudflats are naturally being built along the shoreline of the NDC. These offer protection to the sea defence structures and promote the growth of mangroves. • NAREI previously executed a project to plant mangroves along the shoreline of the NDC.	Mangroves	Local communities **ES Linkages:** Trapping/Hunting, Global Climate Regulation, Habitat Provision	High	Moderate	**High**

APPENDIX F – ECOSYSTEM SERVICES AND PRIORITY RATINGS IN REGION 5

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
NDC 26 - Woodlands/Farm – Population estimate 7,000 people (Decreasing due to migration out of the NDC)							
Fishing: Wild-Caught Fish and Shellfish and Aquaculture	Provisioning	• Landing site at the old Mahaica Bridge used by approximately 15 artisanal fishing vessels. This landing site is at the western boundary of the Woodlands/Farm NDC and the Unity/Vereeniging NDC (Region 4). • Landing site at the old Mahaicony Bridge used by approximately 15 vessels. Vessels utilize both banks of the Mahaicony River. The left bank of the River is located in the Woodlands/Farm NDC and the right bank in the Mahaicony/Abary NDC (Region 5). • Pin seines are used by several persons to fish along the shoreline of Dantzig to Fairfield. Pin seines and "juk seines" are also used for fishing along the shorelines of De Hoop, Farm and Drill. • Approximately 25 percent of the people in the NDC use cast nets to fish for sustenance and sale in the Bellamy Canal. One person uses a small boat to set seines in the Bellamy Canal in the vicinity of Taymouth Manor. In addition, several persons also use cast nets to fish in smaller canals which drain into the Bellamy Canal. Catches are used for sustenance and depending on the weight of the catch, for sale. Species caught include tilapia, patwa, pacu, cuirass and mullet. • In 2019, there were extensive breaches of the mangroves and sea dams along the shoreline of Wilhemia to Planter's Hall, particularly between Columbia to Fairfield. Previously, swamps located along Wilhemia to Drill used for commercial shrimping and for catching fish species like tilapia and mullet. However, swathes of swampy areas were eroded during the breach. The swamps in	Marine habitats, inland freshwater ecosystems and mangroves	a) Artisanal fisherfolks using the landing site at Old Mahaica Bridge b) Artisanal fisherfolks using the landing site at the Mahaicony River c) Artisanal fisherfolks using pin seines to fish d) Local communities using cast nets and seines to fish in canals e) Local communities fishing in swamps f) Owner of the aquaculture pond **ES Linkages:** Crabbing, Mangroves, Socio/Economic (Markets and Commerce)	a) High b) High c) Moderate d) High e) Moderate f) Low	a) Moderate b) Low c) Moderate d) Moderate e) Low f) Moderate	**a) High** **b) Critical** **c) Medium** **d) High** **e) High** **f) Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		Dantzig are used several times weekly by approximately 10 persons for fishing with cast nets and seines. Fishing practices like “beating the fish” are also used in the Dantzig swamp. During rainy seasons, some other sections of the shoreline may return to swampy conditions to facilitate fishing. • There is one privately owned aquaculture pond located close to the shoreline in Drill.					
Crabbing	Provisioning	• A few persons are engaged in crabbing for sustenance and, to a limited extent, for sale during the July to September crab season. The intensity of crabbing for sustenance has declined since the 2019 floods because commonly used crabbing grounds were lost.	Mangroves	Local communities engaged in seasonal crabbing **ES Linkages:** Fishing, Mangroves, Hunting/Trapping	Low	Moderate	**Low**
Agriculture: Livestock Grazing	Provisioning	• Livestock grazing close to the seashore has significantly reduced since the 2019 floods. According to local representatives, the affected area from Wilhemia to Planter’s Hall was widely used for grazing. However, since the flood, feeding grass has regrown sparsely and many areas are covered with crab grass which is not suitable for grazing. As such, most grazing occurs further inland on pasturelands which were not impacted by the floods. • Currently, there are approximately 100 heads of cattle, sheep and goats grazing along the shoreline between Fairfield and Dantzig, and approximately 100 heads of cattle and sheep between Planter’s Hall to Cottage.	Sea dam, shoreline	Local communities grazing livestock on the sea dam	High	Moderate	**High**
Agriculture: Cultivated Crops	Provisioning	• Three persons are engaged in rice cultivation close to the shoreline in De Hoop, Drill, Cottage, Quaker’s Hall and Mes Delices. Rice farming in these areas was impacted by the flood and have resumed at a smaller scale, in 2022.	Sea dam, cultivated lands	Local farmers, residents	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Cultivation of cash crops on sea dams and reserves has stopped since the 2019 floods.					
Hunting/Trapping: Wild Meat	Provisioning	• Several persons hunt along the shoreline for iguanas areas for sale. Most of the hunting for iguanas occurs between Now or Never to Farm. • Waterbirds including curi curi and storks are caught for recreation and sustenance. Seasonally, waterbirds are also sold for meat.	Mangroves, seashore	Local communities hunting in the mangroves **ES Linkages:** Crabbing, Mangroves	Moderate	Moderate	**Medium**
Socio/Economic: Wharfs	Provisioning	• Wharf for transport of logs and lumber located in Zeskendren. Logs and other timber products from Moraikobai are transported by villagers for sale to lumber dealers. • Privately owned vessels used for recreational travel in the Mahaicony River are also launched from this wharf, particularly on weekends.	River ecosystems, commercial area	Loggers, lumber dealers and local communities **ES Linkage:** Socio/Economic (Markets and Commerce)	Moderate	Moderate	**Medium**
Socio/Economic: Markets and Commerce	Provisioning	• Daily market in Zeskendren comprising of retail businesses, lumber dealers and restaurants.	River bank	Local communities and vendors **ES Linkages:** Fishing, Socio/Economic (Wharfs)	High	Moderate	**High**
Ritual/Religious	Cultural	• Religious activities by local Hindu communities are conducted along sea dams and the shoreline, in areas where there is access. The shoreline areas most widely used, particularly during special religious holidays, are located in Fairfield to Cottage. Some sections of the Bellamy Canal are also used for religious purposes by local Hindu communities. • Rastafarian communities use the Bellamy Canal to make religious offerings.	Sea dam, shoreline	a) Local Hindu communities using shoreline areas b) Local Hindu and Rastafarian communities using the Bellamy Canal **ES Linkage:** Tourism and Recreation	a) Moderate b) Moderate	a) Moderate b) Moderate	**a) Medium** **b) Medium**
Tourism and Recreation	Cultural	• The Fairfield shoreline area is used for recreational activities. On special holidays like Easter, locals visit the area to fly kites, picnic and have BBQs.	Sea dam, shoreline	a) Local communities using sea dams and shoreline in Fairfield	a) Moderate b) Low	a) Moderate b) Moderate	**a) Medium** **b) Low**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Sea dams in De Hoop, High Dam and Fairfield are used for exercise.		b) Local communities using High Dam and sea dam in De Hoop **ES Linkage:** Ritual/Religious			
Global Climate Regulation	Regulating	• Mangrove cover along some sections of the shoreline of the NDC including new growth mangroves in Farm supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing, Hunting/Trapping	Low	Moderate	**Low**
Shoreline Protection and Erosion Regulation	Regulating	• The 2019 floods resulted in significant erosion of mangroves along the shoreline of most of the affected areas. Mangroves have not regrown because mud banks also washed away. • Generally, there was mangrove cover loss along the shoreline from Planter's Hall and continuing west to Belvedere. In order to repair the breaches, rip raps were installed along the shoreline of Fairfield to Dantzig and De-Hoop. In addition, in Fairfield to Dantzig, a secondary dam was established and lands previously used for rice cultivation were converted to flood basins to retain water should overtopping occur during spring tides. • Natural degradation and mortality was reported to be occurring at Cottage, Now-or-Never, and Zeskindren. On the other hand, mangrove growth was reported to occur along the Bellamy Canal at Farm.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Climate Regulation, Crabbing, Fishing, Hunting/Trapping	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:** Climate Regulation, Shoreline Protection,	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				Crabbing, Fishing, Hunting/Trapping			
NDC 28 - Mahaicony/Abary – Population estimate 7,000 people (Stable)							
Fishing: Wild-caught fish and shellfish	Provisioning	• Landing site for approximately 75 artisanal fishing vessels at the Abary River. According to NDC representatives, all boats do not regularly operate because of low catches. Many fisherfolk are trying to sell their vessels and have already found alternative livelihoods in cash crop farming. • Landing site at the old Mahaicony Bridge used by approximately 15 vessels. Vessels utilize both banks of the Mahaicony River. The left bank of the River is located in the Woodlands/Farm NDC and the right bank in the Mahaicony/Abary NDC (Region 5). • Most vessels at Abary and Mahaicony Bridge use drift seines. Chinese seines are used by two fisherfolk, one to fish close to the mouth of the Abary River and the other, close to the mouth of the Mahaicony River. In addition, baited hooks are used by three fisherfolk in the Abary River and three in the Mahaicony River. • Pin seines are not widely used for fishing in the NDC. Pin seines are viewed as an old fashioned fishing method which requires significant effort. In addition, the accumulation of drift mud along the shoreline area, from the washing ashore of spoils from the dredging of the Berbice River, makes the shoreline area unsuitable for pin seine fishing. However, poles that are used for pin seine fishing were observed along the shoreline of the Good Faith beach. • More than 150 persons are engaged in daily fishing in swamps and canals throughout the NDC. These persons use cast nets to catch shrimp, tilapia and sheriga crabs for sustenance and sale.	Marine environment, mangroves	a) Artisanal fisherfolk utilizing the Abary landing site b) Artisanal fisherfolk utilizing the Mahaicony Bridge landing site c) Local communities using pin seines to fish along the shoreline d) Local communities using cast nets to fish in swamps and canals **ES Linkages:** Mangroves, Crabbing, Apiculture, Hunting/Trapping	a) Essential b) Essential c) Low d) Essential	a) Moderate b) Moderate c) Moderate d) Moderate	**a) Critical** **b) Critical** **c) Low** **d) Critical**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Crabbing	Provisioning	• More than 100 persons are engaged in crabbing during the July to September crab season. In this season, people come from the East Coast Demerara (Region 4) for crabbing and these catches are typically sold outside the NDC. • A few persons are engaged in crabbing throughout the year and crabs are caught in their burrows/holes at night. These catches are for sustenance and depending on the quantity caught, for sale.	Mangroves	a) Persons engaged in crabbing seasonally b) Local communities engaged in crabbing regularly **ES Linkages:** Mangroves, Fishing, Apiculture, Hunting/Trapping	a) Essential b) High	a) Moderate b) Moderate	**a) Critical** **b) High**
Apiculture	Provisioning	• Beekeeping in the mangroves with three sets of active hives in Huntley and Airy Hall.	Mangroves	Local communities **ES Linkages:** Mangroves, Crabbing, Fishing, Hunting/Trapping	High	High	**Medium**
Agriculture: Livestock Grazing	Provisioning	• Approximately fifty people graze over 1,000 heads of cows, goats, sheep and pigs throughout the shoreline of the NDC. Grazing along the shoreline area typically occurs when rice is being cultivated in the backlands so as to prevent damage to the crop by grazing animals. Livestock, particularly goats, also feed on mangrove seeds when grazing on the shoreline areas. After the rice crop is harvested, a large percentage of the animals are returned to the back dams for grazing.	Sea dam, mangroves, shoreline	Local communities grazing livestock on the sea dam and shorelines **ES Linkage:** Mangroves	Essential	High	**High**
Trapping/Hunting: Wild Meat	Provisioning	• Approximately 20 people hunt in the mangroves of Huntley, Letter T and Abary for sale and sustenance. Species captured include iguanas, agouti, and acouri. Sea birds are also caught. Curi are shot, plover are shocked and wisi wisi ducks are also captured.	Mangroves	Local communities hunting in the mangroves **ES Linkages:** Mangroves, Crabbing, Apiculture, Fishing	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Socio/Economic: Tug and Barge Repairs	Provisioning	• The right bank of the Mahaicony River is used by a private operator for tug and barge repairs.	River bank	Private operator **ES Linkage:** Fishing	Moderate	Moderate	**Medium**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Moderate	**Critical**
Ritual/Religious	Cultural	• The Good Faith beach is used by more than 10 persons daily, and more than 100 on weekends and special religious holidays. • Recently, a group of local volunteers established a Community Revitalization Group. The Group secured donations to construct a cremation tarmac on the access road leading to the Good Faith Beach. Prior to the construction of the tarmac, cremations were conducted on the beach. The Group plans to fence the area and construct seating as well as sanitary facilities.	Beach	a) Local Hindu communities b) Local communities in the NDC and Region 5 utilizing the cremation tarmac **ES Linkage:** Tourism and Recreation, Fishing	a) High b) Essential	a) Low b) Moderate	**a) Critical** **b) Critical**
Tourism and Recreation	Cultural	• The Good Faith beach is frequented by persons from Region 5. Persons from Regions 4 and 6 also visit occasionally. There are approximately 50 persons per day and more than 50 families on holidays and weekends. More than 100 small vehicles can be accommodated on the beach. On weekends, there are softball cricket matches and on holidays like Easter, there are special events like BBQs. • This beach is used increasingly as beaches in other NDCs are being eroded. The Community Revitalization Group provides garbage bags and bins for visitors, and also engages in clean up exercises. • The small beach which was being formed at Abary has eroded and this area is no longer used.	Beach	Local communities in NDC and Region 5 using the Good Faith Beach for recreation **ES Linkages:** Ritual/Religious, Fishing, Mangroves	Essential	Low	**Critical**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing, Hunting/Trapping, Apiculture, Tourism and Recreation, Livestock Grazing	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Extensive area of mangrove forest on the shoreline protecting the seashore from the impacts of the sea. Mangroves also protect the river defense along the Abary River. Mangroves and earthen sea dams are the only sea defences along the shoreline of the NDC. • According to the NDC, there is significant erosion and loss of mangrove cover on the eastern bank of the Mahaicony River (heading towards the mouth of the River) as well as along the shoreline from an area called Tullock (at the mouth of the Mahaicony River) continuing east along the shorelines of Fellowship, Grove, Huntley and Dundee. During spring tides, most villages are flooded.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Climate Regulation, Crabbing, Fishing, Livestock Grazing, Hunting/Trapping, Apiculture, Tourism and Recreation	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:** Climate Regulation, Shoreline Protection, Crabbing, Livestock Grazing, Fishing, Hunting/Trapping, Apiculture, Tourism and Recreation	High	Moderate	**High**
NDC 29 - Profit/Rising Sun – Population estimate 8,000 people (Decreasing due to migration out of the NDC)							

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• A few persons fish with cast nets in canals, including the Bellamy Canal, for sustenance. However, this activity is declining because catches are lower. Locals believe that effluent, contaminated with malathion, which is discharged from rice fields into canals is the main reason for reduced catch. • Fishing landing sites for artisanal fishing vessels in Belladrum, Profit/Foulis and Weldaad are no longer operational. All vessels have relocated to landing sites at Abary or Onverwagt.	River Ecosystems	Local communities using cast nets to fish along the shoreline	Low	Moderate	**Low**
Trapping/Hunting: Wild Meat	Provisioning	• Mangrove cover loss along the shoreline of the NDC has resulted in reduced activities for hunting along the shoreline. Currently, a few persons capture cranes for sustenance in the mangroves along the Golden Fleece shoreline.	Mangroves, shoreline	Local persons hunting in the mangroves **ES Linkage:** Mangroves, Livestock Grazing	Low	Moderate	**Low**
Agriculture: Livestock Grazing	Provisioning	• Approximately 50 persons graze livestock on sea dams and along the shoreline throughout the NDC. In total, approximately 1,000 heads of cattle, goats and sheep are grazed along the shore. In addition, following the rice season, cattle are allowed to graze in rice fields in Foulis that are located close to the shoreline. • However, there is a reported high rate of thievery of livestock.	Sea dam, mangroves, cultivated lands	Local communities grazing livestock on the seashore **ES Linkage:** Mangroves, Livestock Grazing	Essential	Moderate	**Critical**
Agriculture: Crop Cultivation	Provisioning	• Cultivation of coconuts and cash crops sea dams and along the shoreline of Profit and Foulis. Lands used for rice cultivation are also located close to the shoreline in Profit and Foulis. • Cultivation of cash crops on Golden Fleece sea dam.	Sea dam, cultivated lands	a) Local communities cultivating cash crops and coconuts in Profit and Foulis b) Local communities cultivating rice in Profit and Foulis	a) Moderate b) High c) Low	a) Moderate b) Moderate c) High	**a) Medium** **b) High** **c) Low**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				a) Local communities cultivating cash crops in Golden Fleece **ES Linkage:** Crop Cultivation			
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Ritual/Religious	Cultural	• Hindu rituals and religious practices are conducted in Belladrum and Golden Fleece where there is easy access to the shoreline. • The site at the Weldaad beach which was used for cremations eroded. Instead, local communities use cremation sites in Bushlot or Blairmont.	Beach, shoreline	Local Hindu communities **ES Linkage:** Tourism and Recreation	Moderate	Moderate	**Medium**
Tourism and Recreation	Cultural	• Beaches in Belladrum and Golden Fleece are used by approximately 50 persons per day to relax, swim, exercise and socialize. More persons visit on weekends and holidays, like Easter. A new bar has been established on the sea dam, close to the shoreline of Belladrum. • In Profit, there are sandy and shell beaches which are used by a few persons for recreation. • Rising Sun Turf Club used for horse racing competitions. However, horse racing competitions were stopped due to public health restrictions associated with the COVID-19 pandemic.	Beach, shoreline	a) Local communities using beaches in Belladrum and Golden Fleece b) Owner, workers and patron of bar in Belladrum c) Local communities using the Profit beach d) Rising Sun Turf Club **ES Linkage:** Ritual/Religious	a) High b) Moderate c) Low d) Low	a) Moderate b) High c) Moderate d) Moderate	**a) High** **b) Low** **c) Low** **d) Low**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection,	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				Trapping/Hunting, Livestock Grazing			
Shoreline Protection and Erosion Regulation	Regulating	• There has been significant erosion of mangroves throughout the shoreline of the NDC. According to the NDC, over the last five years more than 80 percent of the mangrove cover has been lost. In response to mangrove erosion, hard sea defence structures were installed along the shoreline of Profit to Belladrum. Mangrove cover was cleared in these areas to facilitate construction of these hard structures. • Natural degradation and erosion of mangroves is occurring between Paradise to Rising Sun with the most significant erosion being in Washington.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Climate Regulation, Trapping/Hunting, Livestock Grazing	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:** Climate Regulation, Shoreline Protection, Trapping/Hunting, Livestock Grazing	High	Moderate	**High**
NDC 30 - Seafield/Tempie – Population estimate 5,000 people (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Approximately 10 persons catch shrimp, tilapia, coo coo belly, and cuffum in the swamp ponds or drainage canals for sustenance. • Previously, there were landing sites for fishing boats in Seafield and Jacoba but these are no longer operational.	Marine environment, mangroves	Fishing and shrimping in swamp ponds, mangroves and drainage canals **ES Linkages:** Mangroves, Crabbing, Livestock Grazing, Trapping/Hunting, Mangrove Materials	Moderate	Moderate	**Medium**
Crabbing	Provisioning	• Approximately 10 persons are engaged in crabbing as a livelihood activity throughout the year particularly in the mangroves of Jacoba to Ross.	Mangroves, shoreline	a) Persons engaged in crabbing as a livelihood activity	a) High b) Moderate	a) Moderate b) Moderate	**a) High** **b) Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		Most of the persons engaged in crabbing are from outside the district including persons from the East Coast of Demerara who visit the area with cars, at least weekly, to catch crabs. • During the crab season, many locals catch crabs for sustenance and recreation.		b) Local communities crabbing seasonally for sustenance and recreation **ES Linkages:** Mangroves, Fishing, Livestock Grazing, Trapping/Hunting, Mangrove Materials			
Agriculture: Livestock Grazing	Provisioning	• Approximately 25 persons throughout the NDC graze cattle, sheep and goats on the sea dam and in mangroves. The shoreline areas that are most commonly used for grazing livestock are in Seafield and Lichfield to Ross.	Sea dam, mangroves, shoreline	Local communities grazing livestock on sea dams and in mangroves in: a) Seafield b) Lichfield to Ross **ES Linkages:** Mangroves, Fishing, Crabbing, Trapping/Hunting, Mangrove Materials	a) Moderate b) High	a) Moderate b) Moderate	**a) Medium** **b) High**
Agriculture: Cultivated Crops	Provisioning	• Approximately four persons cultivate cash crops on the sea dam in Brittania and Chester. • Bananas are cultivated on the sea dam in Jacoba. • Coconuts are cultivated on the sea dam in Jacoba to Ross. • Lands used for rice cultivation are also located close to the shoreline in Bengal and No. 40. • The cultivation of cash crops previously occurred in Lichfield but this has stopped because of erosion of the sea dam and salt water intrusion in areas where crops were planted.	Sea dam, shoreline, mangroves, cultivated lands	a) Local communities cultivating crops in Brittania and Chester b) Local communities cultivating coconuts on the sea dam in Jacoba to Ross c) Local communities cultivating bananas on the Jacoba sea dam d) Local communities cultivating rice	a) Moderate b) High c) Low d) High	a) Moderate b) Moderate c) Moderate d) Moderate	**a) Medium** **b) High** **c) Low** **d) High**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Trapping/Hunting: Wild Meat	Provisioning	• A few persons capture iguanas and shore birds on the seashore. Plover birds are caught using wire. Curi curi and wild ducks are also trapped for meat.	Mangroves, shoreline	Local communities hunting in the mangroves **ES Linkages:** Mangroves, Fishing, Crabbing, Livestock Grazing, Mangrove Materials	Low	Moderate	**Low**
Mangrove Materials	Provisioning	• A few households in Chester and Jacoba harvest mangroves to be used for firewood and to construct livestock pens.	Mangroves	Local households harvesting mangroves **ES Linkages:** Mangroves, Fishing, Crabbing, Livestock Grazing, Trapping/Hunting	Low	High	**Low**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Ritual/Religious	Provisioning	• The canal and sea dam in Jacoba are used by local Hindu communities for ritual and religious purposes.	Sea dam	Local Hindu communities	Low	Low	**Medium**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Fishing, Crabbing, Livestock Grazing, Trapping/Hunting	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Erosion has significantly reduced the shoreline within the NDC over the years. Mangroves and earthen sea dams are the primary sea defences along the shoreline of the NDC.	Mangroves	Local communities **ES Linkages:**	Essential	Moderate	**Critical**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Mangrove cover loss reportedly occurs in several sections of the shoreline and was most significant in Lichfield. Mangroves were breached in Kingelly and this has been repaired. On the other hand, mangrove cover gain was observed in Jacoba.		Habitat Provision, Climate Regulation, Fishing, Crabbing, Livestock Grazing, Trapping/Hunting			
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:** Climate Regulation, Shoreline Protection, Fishing, Crabbing, Livestock Grazing, Trapping/Hunting	High	Moderate	**High**
NDC 31 – Union/Naarstigheid – Population estimate 15,000 people (Increasing due to new housing schemes)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site for more than 20 artisanal fishing vessels at the Trafalgar/Onverwagt koker. A few fisherfolk use pin seines to fish along the Trafalgar shoreline and catch is landed in catamarangs. • Landing site for approximately 20 to 40 artisanal fishing vessels in Bush Lot. Most of the vessels that use this landing site are sail boats. According to local fisherfolk, mangrove proliferation along the Bush Lot shoreline has made access to the landing site challenging and has curtailed the number of fishing trips that can be made by fisherfolk. Some vessels have relocated to the Trafalgar/Onverwagt koker. However, vessels which use only sails cannot relocate to the Trafalgar koker because there is a sand bar that runs parallel to the shoreline which cannot be crossed by vessels using only sails. • Locals catch shrimp, tilapia, coo coo belly, and cuffum daily in the natural swamps, ponds, or drainage canals throughout the NDC for sustenance and sale. The number of people	Marine environment swamps, ponds, drainage canals, shoreline	a) Fisherfolk utilizing the landing site at the Trafalgar/Onverwagt koker b) Fisherfolk utilizing the landing site at Bush Lot c) Local communities fishing in swamps, ponds and drainage canals for sustenance and sale **ES Linkages:** Mangroves, Crabbing, Apiculture, Trapping/Hunting, Ritual/Religious	a) Essential b) Essential c) High	a) Moderate b) Low c) High	**a) Critical** **b) Critical** **c) Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		involved in these activities vary seasonally and this type of fishing is more common during the rainy seasons.					
Crabbing	Provisioning	• Persons from within and outside the NDC district catch crabs seasonally for sustenance and sale. During the July to September season, crabbing is also a recreational activity for local communities. • Several persons are also engaged in crabbing throughout the year as a livelihood activity.	Mangroves, shoreline	a) Persons crabbing seasonally for sale, sustenance and recreation b) Persons crabbing throughout the year for livelihoods **ES Linkages:** Mangroves, Fishing, Apiculture, Trapping/Hunting, Ritual/Religious	a) Essential b) Moderate	a) Moderate b) Moderate	**a) Critical** **b) Medium**
Agriculture: Livestock Grazing	Provisioning	• Grazing of livestock (cattle, goats and sheep) is increasing on sea dams and along the shoreline throughout the NDC. Grazing along the shoreline is most prevalent in Trafalgar/Onverwagt, Bush Lot and Hopetown.	Sea dam, shoreline	Local communities grazing livestock in: a) Trafalgar/Onverwagt b) Bush Lot c) Hopetown	a) High b) High c) High	a) High b) High c) High	**a) Medium** **b) Medium** **c) Medium**
Agriculture: Crop Cultivation	Provisioning	• Cultivation of cash crops, fruits and coconuts on sea dams in Trafalgar, Bush Lot, Hopetown and Onderneeming-Naarstighied.	Sea dam, cultivated lands, shoreline	Local communities farming on sea dams in: a) Trafalgar b) Bush Lot c) Hopetown d) Onderneeming-Naarstighied	a) Low b) Moderate c) Low d) High	a) Moderate b) Moderate c) Moderate d) Moderate	**a) Low** **b) Medium** **c) Low** **d) High**
Apiculture	Provisioning	• Beekeeping in the mangroves of Trafalgar, Lovely Lass, Bush Lot, Hopetown and Onderneeming-Naarstighied. Beekeepers are organized in groups throughout the NDC. Honey harvested from the	Mangroves, shoreline	Local communities engaged in beekeeping for livelihoods	High	High	**Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		hives is mainly sold in the markets in the NDC district.		**ES Linkages:** Mangroves, Crabbing, Fishing, Trapping/Hunting, Ritual/Religious			
Trapping/Hunting: Wild Meat	Provisioning	• Marine birds are caught in mangroves throughout the NDC district for sustenance and sale. Species caught include plover (which is caught using wire), curi curi, stork, egrets and wild ducks. • Hunting of marine birds occurs throughout the year and is increasing. In particular, fisherfolk from the Bushlot landing site, whose fishing activities are curtailed because of accessibility, are engaged in hunting birds in the mangroves surrounding the landing site for sustenance. Depending on the quantity of birds caught, they may also be sold. • In addition, iguanas are caught along the shoreline during the July to August season.	Mangroves, shoreline	Local people hunting in mangroves **ES Linkages:** Mangroves, Crabbing, Apiculture, Fishing, Ritual/Religious	High	High	**Medium**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Ritual/Religious	Cultural	• Local Hindu communities utilize the sea dams and shoreline areas of Onverwagt and Bushlot for religious purposes. • A crematorium at Bush Lot is used by the residents of the NDC.	Shoreline, coastlands	a) Local Hindu communities using the Onverwagt shoreline b) Local Hindu communities using sea dams and shoreline of Bush Lot c) Local communities using the Bush Lot crematorium **ES Linkages:** Mangroves, Crabbing,	a) Low b) Essential c) High	a) Moderate b) Moderate c) Moderate	**a) Low** **b) Critical** **c) High**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				Apiculture, Trapping/Hunting			
Tourism and Recreation	Cultural	• Bush Lot United Turf Club is a horse racing track that was used by thousands of persons, at least each quarter, prior to the COVID-19 pandemic. Since the onset of the pandemic, horse races have stopped.	Coastland, residential and commercial areas	Patrons of the Bush Lot United Turf Club	Low	Moderate	**Low**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Apiculture, Trapping/Hunting, Ritual/Religious	High	Moderate	**High**
Shoreline Protection and Erosion Regulation	Regulating	• Extensive area of mangroves are the primary form of sea defence in the NDC and help to protect the shoreline from impacts of the sea. • Mangrove cover is increasing throughout the NDC, particularly in Bushlot, Hopetown and Onderneeming-Naarstighied.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Climate Regulation, Crabbing, Apiculture, Trapping/Hunting, Ritual/Religious	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:** Climate Regulation, Shoreline Protection, Crabbing, Apiculture, Trapping/Hunting, Ritual/Religious	High	Moderate	**High**
NDC 32 – Bath/Woodley Park – Population estimate 18,000 people (Increasing due to new housing schemes)							

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site at the No. 12 outfall for approximately six artisanal fishing vessels. • One person uses pin seines to fish along the shoreline in Woodley Park. • Several families in the NDC district catch tilapia and shrimp in swamps and canals for sustenance daily. Previously, these were intensively used for commercial fishing but such activities no longer occur.	Marine environment; Mangroves ecosystem	a) Fisherfolk utilizing the landing site at the No. 12 outfall b) Local person using pin seines to fish along the shoreline c) Local communities fishing for sustenance in swamps and canals **ES Linkages:** Crabbing	a) Low b) Low c) High	a) Low b) Moderate c) Moderate	**a) Medium** **b) Low** **c) High**
Crabbing	Provisioning	• In the July to September crab season, approximately 50 percent of the population catch crabs for sustenance and recreation. Moreover, in the crabbing season, approximately six persons regularly catch crabs for sale and a large portion of the catch is exported to Georgetown. • A few persons catch crabs regularly throughout the year primarily for sustenance.	Mangroves	a) Local communities engaged in crabbing seasonally for sale, sustenance and recreation b) Local communities engaged in crabbing throughout the year **ES Linkage:** Fishing	a) Essential b) Moderate	a) High b) High	**a) High** **b) Low**
Agriculture: Livestock Grazing	Provisioning	• Approximately 6 to 7 persons graze livestock on sea dams throughout the NDC. Sheep and goats are the main types of livestock grazed but there are also few heads of cattle.	Sea dam	Local communities grazing livestock on sea dams	Moderate	Moderate	**Medium**
Agriculture: Cultivated Crops	Provisioning	• Cultivation of cash crops on the sea dam in Hope by one person. • Cultivation of bananas on the sea dam in Woodley Park by at least one person.	Sea dam	Locals cultivating cash crops and fruits on the sea dam in: a) Hope b) Woodley Park	a) Low b) Low	a) Moderate b) Moderate	**a) Low** **b) Low**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Ritual/Religious	Cultural	• Local Hindu communities using the sea dams and canals along the No. 12 dam and in Woodley Park for religious/ritual purposes.	Coastal	Local Hindu communities in: a) No. 12 b) Woodley Park	a) Moderate b) Essential	a) Moderate b) Moderate	**a) Medium** **b) Critical**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Mangroves and earthen sea dams are the only sea defences along the shoreline of the NDC.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Climate Regulation, Crabbing, Fishing	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:** Climate Regulation, Shoreline Protection, Crabbing, Fishing	High	Moderate	**High**
NDC 33 Woodlands/Bel Air – Population estimate 1,264 people (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• A few persons fish in swamps and drainage canals for sustenance and recreation. • Previously, there was a landing site at No. 9 for approximately two artisanal fishing vessels. However, this site is no longer active because mangrove growth has resulted in siltation of the channel. These vessels have relocated to the No. 12 outfall in the Bath/Woodley Park NDC.	Shoreline	Local communities fishing for sustenance and recreation along the shoreline	Low	High	**Low**
Crabbing	Provisioning	• During the July to September crabbing season, a few persons catch crabs for sale within the NDC district. In addition, many persons catch crabs for	Mangroves, shoreline	Local communities engaged in seasonal crabbing for sale,	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		sustenance and recreation. Most of the crabbing occurs in the No. 7 mangroves.		sustenance and recreation **ES Linkages:** Mangroves, Trapping/Hunting, Apiculture			
Agriculture: Livestock Grazing	Provisioning	• A few families graze livestock on the sea dams throughout the NDC. Grazing along the shoreline has significantly reduced because of NAREI's mangrove restoration in the area. According to the NDC, there are penalties in place for grazing livestock in mangrove areas.	Coastal, Pasturelands	Local communities grazing livestock on sea dams	Moderate	Moderate	**Medium**
Agriculture: Crop Cultivation	Provisioning	• Cultivation of cash crops and fruits on the reserve lands south of the façade by approximately 5 persons in No. 7, No. 8 and No. 10. In addition, in No. 10 cash crops and bananas are cultivated directly on the sea dam and on the sidelines.	Sea dams, sea defence reserves	Local communities cultivating crops in: a) No. 7 b) No. 8 c) No. 10	a) Low b) Low c) Moderate	a) Moderate b) Moderate c) Moderate	**a) Low** **b) Low** **c) Medium**
Trapping/Hunting: Wild Meat	Provisioning	• Birds such as curi curi, egrets, and wild ducks are hunted with shotguns by a few hunters on an irregular basis for meat. Plover birds are caught using wire. • Generally, persons from the NDC hunt in the back dams or in the mangroves of No. 12 (located in the Bath/Woodley Park NDC).	Mangroves, shoreline	Local communities hunting in the mangroves **ES Linkages:** Mangroves, Crabbing, Apiculture	Low	High	**Low**
Apiculture	Provisioning	• One person is engaged in beekeeping along the No. 10 shoreline.	Mangroves, shoreline	Local person engaged in beekeeping **ES Linkages:** Mangroves, Crabbing, Trapping/Hunting,	Low	High	**Low**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Ritual/Religious	Cultural	• Local Hindu communities, from within and outside the NDC district, use the sea dams and main canal in No. 6/No. 7 and No. 10 village for ritual and religious purposes.	Sea dam, canal	Local Hindu communities using areas in: a) No. 6 and No. 7 b) No. 10	a) Moderate b) Low	a) Moderate b) Moderate	**a) Medium** **b) Low**
Tourism and Recreation	Cultural	• Norman Singh Memorial Turf Club is located close to the shoreline in Bel Air. This horse racing track that was used by thousands of persons, at least each quarter, prior to the COVID-19 pandemic. Since the onset of the pandemic horse races have stopped.	Coastland, residential and commercial areas	Patrons of the Norman Singh Memorial Turf Club	Low	Moderate	**Low**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing, Trapping/Hunting, Apiculture	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Mangroves and earthen sea dams are the only sea defences along the shoreline of the NDC. NAREI led mangrove restoration efforts along the shoreline in No. 6, No. 7 and a section of No. 5. • There is significant erosion along the section of the No. 5 shoreline where mangroves were not restored. During spring tides, residents in this area experiences overtopping and occasionally, flooding.	Mangrove Forests	Local communities; farmers; beekeepers **ES Linkages:** Habitat Provision, Climate Regulation, Crabbing, Fishing, Trapping/Hunting, Apiculture	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:** Climate Regulation, Shoreline Protection, Crabbing, Fishing,	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				Trapping/Hunting, Apiculture			
NDC 34 Zeelust/Rosignol – Population estimate 15,000 people (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site at Rosignol for approximately 40 artisanal fishing vessels. Most of the vessels at this landing site target snapper. This landing site is managed by the Rosignol Fishermen's Cooperative Society. • Landing site at De Edward for 78 artisanal fishing vessels. Most of these vessels target snapper and spend several days at sea on each fishing trip. Approximately 15 vessels target bangamary and make daily trips. A few vessels also use Chinese seines to catch shrimp. This landing site is managed by the Three Door Cooperative Society and includes a fish market as well as areas used for boat repair and seine mending. • Landing site at Victory Dam used by 17 artisanal fishing vessels. Among these, 16 vessels use Chinese seines to target shrimp and one vessel uses Cadell lines. Vessels that dock at Victory Dam occasionally offload their produce at Bennet Dam due to access to markets. • Landing site for approximately four artisanal fishing vessels along the No. 2 shoreline. A few persons use pin seines for fishing along the No. 2 shoreline and small boats or catamarangs are used to retrieve the catch. • More than 10 persons in No. 2 and No. 3 catch shrimp daily in swamps for sustenance and sale. In addition, approximately 5 persons use haul seines to catch fish and shrimp along the No. 3 shoreline as a livelihood activity.	Marine environment, mangroves, swamps, canals, shoreline	a) Fisherfolk utilizing the Rosignol landing site b) Fisherfolk utilizing the De Edward landing site c) Fisherfolk utilizing the Victory Dam landing site d) Fisherfolk utilizing the No. 2 landing site e) Fisherfolk utilizing pin seines, cast nets and haul seines to for fishing in swamps and along the shoreline **ES Linkages:** Mangroves, Crabbing, Trapping/Hunting, Socio/Economic (Ice Factory, Fish Processing, Boat Building), Ritual/Religious	a) Essential b) Essential c) High d) Moderate e) High	a) Moderate b) Moderate c) Moderate d) Moderate e) Moderate	**a) Critical** **b) Critical** **c) High** **d) Medium** **e) High**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Crabbing	Provisioning	• During the July to September crabbing season, several persons catch red crabs (locally referred to as bok crabs) in the mangroves of No. 2 and No. 3. • Sheriga crabs are caught throughout the year in the mangroves of No. 2 and No. 3 for sustenance and sale.	Mangroves	Local communities engaged crabbing **ES Linkages:** Mangroves, Fishing, Trapping/Hunting	Moderate	Moderate	**Medium**
Agriculture: Livestock Grazing	Provisioning	• Grazing on sea dams and along the shoreline occurs throughout the NDC. • One person grazes cattle, sheep and goats in No. 4, approximately 14 persons in No. 3 and more than 5 persons in No. 2. • More than 2 persons also graze livestock in Rosignol.	Sea dam, shoreline, mangroves	Local communities grazing livestock on sea dams in: a) No. 2 to No. 4 b) Rosignol	a) High b) Moderate	a) Moderate b) Moderate	**a) High** **b) Medium**
Agriculture: Crop Cultivation	Provisioning	• Approximately 10 persons cultivate crops on sea dams between De Edward and No. 4.	Sea dam, shoreline	Local communities cultivating crops on the sea dam	High	High	**Medium**
Trapping/Hunting	Provisioning	• Marine birds are caught seasonally for sustenance and sale along the No. 2 shoreline. • Cage birds (finches), particularly species commonly referred to as bastard and grasee, are also caught along the No. 2 shoreline.	Mangroves, shoreline	Local people hunting and trapping bids in the mangroves **ES Linkages:** Mangroves, Fishing, Crabbing	Low	Moderate	**Low**
Aquatic Transportation	Provisioning	• Small passenger boats (commonly called water taxis) were used daily by thousands of passengers to travel between Rosignol and New Amsterdam (Region 6). However, this service was suspended as a result of the COVID-19 pandemic. • In May 2022, the Government of Guyana announced that the water taxi service will be allowed to resume. However, most of these vessels were in disrepair given the prolonged down-time and operations will resume only after they have been repaired.	Riverine ecosystems, shoreline	Local communities and residents of Guyana using the water taxi service **ES Linkage:** Socio/Economic (Markets and Commerce)	Essential	Low	**Critical**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Socio/Economic: Seafood Processing	Provisioning	• Fish processing plant at Rosignol purchases landed catch, particularly from the Rosignol landing site, for export.	Residential and commercial areas	Local fisherfolk, Export market **ES Linkage:** Fishing	Essential	Moderate	**Critical**
Socio/Economic: Manicole Palm Processing Facility	Provisioning	• Processing plant in Rosignol, along the Berbice River dam, for processing manicole palm for export.	River bank, residential and commercial areas	Local harvesters from riverine communities including Amerindians, local persons employed by the plant	High	Moderate	**High**
Socio/Economic: Ice Factory	Provisioning	• There is an ice factory located within the compound of the Rosignol Fishermen's Cooperative Society. The ice from this factory is purchased almost exclusively by fisherfolk who are part of the Society. • The quantity of ice produced is insufficient to supply fisherfolk from other landing sites. According to the Chairperson of the Three Door Cooperative Society, ice procurement for fishing trips is one of the major challenges encountered at that landing site and ice has to be purchased from Georgetown.	River bank, residential and commercial areas	Fisherfolk who belong to the Rosignol Fishermen's Cooperative Society **ES Linkage:** Fishing	Essential	Low	**Critical**
Socio/Economic: Boat Building and Repairs	Provisioning	• Boat building and repairs are conducted at three of the fishing landing sites in the district namely, Rosignol landing site, De Edward landing site and Victory Dam.	River bank	Local fisherfolk, boat builders, lumber dealers **ES Linkage:** Fishing	High	Moderate	**High**
Socio/Economic: Markets and Commerce	Provisioning	• Daily market at Rosignol comprising of retail businesses, restaurants and bars.	River bank, residential and commercial areas	Local communities and vendors in Rosignol **ES Linkages:** Fishing, Aquatic Transportation	High	Low	**Critical**
Socio/Economic: Berbice River Bridge	Provisioning	• The Berbice River Bridge is used by up to thousands of people daily to facilitate passenger transportation to and from Region 6. The Bridge is accessed via the NDC.	River Bank	Residents of Guyana and tourists using the Berbice River Bridge	Essential	Low	**Critical**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Ritual/Religious	Cultural	• Local Hindu communities use sea dams in No.2/ No. 3, De-Edward (at the three-door sluice), and Rosignol daily for religious purposes. In No. 2/No. 3 and Rosignol, these areas are also used for Maha Kali worship.	Sea dams, river bank	Local Hindu communities in: a) No. 2/No. 3 b) De Edward c) Rosignol **ES Linkage:** Mangroves, Fishing	a) High b) Low c) Moderate	a) Moderate b) Moderate c) Moderate	**a) High** **b) Low** **c) Medium**
Tourism and Recreation	Cultural	• Local communities use the sea dam for recreation and relaxation. For example, during the ground verification exercise (close to the Easter weekend), a few persons were observed flying kites on sea dams in De Edward.	Sea dams, river bank	Local communities	Low	Moderate	**Low**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing, Trapping/Hunting, Ritual/Religious	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Extensive area of mangroves throughout the NDC helps to protect the shoreline from impacts of the sea. Mangroves and earthen sea dams are the only sea defences along the shoreline of the NDC.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Climate Regulation, Crabbing, Fishing, Trapping/Hunting, Ritual/Religious	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:**	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area Based on Stakeholder Input	Relevant Land Use / Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				Climate Regulation, Shoreline Protection, Crabbing, Fishing, Trapping/Hunting, Ritual/Religious			

APPENDIX G – ECOSYSTEM SERVICES AND PRIORITY RATINGS IN REGION 6

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
NDC 35 - Ordinance/Fort Lands – Population estimate 8,000 people (Increasing due to new housing scheme)							
Fishing: Aquaculture, Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately 50 artisanal fishing vessels in Sheet Anchor. Fisherfolk fish in the Berbice River and the Canje Creek targeting both fish and shrimp.	Marine habitats, riverine ecosystems, mangroves	Fisherfolk utilizing the Sheet Anchor landing site **ES Linkage:** Transportation	Essential	Low	**Critical**
		• At least two ponds are being privately developed to be used for aquaculture in Ordinance (in proximity to the Berbice Bridge). • Approximately 100 persons catch shrimp and fish daily in the mangroves and canals using cast nets. Catches are for sustenance and/or sale. Some persons also travel to the neighbouring district to fish in the No. 19 swamp and transport catch to be sold in villages in the district.		a) Owners of aquaculture ponds b) Local communities engaged in fishing in the mangroves for sustenance and sale **ES Linkages:** Livestock Grazing, Crabbing, Mangroves, Recreation	a) Moderate b) Essential	a) Moderate b) Moderate	**a) Medium** **b) Critical**
Crabbing	Provisioning	• Approximately 25 persons are engaged in crabbing throughout the year as a primary livelihood activity. These crabs are supplied to 3 crab meat processing operators who subsequently sell to vendors based in Georgetown. • During the July to September crab season, there is an increase in the number of persons that catch crabs for sale. Local communities are also engaged in crabbing for sustenance and recreation during the crab season.	Mangroves	a) Local communities engaged in crabbing as a primary livelihood b) Local communities engaged in seasonal crabbing for sale, sustenance and recreation	a) High b) Essential	a) Moderate b) Moderate	**a) High** **b) Critical**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				ES Linkages: Mangroves, Fishing, Recreation			
Agriculture: Livestock Grazing	Provisioning	• More than 2,000 heads of cattle, sheep and goats graze in Ordinance on extensive pastures located close to the bank of the Berbice River. • Sheep, goats and pigs graze on the Palmyra sea dam and pens have been constructed for their housing in the vicinity of the koker. The pens are privately owned by approximately two persons. • More than 100 heads of cattle, sheep and goats are grazed on private lands in Sheet Anchor. • There is a small pig pen in Sheet Anchor. However, there are concerns that required facilities for public sanitation and hygiene are not met by this operation. • Generally, pastures in the backlands of the NDC in Palmyra and Cumberland has decreased because lands were converted to housing.	Pastures, sea dam	Local communities that graze animals in: a) Ordinance b) Palmyra c) Sheet Anchor d) Owner of the small pig pen in Sheet Anchor **ES Linkage:** Cultivated Crops	a) Essential b) Low c) Moderate d) Low	a) Moderate b) Moderate c) Moderate d) High	**a) Critical** **b) Low** **c) Medium** **d) Low**
Agriculture: Cultivated Crops	Provisioning	• Cash crop cultivation on the sea dam in Palmyra, on lands adjacent to the Grand Canal.	Sea dam	Local communities engaged in crop cultivation **ES Linkage:** Livestock Grazing	Low	High	**Low**
Aquatic Transportation	Provisioning	• The main docking area in Sheet Anchor (also used as the fishing landing site) is used by commercial and other privately owned boats used for passenger transportation to communities in the Berbice River. • The Canje Creek is used by GUYSUCO to transport sugar from estates in Rose Hall and Albion to the Berbice River and thereafter, to packaging plants outside the district.	Riverine ecosystems	a) Local communities using the Sheet Anchor docking area b) GUYSUCO **ES Linkage:** Fishing	a) Essential b) Essential	a) Moderate b) Low	**a) Critical** **b) Critical**
Social/Economic: Sawmill	Provisioning	• A privately owned sawmill is located on the right bank of the Canje Creek in Sheet Anchor that employs up to 5 persons on a part time basis. The Canje River is used to transport logs to mill.	Coastal	Sawmill owner, workers, loggers	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				ES Linkage: Aquatic transportation			
Social/Economic: Wharfs	Provisioning	• Approximately 10 business have small wharfs/docks on both banks of the Canje Creek in Sheet Anchor to facilitate transport of building supplies (stone, steel, and sand).	Coastal	Business owners	Essential	Moderate	**Critical**
Social/Economic: Boat Building and Repairs	Provisioning	• The left bank of the Canje Creek is used for building and repairs of small vessels. One operator also builds and repairs barges and repair tugs in this area.	Coastal	Local communities engaged in boat building and repairs	High	Low	**Critical**
Social/Economic: Market and Commerce	Provisioning	• A small daily market at Sheet Anchor comprising of retail businesses and restaurants.	River bank	Local communities and vendors in Sheet Anchor **ES Linkages:** Fishing	Low	Moderate	**Low**
Socio/Economic: Berbice River Bridge	Provisioning	• The Berbice River Bridge is used by thousands of people daily to facilitate passenger transportation to and from Region 6.	River Bank	Residents of Guyana and tourists using the Berbice River Bridge	Essential	Low	**Critical**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Social/Economic: Squatting	Provisioning	• Squatting at Sheet Anchor by 10 to 20 households. Squatting has increased in this area and there is some uncertainty about the ownership of the lands occupied by the squatters.	Coastal	Local communities	Low	Moderate	**Low**
Religious/Ritual	Cultural	• Religious activity along the dams leading to the Canje Creek in Sheet Anchor and along the Berbice River by less than 10 persons daily and more on religious days. • Waterways in inland areas in the NDC are also used for religious purposes including in Palmyra and No. 2 Village.	River banks, sea dam	Local Hindu communities	Moderate	Moderate	**Medium**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:**	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Recently, improved regulation of mangrove harvesting by the Guyana Forestry Commission (GFC) has resulted in new growth and increased mangrove cover throughout the NDC. Previously, fisherfolk were harvesting mangroves without restriction to construct “chase” and “pens”. New growth mangroves sequester large volumes of carbon as the stand matures.		Habitat Provision, Shoreline Protection, Crabbing, Fishing			
Shoreline Protection and Erosion Regulation	Regulating	• Extensive area of mangrove forest on the riverbanks protecting the land from the Berbice River and Canje Creek. Increased mangrove cover has resulted in the narrowing of the Crab Island channel due to mud accumulation. This channel is completely blocked in the vicinity of Sheet Anchor.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing	Moderate	Moderate	**Medium**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**
NDC 36 – Kintyre/Borlam – Population estimate 1,000 people (Stable)							
Fishing: Aquaculture, Wild-Caught Fish and Shellfish	Provisioning	• There are more than 20 privately owned fish and shrimp ponds in proximity to the shoreline throughout the NDC in Seawell and Bohemia to Borlam. Aquaculture operators have received Government support for improved empoldering of berms and enhanced drainage between production cycles. • Swamp areas throughout the NDC are used communally for fishing using cast net by local communities. The most commonly used area is the “No. 19 swamp” which is located between No. 19 and East Lothian. People from outside of the NDC district visit this swamp to catch fish for sustenance and sale.	Coastlands, shoreline, mangroves	a) Owners of private fish and shrimp ponds b) Local communities fishing in communal swamps and ponds c) Local communities fishing for sustenance and recreation in canals d) Local communities	a) Essential b) Essential c) Moderate d) Low	a) Low b) Low c) Moderate d) Moderate	**a) Critical** **b) Critical** **c) Medium** **d) Low**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Local communities also fish in the canal adjacent to the Borlam Dam using cast nets. • A few persons fish for sustenance and recreation in the Grand Canal using cast nets. The “beat the fish” method of fishing (in which a seine in tied across the width of the canal and fishes are chased in the direction of the seine) is also practiced here. • Pin seine poles have been erected along the shoreline of Borlam Dam for use by a few fisherfolk. Catches are used for sustenance and, the surplus, for sale.		engaged in pin seine fishing **ES Linkages:** Trapping/Hunting, Crabbing, Ritual/Religious, Recreation, Mangroves			
Crabbing	Provisioning	• Two types of crabs are captured in the NDC namely, the red crabs (commonly called bok crabs) which is mainly caught during the July to September crab season and the sheriga crabs which are caught throughout the year. • During the crab season, more than 40 persons from the NDC are engaged in crabbing for sale and sustenance. Some persons also catch crabs for recreation during the crab season. Persons from outside the NDC district also visit to catch crabs in the mangroves during the crab season. • Throughout the year, a few persons catch sheriga crabs in the mangroves. Crab catches are typically accompanied by catches of shrimp, tilapia, hassar and coo coo belly.	Mangroves	a) Local communities engaged in seasonal crabbing b) Local communities engaged in crabbing throughout year **ES Linkages:** Fishing, Trapping/Hunting, Mangroves, Recreation	a) Essential b) High	a) Moderate b) Moderate	**a) Critical** **b) High**
Trapping/Hunting: Wild Meat	Provisioning	• Approximately 40 persons are involved in the daily capture of sea birds including spika, curi curi, plover and wisi wisi ducks. Iguanas are caught for meat at the shoreline and around the fish and shrimp ponds. • During the bird season from September to February, an additional 20 to 30 persons hunt birds and iguanas in the mangroves.	Mangroves	Local communities capturing wildlife in the mangroves throughout the year **ES Linkages:** Crabbing, Mangroves	High	Moderate	**High**
Agriculture: Livestock Grazing	Provisioning	• Grazing of more than 1,000 heads of cattle, sheep, goats, pigs, ducks and chickens in Bohemia to Warren.	Coastal, Pastures	Local communities in: a) Bohemia to Warren	a) Essential b) High	a) Moderate b) Moderate	**b) Critical** **b) High**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Grazing of more than 500 heads of cattle, sheep and goats in Seawell on pastures located in proximity to the bank of the Berbice River. • Generally, grazing has declined in the NDC because of limited security and high levels of animal theft.		b) Seawell **ES Linkage:** Crop Cultivation			
Agriculture: Cultivated Crops	Provisioning	• Approximately two persons are engaged in the cultivation of cash crops and bananas on the sea dam in Seawell. • Rice is cultivated in proximity to the shoreline in Bramfield, No. 7, No. 11 and Bohemia/Warren.	Sea dam, cultivated lands	a) Persons engaged cultivation on sea dams b) Rice farmers **ES Linkage:** Livestock Grazing	a) Low b) High	a) High b) Low	**a) Low** **b) Critical**
Social/Economic: Brick Burning	Provisioning	• During the dry season, there is brick making from the burning of clay in close proximity to the sea dam. The NDC raised concerns that this activity increases erosion risk due to the extraction of soil along the sea dam and the clearing of mangroves.	Sea dam	Local persons engaged in brick making	Low	Moderate	**Low**
Social/Economic: CGX Shore Base	Provisioning	• The CGX shore base is located in Seawell with a wharf on Crab Island. Recently, CGX has undertaken work to expand the shore base and associated facilities. Some NDC members accompanied the President of Guyana during a visit to the construction site earlier in the year. • The NDC anticipates the shore base operations will provide employment opportunities for people in the district.	Coastland, shoreline	CGX and workers	High	Low	**Critical**
Social/Economic: Squatting	Provisioning	• A few persons are squatting in about five structures located on the sea dam in Bohemia. • In Seawell, several households are situated on lands for which they hold a Transport. However, the area was not officially developed as a housing scheme.	Sea dam, coastland	Local communities **ES Linkages:** Livestock Grazing	Low	Moderate	**Low**
Religious/Ritual	Cultural	• Religious activity at Seawell and Borlam Dam, with daily and weekly use by local Hindu communities.	Seashore; Sea dam	Hindu religious activities **ES Linkages:** Fishing, Crabbing	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Tourism and Recreation	Cultural	• Several persons visit the dams in the NDC to relax, bird watch and fish in the canals.	Coastal and Marine	Local communities **ES Linkages:** Fishing, Crabbing, Trapping/Hunting	Low	Moderate	**Low**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Extensive area of mangrove forest protects the local communities from the impacts of the sea. Mangroves and earthen sea dams are the only sea defences along the shoreline of the NDC. • Over the previous few years, there has been significant erosion of the shoreline area. The most significant erosion is reportedly occurring in No. 11 and Bohemia to Warren.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	High	Moderate	**High**
NDC 37 – Gibraltar/Fyrish – Population estimate 5,600 people (Stable)							
Fishing: Aquaculture, Wild-Caught Fish and Shellfish	Provisioning	• Fish and shrimp ponds are located throughout the shoreline of the NDC and are privately owned by 17 persons. Most of these ponds are located in Fyrish. • Operators of fish and shrimp ponds have received Government support for soil excavation to create ponds, improve empoldering of berms and enhance drainage between production cycles. According to an aquaculture operator, the ponds created by Government contractors	Marine environment; Mangroves; Crab grass	a) Owners of fish and shrimp ponds b) Local communities fishing in canals for sustenance	a) Essential b) Moderate	a) Low b) Moderate	**a) Critical** **b) Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		were dug too deep and this has adversely impacted natural shrimp mortality and consequently, productivity of the shrimp ponds. • Moreover, with support from the Government, aquaculture operators have organized themselves into a cooperative society that has established rules which all operators should follow. • Approximately 15 to 20 people use cast nets and hooks to fish in canals for sustenance. Most of this type of fishing occurs in canals in No. 1 to Courtland, and in Fyrish, to a limited extent.		**ES Linkage:** Mangroves, Recreation			
Crabbing	Provisioning	• A few persons are engaged in crabbing for recreation and sustenance. Crabs are rarely caught for sale.	Mangroves	Local communities crabbing for recreation and sustenance **ES Linkages:** Trapping/Hunting, Recreation	Low	High	**Low**
Agriculture: Livestock Grazing	Provisioning	• Approximately 200 to 300 cattle, sheep, goats and pigs graze along the sea dams of the NDC, depending on ease of access to the shoreline area. Generally, most grazing occurs in the backlands of the NDC where there are established pasturelands.	Mangroves, sea dam	Local communities that graze animals along the shoreline	Moderate	Moderate	**Medium**
Hunting/Trapping: Wild Meat	Provisioning	• Sea birds, including spika, curi curi, plover, and wisi wisi ducks, are seasonally caught for meat by approximately 25 persons. This activity occurs throughout the shoreline of the NDC but the Fyrish shoreline is most widely used. People from outside the NDC are also engaged in seasonal capture of birds.	Mangroves	Local communities capturing wild birds **ES Linkage:** Crabbing	Moderate	Moderate	**Medium**
Religious/Ritual	Cultural	• Hindu religious activities are practiced along the shoreline throughout the NDC. The most commonly used areas are No. 1/Courtland and Fyrish (Long Dam).	Coastal	Local Hindu communities **ES Linkage:** Fishing	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration. Mangrove cover is increasing and new growth mangroves sequester large volumes of carbon as the stand matures.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Extensive area of mangrove forest on the shoreline protecting the coast from the impacts of the sea. Mangroves and earthen sea dams are the only sea defences along the shoreline of the NDC. • Mangroves are increasing throughout the NDC due to natural growth. In addition, breaches to mangroves by aquaculture operators has declined and this also contributes to mangrove growth.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**
NDC 38 – Kilcoy/Hampshire – Population estimate 25,000 people (Increasing due to the development of new housing schemes)							
Fishing: Aquaculture, Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately 60 to 80 artisanal fishing vessels at Albion. • Pin seine fishing along the shoreline of the NDC has entirely stopped due to the proliferation of mangroves.	River and ocean	Fisherfolks using the landing site at Albion **ES Linkages:** Ritual/Religious	Essential	Low	**Critical**
	Provisioning	• There are approximately 63 privately owned fish and shrimp ponds throughout the shoreline of the NDC. Currently, these ponds occupy more than 3 kilometers along the shoreline. Aquaculture operators received Government support for soil excavation to create ponds, improve empoldering of berms	Shoreline, coastlands	a) Operators of privately fish and shrimp ponds b) Local communities	a) Essential b) Essential	a) Low b) Moderate	**a) Critical** **b) Critical**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		and enhance drainage between production cycles. There are plans to create new fish ponds in the immediate future. • More than 50 persons use cast nets and hand seines to fish in mangroves and canals throughout the NDC daily. Drag nets are also used for fishing, primarily along the Albion shoreline area. Catches are used mainly for sustenance but the surplus is sometimes sold.		engaged in subsistence fishing along the sea shore **ES Linkage:** Mangroves, Crabbing			
Crabbing	Provisioning	• Two types of crabs are captured in the NDC namely, red crabs (commonly called bok crabs) and sheriga crabs. • Crabs are caught daily by people who live close to the shoreline for sustenance and for sale. More than 50 people are engaged in this activity. • During crabbing season, more persons from the NDC catch crabs for sale and people from outside of the NDC district also visit to catch crabs for sale. Moreover, during the crabbing season, almost all households in the district catch crabs as a recreational activity and crabs caught in this way are used for sustenance.	Mangroves	a) Local communities engaged in crabbing throughout the year b) Local communities engaged in crabbing seasonally **ES Linkages:** Trapping/Hunting, Mangroves, Recreation	a) High b) Essential	a) Moderate b) Moderate	**a) High** **b) Critical**
Hunting/Trapping: Wild Meat	Provisioning	• Iguanas and sea birds including plovers, egret, curi curi, stork, and wild ducks are caught in mangroves throughout the NDC by a few persons for sustenance and for sale. Some people from outside the NDC district also visit the area to capture wild meat in the mangroves.	Mangroves; shoreline	Local communities **ES Linkages:** Crabbing, Mangroves	Moderate	Moderate	**Medium**
Agriculture: Livestock Grazing	Provisioning	• A poultry farm located in Kilcoy and Chesney (No. 4 Dam) comprises more than five multi-storey chicken pens, each pen containing approximately 20,000 chickens. • Cattle, goats, sheep and pigs are grazed along the shoreline areas throughout the NDC. Other animals like horses and donkeys are also grazed along the shoreline area.	Coastal	a) Owner of chicken pen and workers b) Local communities grazing animals along the shoreline	a) Essential b) High	a) Moderate b) Moderate	**a) Critical** **b) High**
Agriculture: Cultivated Crops	Provisioning	• Approximately three persons cultivate cash crops and fruits (including tomatoes and watermelon) on the sea dams in Kilcoy, Chesney, Nigg and Albion.	Sea dams	Local communities	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Apiculture	Provisioning	• Wild bees have established hives in the mangroves in some areas. A few persons in Hampshire collect honey from these hives for sustenance and, depending on the volume harvested, for sale.	Mangroves	Local communities harvesting honey from wild bee hives **ES Linkages:** Mangroves, Crabbing, Trapping/Hunting	Low	Moderate	**Low**
Social/Economic: Industrial Site	Provisioning	• Industrial Site in Hampshire is operational. Current operations including a chips factory and a hatchery.	Commercial lands	Local business communities	High	Low	**Critical**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes being developed by the Government. This includes a section of new housing area being developed in Belvedere.	Residential lands	Local communities residing in residential areas	Moderate	Low	**High**
Mangrove Materials	Provisioning	• Some harvesting of mangroves for firewood by a few families.	Mangroves	Families harvesting mangroves for firewood	Low	High	**Low**
Religious/Ritual	Cultural	• Hindu temples devoted to Maha Kali worship are located in proximity to the seashore in Chesney, Hampshire, Nigg, No. 4 Dam (Kilcoy) and Belvedere. Generally, there has been an increase in religious activities associated with Maha Kali worship in this district. • Hindu religious activities are also conducted on the sea dam in Albion. This is the only area where offerings can reach the shoreline. Previously, almost the entire shoreline throughout the NDC was used for Hindu religious activities but mangrove proliferation has significantly restricted access. Many persons now travel to areas outside of the NDC district (as far east as beaches in Bushlot and No. 63 village) for religious purposes. This has resulted in significant inconvenience and expense to local communities.	Sea dam, coastland	a) Local Hindu communities using temples for Maha Khali worship b) Local Hindu communities **ES Linkage:** Fishing	a) Moderate b) High	a) High b) Moderate	**a) Medium** **b) High**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration. Mangrove cover is increasing and new growth mangroves sequester large volumes of carbon as the stand matures.	Mangroves	Local communities **ES Linkages:**	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				Habitat Provision, Shoreline Protection, Crabbing, Fishing			
Shoreline Protection	Regulating	• Extensive area of mangrove forest protects the coast from the impacts of the sea. Mangroves and earthen sea dams are the only sea defences along the shoreline of the NDC. • Mangroves are increasing throughout the NDC due to natural growth. However, mangroves are breached to allow sea water to be channeled to the fish and shrimp ponds.	Mangrove	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangrove	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	High	Moderate	**High**
NDC 39 – Rose Hall Town – Population estimate 15,000 people (Stable)							
Fishing: Aquaculture, Wild-Caught Fish and Shellfish	Provisioning	• A few fisherfolks set juk seines along the shoreline of the Rose Hall beach. A few persons use drag seines along the shoreline of Rose Hall beach. • Pin seines are no longer used for fishing at the Rose Hall beach because the mud flats have been replaced by a sandy substrate. In addition, fishing boats cannot land in Rose Hall because there is no access channel leading to the shoreline.	Beach, shoreline	Local fisherfolk fishing along the shoreline of Rose Hall beach **ES Linkages:** Recreation, Religious/Ritual	Moderate	Moderate	**Medium**
	Provisioning	• There is one privately owned fish and shrimp pond located in Williamsburg. • Approximately 20 persons fish in swamps and canals daily, particularly adjacent to the Rose Hall beach access road where there are swampy areas. Catches are used mainly for sustenance but are also occasionally sold.	Coastland	a) Operator of privately owned fish pond b) Local communities fishing in swamps	a) Moderate b) High	a) Moderate b) Moderate	**a) Medium** **b) High**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				ES Linkage: Mangroves			
Crabbing	Provisioning	• During the July to September crab season, several persons are engaged in crabbing as a livelihood activity. Many persons also catch crabs as a recreational activity and for sustenance during the crab season.	Beach, mangroves, shoreline	Local communities catching crabs for sale, sustenance and recreation **ES Linkages:** Mangroves, Trapping/Hunting, Recreation	Moderate	Moderate	**Medium**
Trapping/Hunting: Wild Meat	Provisioning	• Birds, particularly plover birds, are caught daily using wire or nets by a few persons for sustenance or for sale at the Rose Hall market. This activity has increased and there is a dedicated section in the market for the sale of wild birds.	Mangroves, shoreline	Local communities engaged in bird catching in mangroves **ES Linkages:** Mangroves, Crabbing	High	Moderate	**High**
Agriculture: Livestock Grazing	Provisioning	• Cattle, goats and sheep are only rarely grazed along the shoreline because of high levels of theft. Most livestock farmers have pens inland where livestock is reared. During the wet seasons, when the conditions of the pens deteriorate, some livestock is taken to the Rose Hall beach to graze.	Beach, mangroves, shoreline	Local communities grazing livestock along the shoreline	Low	High	**Low**
Social/Economic: Housing	Provisioning	• Residential areas comprising of a section of a housing scheme developed by the Government.	Residential lands	Local communities residing in residential areas	Moderate	Low	**High**
Mangrove Materials	Provisioning	• A few persons harvest mangroves for construction purposes. However, the Town Council restricts the harvesting of mangroves.	Mangroves	Local persons harvesting mangroves	Low	High	**Low**
Religious/Ritual	Cultural	• Hindu religious activities are held at the Rose Hall beach. Hundreds of people use the beach for religious and ritual purposes weekly. Larger numbers of people visit the beach during special Hindu days of worship.	Beach, shoreline	a) Local Hindu communities using the Rose Hall beach	a) Essential b) Low	a) Low b) Moderate	**a) Critical** **b) Low**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• During the wet seasons, the Rose Hall beach cannot be accessed due to the poor condition of the earthen access dam. There are no alternative locations to be used for religious or ritual purposes. As such, when the beach is not accessible, persons travel east to Bushlot or the No. 63 beach for ritual and religious purposes. • There is a temple for Maha Kali worship located along the access road leading to the Rose Hall beach.		b) Local Hindu communities using the Maha Kali temple **ES Linkage:** Fishing, Recreation			
Tourism and Recreation	Cultural	• The Rose Hall beach is used by the wider community and is frequented by more than hundreds of persons daily and approximately 500 on weekends. Thousands of people visit the beach on special holidays like Easter Monday and this is comparable to the number of persons that visit popular beaches like the No. 63 beach. • However, the beach cannot be accessed by local communities during wet seasons because of the poor condition of the earthen access road.	Beach	Local communities and residents throughout Region 6 **ES Linkages:** Fishing, Ritual/Religious	Essential	Low	**Critical**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration. Mangrove cover is increasing and new growth mangroves sequester large volumes of carbon as the stand matures.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Extensive area of mangrove forest protecting the town from the impacts of the sea. Mangroves and earthen sea dams are the only sea defences along the shoreline of the municipality. Mangroves are increasing throughout the municipality due to natural growth.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangrove Forests	Local communities **ES Linkages:**	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				Habitat Provision, Shoreline Protection, Crabbing, Fishing			
NDC 40 - Port Mourant/John – Population estimate 16,000 people (Increasing due to the development of new housing areas)							
Fishing: Aquaculture, Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately nine artisanal fishing vessels at the Port Mourant outfall that catch fish and shrimp.	River and ocean	Fisherfolk using the Port Mourant outfall **ES Linkage:** Livestock Grazing	High	Low	**Critical**
	Provisioning	• There are approximately 100 privately owned shrimp and fish ponds located along the entire shoreline of the NDC. The ponds are owned by approximately 40 persons. The owners of these fish ponds have received support from Government to empolder berms and to facilitate drainage. There are limited lands close to the shoreline to create new fish ponds. • More than 25 persons catch shrimp, tilapia, coo coo belly, and cuffum in the swamps or drainage canals daily for sustenance and sale. In Tain to John, abandoned rice fields near to the shoreline are swampy during wet seasons and approximately 25 percent of the people who live close to these areas fish in this swamp daily.	Coastland, sea dams	a) Owners of private fish and shrimp ponds b) Local people fishing in swamps and drainage canals **ES Linkage:** Mangroves	a) Essential b) High	a) Moderate b) Moderate	**a) Critical** **b) High**
Crabbing	Provisioning	• Approximately 50 persons are engaged in crabbing as a primary livelihood activity throughout the year. Persons from outside of the NDC also visit mangroves to catch crabs for sale throughout the year. • During the crab season, a larger number of persons are engaged in crabbing for sale and sustenance.	Mangroves	Local communities engaged in crabbing **ES Linkage:** Mangroves, Trapping/Hunting	Essential	Moderate	**Critical**
Agriculture: Livestock Grazing	Provisioning	• There is a large-scale poultry farm in John which has several large multi-story pens with approximately 5,000 chickens per pen.More than 20 persons are employed full time. • There is a medium-scale poultry farm in Port Mourant (close to the Babu John crematorium).	Coastal	a) Owner and workers of poultry farm in John and Port Mourant	a) Essential b) High c) High	a) Moderate b) Moderate c) High	**a) Critical** **b) High** **c) Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• There is a large-scale duck farm at Tain. • There are also several small pig pens in Tain and John. • The population of cattle, sheep and goats in the NDC has drastically reduced as a result of the significant floods in 2021. Currently, there are approximately 200 heads of livestock throughout the NDC which are grazed on sea dams in Port Mourant (Babu John) and Tain to John. The NDC has no established pasture.		b) Owner and workers of duck farm and pig pens c) Local communities grazing animals in proximity to the seashore **ES Linkages:** Fishing, Crop Cultivation			
Trapping/Hunting: Wild Meat	Provisioning	• Shore birds including plover, spika, curi curi and carrow are caught using wire for sale at the local markets in Port Mourant and Rose Hall. Approximately 10 persons from Port Mourant and approximately 25 persons from Clifton to John catch birds as a livelihood activity. Larger numbers of persons are involved bird catching on a seasonal basis.	Mangroves, shoreline	Local communities capturing birds for sale **ES Linkage:** Mangroves, Crabbing	High	Moderate	**High**
Agriculture: Crop Cultivation	Provisioning	• Cultivation of cash crops and bananas on sea dams in Port Mourant (Babu John). • Cash crops and fruit (squash, watermelon and pumpkin) are cultivated on sand reefs in Clifton to John.	Sea dam, shoreline	a) Local communities cultivating crops in Port Mourant b) Local communities cultivating crops on sand reefs **ES Linkages:** Livestock Grazing	a) Low b) Moderate	a) High b) Moderate	**a) Low** **b) Medium**
Religious/Ritual	Cultural	• The beach along the Port Mourant shoreline is used by local Hindu communities for religious and ritual activities. The access to the shoreline is via the same access road used to reach the Rose Hall beach. During wet seasons, access to the beach is significantly restricted because of the poor condition of the access road.	Beach and coastland	a) Local Hindu communities using Port Mourant beach b) Local communities in Region 6 using the	a) Moderate b) Essential	a) Moderate b) Low	**a) Medium** **b) Critical**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• The main cremation site for the Region is located at Babu John and is dedicated to late Presidents Cheddi Jagan and Janet Jagan.		Babu John Crematorium in Port Mourant **ES Linkage:** Recreation			
Tourism and Recreation	Cultural	• Locals utilize the Port Mourant beach from the Rose Hall entrance for recreational purposes. During wet seasons, access to this area is significantly restricted because of the poor condition of the access road.	Coastal and Marine	Local communities in NDC and Region 6 **ES Linkage:** Religious/Ritual	Moderate	Moderate	**Medium**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration. Mangrove cover is increasing and new growth mangroves sequester large volumes of carbon as the stand matures.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Mangrove forest aids in capturing sediments along the shoreline. Mangroves and earthen sea dams are the only sea defences along the shoreline of the NDC. • Mangroves are increasing throughout the NDC due to natural growth. However, mangroves are also breached to allow sea water to be channeled to the fish and shrimp ponds.	Mangrove Forests, Coastal	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
NDC 41 - Bloomfield/Whim – Population estimate 4,000 people (Increasing due to rentals in the NDC)							
Fishing: Aquaculture, Wild-Caught Fish and Shellfish	Provisioning	• Landing sites at the outfalls in Letter Kenny and Whim were previously used by artisanal fishing vessels. Three artisanal vessels used the Letter Kenny outfall and one vessel used the Whim outfall. However, local stakeholders indicated that the Letter Kenny landing site is rarely used and two of the three vessels docked at the landing site have been abandoned. The Whim outfall is no longer used by artisanal fishing boats. The primary reason for reduced use of these landing sites is the heavy siltation of the channels which makes access challenging. • Nonetheless, fishing is one of the main livelihoods in the NDC. More than 30 artisanal fishing vessels (mainly snapper boats) are owned by persons from the NDC but these fisherfolk use landing sites out of the district at Adventure and Complex 66. • In addition, more than 100 persons in the NDC are employed as fisherfolk on boats at different landing sites throughout the Corentyne Coast. Fishing is the main livelihoods for Whim population.	Mangroves, sea dam	Fisherfolk using the landing site at Letter Kenny **ES Linkages:** Livestock Grazing	Low	High	**Low**
	Provisioning	• Approximately 30 fish and shrimp ponds, owned by about 10 persons, are operational within the NDC. Lands immediately adjacent to the entire shoreline have been occupied by the fish and shrimp ponds. The owners of the ponds have benefited from Government support to improve berming and drainage. • Approximately 15 persons use cast nets to fish along the shoreline and in the canals of Letter Kenny and Whim. Pin seine fishing is not practiced within the NDC but two persons from the NDC set pin seines in Eversham (located outside the NDC district).	Coastland, mangroves, shoreline	a) Owners of fish and shrimp ponds in b) Persons using cast nets to fish in swamps and canals **ES Linkage:** Mangroves	a) Essential b) Moderate	a) Low b) Moderate	**a) Critical** **b) Medium**
Crabbing	Provisioning	• Two types of crabs were previously caught in the NDC. Sheriga crabs were caught by approximately 15 people throughout the year for sale. However, this activity has almost entirely stopped because the lands on which these	Mangroves	Local communities engaged in seasonal crabbing	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		crabs were caught are privately controlled by the owners of fish ponds. • Red crabs (commonly called bok crabs) are caught seasonally by approximately 50 people for sale. During the crab season, several households also catch crabs for sustenance and recreation.		**ES Linkages:** Mangroves, Hunting/Trapping, Recreation			
Agriculture: Cultivated Crops	Provisioning	• Cash crop cultivation in close proximity to the sea dam in Whim. Crops include coconuts, watermelon, muskmelon, cucumbers, bora, tomatoes, and eggplant.	Sea dam; Cultivated areas	Locals cultivating crops on the sea dam in Whim **ES Linkage:** Livestock Grazing, Fishing	Low	Moderate	**Low**
Agriculture: Livestock Grazing	Provisioning	• Grazing occurs throughout the NDC but is more predominant in Whim to Letter Kenny, and there are hundreds of heads of cattle, goats, and sheep. Grazing along the sea dams and shoreline has increased but local communities face significant challenges associated with the theft of livestock.	Mangroves; sea dam	Local communities; Private cattle farmers **ES Linkage:** Crop Cultivation, Fishing	Moderate	Moderate	**Medium**
Hunting/Trapping: Wild Meat	Provisioning	• Shore birds including egret, curi curi, dukla, plover, wisi wisi, and spika are caught for sustenance or sale. These birds are captured seasonally by approximately 20 persons. • Iguanas are caught in the mangroves by persons from outside the NDC district. Iguanas are not typically consumed by households in the NDC.	Mangroves, shoreline	Local communities capturing shore birds and iguanas **ES Linkages:** Mangroves, Crabbing	Moderate	Moderate	**Medium**
Religious/Ritual	Cultural	• Local Hindu communities use the sea dams in Bloomfield and Letter Kenny for religious purposes. However, these areas are no longer popularly used and people prefer to visit beaches in Bushlot and No. 63 village for religious purposes. • There are three Hindu temples for Maha Kali worship located in proximity to the sea dams in Letter Kenny and Whim.	Coastal	a) Local Hindu communities using shoreline between Bloomfield and Letter Kenny b) Local Hindu communities using the temples	a) Low b) Moderate	a) Moderate b) Moderate	**a) Low** **b) Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Tourism and Recreation	Cultural	• Locals and diaspora visitors use sea dams in Letter Kenny and Whim for recreational purposes, including bird watching. The Whim sea dam is used weekly by several families for recreation.	Sea dam, mangroves	Local communities using sea dams for recreation	Low	Moderate	**Low**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Mangrove forests capture sediments along the shoreline. Mangroves and earthen sea dams are the only sea defences along the shoreline of the NDC. • Mangrove cover has drastically reduced along the shoreline of Letter Kenny to Whim due to anthropogenic factors. Mangroves are cleared to facilitate filling of aquaculture ponds and the drainage of the ponds after each production cycle. In Letter Kenny, extensive mangrove clearance along a section of the shoreline has resulted in the erosion of the earthen sea dam. In Whim, large (mature) mangroves have been cleared from the border with the sea dam. The NDC has reported this activity to the relevant authorities but no action has yet been taken.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	High	Moderate	**High**
NDC 42 - Lancaster/Hogstye – Population estimate 4,624 people (Stable)							
Fishing: Aquaculture, Wild-	Provisioning	• Landing site at the canal between Hogstye and Adventure used by approximately 16 artisanal fishing vessels. The number of large fishing boats has increased as there is	Marine environment,	a) Fisherfolk using the landing site at Hogstye/Adventure	a) Essential b) High	a) Low b) Moderate	**a) Critical** **b) High**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Caught Fish and Shellfish		easy access and the landing site at Complex #66 is crowded. None of the boats at the outfall are owned by persons from the NDC. However, persons from the NDC, mostly from Lancaster, work on fishing boats that land at various sites along the Corentyne Coast. • Two persons from the NDC use pin seines to fish along the shoreline. One person operates between Lancaster to Liverpool and the other between Ulverston to Second Alness. • Approximately 30 persons use “choke” seines to fish along the shoreline throughout the NDC but this is most common in Alness.	mangroves, shoreline	b) Local fisherfolk fishing with pin seines and choke seines along the shoreline **ES Linkages:** Recreation, Ritual/Religious			
	Provisioning	• There are three privately owned fish and shrimp ponds in the NDC located in Lancaster, Liverpool and Manchester. • Persons throughout the NDC use cast nets for fishing in swamps and canals throughout the NDC. Catch from cast nets are used mainly for sustenance but depending on the quantity, surplus catch is also sold.	Coastland, mangroves	a) Owners of the fish and shrimp ponds b) Local fisherfolk using cast nets to fish for sustenance **ES Linkage:** Mangroves	a) Essential a) Moderate	a) Moderate b) Moderate	**a) Critical** **b) Medium**
Crabbing	Provisioning	• Crabbing is common during the July to September crab season. Typically, crabs are caught by the people who use pin seines and choke seines to fish along the shoreline.	Beach, mangroves, shoreline	Local communities engaged in seasonal crabbing **ES Linkage:** Mangroves, Fishing, Trapping/Hunting	High	Moderate	**High**
Trapping/Hunting: Wild Meat	Provisioning	• Shore birds are captured seasonally for sustenance and sale by a few young people.	Mangroves, shoreline	Young people catching shore birds **ES Linkages:** Mangroves, Crabbing	Low	High	**Low**
Agriculture: Livestock Grazing	Provisioning	• Cattle, goats, sheep and pigs are grazed on sea dams and along the shoreline throughout the NDC. Currently, more	Mangroves, sea dam, shoreline	Local communities grazing animals on	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		than 5,000 heads of livestock is grazed throughout the NDC. • Grazing on the shoreline and sea dams has increased because of significant damage to back dam pastures following the 2021 flood. Other animals like horses are also grazed on sea dams.		sea dams and the shoreline			
Agriculture: Cultivated Crops	Provisioning	• Cultivation of cash crops and fruits along the shoreline throughout the NDC. These activities are increasing and more crops are planted during the wet seasons. Crops include watermelon, bora, tomatoes, muskmelon, etc.	Sea dam, cultivated areas	Local farmers, residents	High	High	**Medium**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Mangrove Materials	Provisioning	• A few persons harvest mangroves to construct arbors for crop cultivation and kitchen gardens.	Mangroves	Local communities harvesting mangroves to support crop cultivation	Low	High	**Low**
Religious/Ritual	Cultural	• Hindu communities use the beaches in Manchester and Alness for religious and ritual purposes. These activities are increasing because access to the beaches has improved. Persons from other districts also visit these beaches and on Sundays, more than 100 people use the beach.	Beach, shoreline	Local Hindu communities **ES Linkages:** Fishing, Recreation, Livestock Grazing	High	Moderate	**High**
Tourism and Recreation	Cultural	• Locals utilize the Manchester and Alness beaches for recreational purposes with more than 100 persons on weekends. COVID-19 restrictions had resulted in a reduction of the number of people visiting the beaches for recreational purposes as well as the social activities, like parties, which took place on the beach. However, recreational use of the beaches is returning to the pre-pandemic norm. • The Ryan Crawford Memorial Turf Club is used for horse racing competitions. However, horse racing competitions	Beach, shoreline	a) Local communities in NDC and Region 6 using the beaches in Manchester and Alness b) Ryan Crawford Memorial Turf Club **ES Linkages:** Fishing,	a) Moderate b) Low	a) Moderate b) Moderate	**a) Medium** **b) Low**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		were stopped due to public health restrictions associated with the COVID-19 pandemic.		Religious/Ritual, Livestock Grazing			
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Mangrove forest capture sediments along the shoreline. Mangroves and earthen sea dams are the only sea defences along the shoreline of the NDC. • Mangrove cover has been decreasing throughout the NDC. Some people harvest the mangroves to build arbors for gardening. In addition, animals that graze in mangroves and along the shoreline consume seeds and seedlings thereby, may limit new growth. • Moreover, the significant accumulation of sand along the shoreline also hinders new growth because mangroves do not grow well in sandy soils. In addition, there has been slight erosion of the beaches in recent years.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	High	Moderate	**High**
NDC 44 - Good Hope/No. 51 – Population estimate 2,300 people (Stable)							
Fishing: Aquaculture, Wild-Caught Fish and Shellfish	Provisioning	• There are four large shrimp ponds in No. 49, all of which are privately owned. Catches include tilapia, mullet, black tail basha and shrimp. Pond owners received support from the Government to rehabilitate ponds by constructing higher berms and improving drainage. Other persons in No. 47 and No. 49 are considering investing in new ponds.	Coastland, mangroves	a) Owners private fish and shrimp ponds b) Local communities using	a) Moderate b) Essential	a) Moderate b) Moderate	**a) Medium** **b) Critical**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Approximately 80 percent of all households use cast nets to fish for sustenance in swamps and canals throughout the NDC on a daily or weekly basis.		cast nets to fish in swamps and canals **ES Linkage:** Mangroves			
Crabbing	Provisioning	• Approximately 30 to 40 persons from within and outside of the district catch crabs seasonally in the mangrove forests in the NDC. Crabbing is done throughout the shoreline and the area between No. 47 to No. 49 is most popularly used. People from as far east as Canje and Palmyra visit the NDC with cars to crab for sale during the crabbing season. In addition, catch is sold both within and outside the NDC. • A few persons catch sheriga crabs throughout the year. Sheriga crabs are also caught in the fish and shrimp ponds regularly.	Mangroves, coastland	a) Local communities engaged in seasonal crabbing b) Local communities crabbing regularly **ES Linkages:** Mangroves, Trapping/Hunting	a) Essential b) Moderate	a) Moderate b) Moderate	**a) Critical** **b) Medium**
Agriculture: Livestock Grazing	Provisioning	• Approximately 50 persons graze sheep, goats and pigs on sea dams and along the shoreline throughout the NDC. Generally, cattle are grazed in pasturelands in the back dam of the NDC.	Mangroves, sea dam, shoreline	Local communities grazing livestock on sea dams and along the shoreline	High	Moderate	**High**
Trapping/Hunting: Wild Meat	Provisioning	• Hunting of iguanas has increased significantly in the mangroves throughout the NDC. Persons from throughout the Corentyne Coast, including New Amsterdam, visit the NDC to catch iguanas for sale. Hunting of shore birds for sustenance and sale has increased and is done daily. The shoreline of No. 48 to No. 51 is used for hunting iguanas and birds. • Cage birds/finches are caught for sale and training along the shoreline of No. 50 and No. 51.	Mangroves, shoreline	People who hunt: a) Iguanas and shorebirds for meat and sale b) Cage birds/finches **ES Linkages:** Mangroves, Crabbing	a) High b) Moderate	a) Moderate b) Moderate	**a) High** **b) Medium**
Agriculture: Cultivated Crops	Provisioning	• Cultivation of cash crops and fruits including coconuts on the sea dam and adjacent lands in No. 47, No. 48, No. 50 and No. 51. In No. 47, the sea dam eroded and mangroves were breached resulting in saltwater intrusion. This significantly challenged cultivation in this area.	Coastal; Pasturelands	Local communities farming on the sea dams	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Social/Economic: Brick Burning	Provisioning	• Brick burning on the sea dam in No. 51 village by one person. Bricks are made using materials excavated from the canal. Previously, mangroves were harvested to be used as fuel (firewood) for brick burning but this no longer occurs.	Coastal	Local communities	Low	Moderate	**Low**
Social/Economic: Sand Excavation	Provisioning	• Sand reefs in No. 51 village are being excavated and sand is sold for construction purposes. The sand reef is located on private lands.	Coastal	Operator of sand excavation activity	Moderate	Low	**High**
Religious/Ritual	Cultural	• Religious activities are held on the sea dam at No. 49 with the most persons visiting this area on Fridays and Sundays. There is easy access to the shoreline at No. 49 Village. • The sea dam in No. 47 and No.51 village is also used for Hindu religious activities.	Coastal	Local Hindu communities **ES Linkages:** Fishing	Moderate	Moderate	**Medium**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration. Mangrove cover is increasing and new growth mangroves sequester large volumes of carbon as the stand matures.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• There is an extensive area of mangrove forest throughout the NDC. Generally, mangrove cover is increasing throughout the NDC. Mangroves and earthen sea dams are the only sea defences along the shoreline of the NDC. • However, there is significant erosion in some areas due to tidal influences, particularly No. 47 and No. 49. This resulted in saline intrusion. In order to remedy this situation, a drain (approximately 1.2 meters [6 feet] wide) was dug behind the sea dam to capture overtopping and reduce saltwater intrusion. This drain has the complementary benefits of preventing animals from grazing in mangroves (which causes damage) and also helping to manage mosquitoes.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:**	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				Habitat Provision, Shoreline Protection, Crabbing, Fishing			
NDC 45 - Macedonia/Joppa – Population estimate 3,500 people (Stable)							
Fishing: Aquaculture and Wild-Caught Fish & Shellfish	Provisioning	• Landing site at Eversham used by approximately five artisanal fishing boats that use bangamary seines and pin seines. Most vessels make day trips. • Landing site at No. 43 outfall for approximately 16 artisanal fishing vessels. The vessels that land at this site are owned by persons from within and outside of the NDC district. Larger vessels that spend several days at sea per fishing trip land at this site. There is seine mending at the No. 43 outfall. • Pin seines are used to fish along the shoreline throughout the NDC. Specifically, there is one pin seine vessel at No. 35, 1 pin seine vessel at Eversham and 2 pin seine vessels at No. 43. Fisherfolk who practice pin seine fishing use small boats or catamarangs for fishing.	Marine environment, shoreline, mangroves	a) Fisherfolk using the landing site in Eversham b) Fisherfolk using the landing site at No. 43 outfall c) Fisherfolk using pin seines to fish along the shoreline **ES Linkage:** Socio/Economic (Boat Building)	a) Moderate b) Essential c) Moderate	a) Moderate b) Moderate c) Moderate	**a) Medium** **b) Critical** **c) Medium**
	Provisioning	• There are six privately owned shrimp ponds on the sea dams of No. 36, Kiltearn, Bengal and No. 43. • Approximately 1,500 persons use cast nets to fish in swamps, canals and mangroves throughout the NDC for sustenance. Catches with cast nets typically include shrimp, tilapia, crek-a-the and hassar. Depending on the quantity caught, surplus catch is also sold.	Coastlands	a) Privately owned shrimp ponds b) Fishing in swamps, canals and mangroves for sustenance **ES Linkage:** Mangroves	a) Essential b) Essential	a) Moderate b) Moderate	**a) Critical** **b) Critical**
Crabbing	Provisioning	• Crabbing is a significant activity in the NDC. Approximately 20 people are engaged in crabbing for sheriga as a regular livelihood activity. • During the crab season, the number of persons engaged in crabbing as a livelihood activity significantly increased.	Mangroves	a) Local communities engaged in crabbing as a primary livelihood	a) High b) Essential	a) Moderate b) Moderate	**a) High** **b) Critical**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		People from as far east as Canje visit the NDC to catch crabs for sale.		b) Local communities engaged in seasonal crabbing **ES Linkages:** Mangroves, Trapping/Hunting			
Agriculture: Livestock Grazing	Provisioning	• Cows, goats, and sheep graze throughout the NDC. Generally, most animals are grazed in pastures in the back dam. However, during the rice season, most animals are brought to the sea dams and shoreline area to graze so as to prevent damage to the rice crop.	Sea dam, shoreline	Local communities grazing animals on sea dams and shoreline	Moderate	Moderate	**Medium**
Agriculture: Cultivated Crops	Provisioning	• Cultivation of cash crops, fruits, and coconuts on sea dam and reserves in the No. 35 (1 person), Brighton (approximately 5 persons), Kiltearn (approximately 2 persons), and Eversham (1 person). In Brighton, fruit and cash crops are also cultivated on the sand reef close to the sea dam. • Coconut trees are cultivated on sea defence reserves throughout the NDC.	Sea dam, sand reef	Local communities cultivating crops on sea dams	High	Moderate	**High**
Trapping/Hunting: Wild Meat	Provisioning	• A few persons catch plover using wire or seine. Curi curi and wild ducks are caught for sustenance and sale. Iguanas are also caught seasonally. People from outside the NDC district also visit, including at nights, to hunt in the mangroves.	Mangroves, shoreline	Local communities hunting in the mangroves. **ES Linkages:** Mangroves, Crabbing	Moderate	Moderate	**Medium**
Social/Economic: Boat Building and Repairs	Provisioning	• Boat building and repairs are conducted at the No. 43 outfall (adjacent to the fishing landing site).	Sea dam	Local fisherfolk, Boat builders, Lumber dealers **ES Linkage:** Fishing	Essential	Moderate	**Critical**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Social/Economic: Housing	Provisioning	• There are residential areas comprising of a section of a housing scheme developed by the Government.	Residential lands	Local communities residing in residential areas	Moderate	Moderate	**Medium**
Religious/Ritual	Cultural	• Hindu religious activities occur along the sea dam in No. 43.	Sea dam	Local Hindu communities **ES Linkage:** Fishing	Low	High	**Low**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration. Mangrove cover is increasing and new growth mangroves sequester large volumes of carbon as the stand matures.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Mangrove forest capture sediments along the shoreline. Mangroves and earthen sea dams are the only sea defences along the shoreline of the NDC. • Mangroves are increasing throughout the NDC due to natural growth. Harvesting of mangroves is restricted and permission has to be obtained from the Guyana Forestry Commission to cut mangroves.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing	Moderate	Moderate	**High**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	High	Moderate	**High**
NDC 46 - Bushlot/Adventure – Population estimate 6,000 people (Stable)							
Fishing: Aquaculture, Wild-Caught Fish and Shellfish	Provisioning	• Landing site at the Bushlot/Kildonan outfall used by five artisanal fishing vessels. • Landing site at Adventure used by approximately 16 artisanal fishing vessels. • Approximately 3 to 5 persons use pin seines for fishing throughout the shoreline of the NDC between Adventure to	Shoreline, river and ocean	a) Fisherfolk utilizing the Bushlot/Kildonan landing site b) Fisherfolk utilizing the Adventure landing site	a) Moderate b) Essential c) Moderate	a) Moderate b) Low c) Moderate	**a) Medium** **b) Critical** **c) Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		Friendship and Kildonan to Bushlot. According to a local pin seine fisherman, approximately 20 to 25 years ago, pin seine fishing was prevalent throughout the shoreline of the district providing livelihoods for more than 50 people. However, reduction in catch resulted in several pin seine fisherfolk seeking alternative livelihoods. Reduced catch was believed to have been associated with the discharge of effluent from back dam rice fields which reduced fish populations nearshore, and by continually increasing competition for the same resource among fisherfolk.		c) Fisherfolk using pin seines to fish along the shoreline **ES Linkages:** Ritual/Religious, Recreation			
	Provisioning	• There are three privately owned shrimp ponds in the NDC. Two are located in Bushlot Farm and one is located in Adventure. • Several persons use cast nets to fish in swamps, canals and outfalls throughout the NDC. There is a communal swamp/pond that is used by virtually all households in Bushlot and Bushlot Farm. Fishing with cast nets is done for sustenance and for recreation. Depending on the quantity caught, surplus catch is also sold. The number of persons who use cast nets for fishing has increased due largely to economic hardships associated with the COVID-19 pandemic.	Coastland	a) Owners of fish and shrimp ponds b) Local communities using cast nets to fish in swamps, canals and at outfalls **ES Linkage:** Mangroves	a) Essential b) Essential	a) Moderate b) Moderate	**a) Critical** **b) Critical**
Crabbing	Provisioning	• Approximately 4 persons regularly catch crabs in the mangroves in Bushlot, Kildonan and to a limited extent, Adventure. Typically, the persons who practice pin seine fishing also regularly catch crabs. • A larger number of persons catch crabs as a livelihood activity during the July to September crabbing season.	Mangroves, shoreline	Local communities engaged in crabbing **ES Linkage:** Mangroves, Trapping/Hunting	High	Moderate	**High**
Trapping/Hunting: Wild Meat	Provisioning	• There are thousands of birds along the shoreline of the NDC and a few persons, mainly in Bushlot and Bushlot Farm, capture birds for sustenance and for sale in local markets. A few persons also catch iguanas. This is mostly done by young people who are unemployed.	Mangroves, shoreline	Young people hunting in mangroves **ES Linkages:** Mangroves, Crabbing	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Plover is caught using a wire or seine. Curi curi and wild ducks are shot. Generally, hunting of shore birds for sale has increased.					
Agriculture: Cultivated Crops	Provisioning	• Cash crops and fruits (watermelon, tomatoes, ochro, eggplant, etc) are cultivated on sea dams throughout the NDC. Cultivation has increased and this is also linked to higher levels of unemployment resulting from the COVID-19 pandemic.	Sea dam	Local communities cultivating crops on the sea dam	High	Moderate	**High**
Agriculture: Livestock Grazing	Provisioning	• Grazing of goats and sheep occurs on sea dams and along the shoreline throughout the NDC. Grazing increased in Bushlot Farm. However, grazing has reduced in other villages because of the increase in crop cultivation on sea dams.	Sea dam, mangroves	Local communities grazing animals on the sea dam	Moderate	Moderate	**Medium**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Religious/Ritual	Cultural	• Hindu religious activities are conducted throughout the NDC. Hindu communities from as far west as Hampshire travel to the beach especially on special Hindu days of worship, like Teerat.	Sea dam, beach, shoreline	Hindu communities using sea dam and beach **ES Linkages:** Fishing, Recreation	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Tourism and Recreation	Cultural	• Approximately 100 persons use the beaches in Bushlot, Bushlot Farm and Kildonan on a weekly basis for recreational purposes. The beaches are popular for recreation on weekends and social activities (including fundraising events) are held on the beach. There are several hundred persons on special holidays like the Easter weekend. • The Kennard's Memorial Turf Club (horse racing tract) is located immediately adjacent to the seashore in Bushlot. The Club has not been recently operational due to the COVID-19 pandemic. However, there is a permanent caretaker on site to support site maintenance.	Beach, shoreline, commercial areas	Local communities in NDC and Region 6 using: a) Beach along Bushlot to Kildonan shoreline b) Kennard's Memorial Turk Club **ES Linkage:** Ritual/Religious	a) High b) Low	b) Moderate b) Moderate	**a) High** **b) Low**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**
Shoreline Protection and Erosion Regulation	Regulating	• Mangrove forest captures sediments along the shoreline. Mangroves and earthen sea dams are the main sea defences along the shoreline of the NDC. However, some sections of the Bushlot shoreline are also protected by hard structures like boulder faces or rip raps. • Mangrove cover is increasing because harvesting mangroves for gardening or for firewood has discontinued.	Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	High	Moderate	**High**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
NDC 47 - Maida/Tarlogie – Population estimate 3,500 people (Stable)							
Fishing: Aquaculture, Wild-Caught Fish and Shellfish	Provisioning	• A few persons fish along the shoreline using pin seines or "juk" seines. • Previously, there were landing sites for approximately 14 artisanal fishing vessels in Maida, Kilmarnock, and Wellington Park. These landing sites were used on an alternating basis depending on the ease of traversing the channels to access the sites. According to the NDC, the landing site at Wellington Park is no longer used as a landing site for fishing vessels because of challenges in accessing the channel. • However, approximately five vessels use the outfalls in Maida and Kilmarnock on an alternating basis. Rehabilitation works were ongoing at the outfalls in Maida and Kilmarnock during ground verification and as such, no vessels were docked. According to the NDC, most artisanal vessels have relocated to landing sites in Adventure or Eversham.	Marine environment, mangroves	a) Fisherfolk utilizing the landing sites in Maida and Kilmarnock b) Fisherfolk who use pin seines to fish along the shoreline	a) Low b) Low	a) Moderate b) High	**a) Low** **b) Low**
	Provisioning	• There are fish and shrimp ponds in Wellington Park, Maida, and Kilmarnock which are privately owned by approximately 14 persons from the NDC. Recently, these operators received support from the Government to rehabilitate the ponds by increasing the height of the berms and facilitating drainage. • There are canals and swamp basins in Tarlogie that are open for communal catch of fish and shrimp. These areas are popularly used by local communities. In addition, several persons from outside the NDC district visit the swamp with buses or trucks to fish for sale. Local communities also use cast nets to fish in canals throughout the NDC.	Coastland	a) Owners of private fish and shrimp ponds b) Local communities using cast nets to fish in swamps and canals **ES Linkage:** Mangroves	a) Essential b) Essential	a) Low b) Moderate	**c) Critical** **b) Critical**
Crabbing	Provisioning	• Crabbing is also an important source of livelihoods throughout the year in the NDC. People from outside the NDC also visit the area to catch crabs. Crab catching is also done by several persons for recreation.	Mangroves, shoreline	Local communities engaged in crabbing	Essential	Low	**Critical**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				ES Linkages: Mangroves, Trapping/Hunting			
Agriculture: Livestock Grazing	Provisioning	• Cattle, sheep and goats are grazed along the shoreline throughout the NDC. The owners of these animals reside in Wellington Park, Philippi, and Kilmarnock. Generally, most animals are grazed in pastures in the back dam.	Mangroves, sea dam	Local communities grazing animals on the shoreline	Moderate	Moderate	**Medium**
Trapping/Hunting: Wild Meat	Provisioning	• Curi curi, flamingo, duckla, wisi wisi, and plover birds are hunted with wires and guns regularly for sale. Hunting of iguanas and sea birds for meat and sale in the mangroves is increasing is done by approximately 20 to 25 persons daily. This activity mainly occurs in Tarlogie and is the main livelihood for the persons who regularly hunt.	Mangroves, shoreline	Local communities hunting in the mangroves **ES Linkages:** Mangroves, Crabbing	High	Moderate	**High**
Agriculture: Crop Cultivation	Provisioning	• Cash crops are cultivated on the sea dam in Wellington Park.	Sea dam	Local communities cultivating crops on sea dams	Low	Moderate	**Low**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Mangrove Materials	Provisioning	• A few persons harvest mangroves in Tarlogie for use in construction. However, harvesting mangroves for personal use is prohibited by the NDC.	Mangroves	Persons harvesting mangroves to support crop cultivation	Low	High	**Low**
Religious/Ritual	Cultural	• Religious activities are held by local Hindu communities in areas with access to the sea at Wellington Park and Maida. Prayers and rituals are conducted weekly. • Local Christian communities use the channel in Wellington Park for baptisms. Approximately 20 baptisms are conducted annually.	Coastal	a) Local Hindu communities b) Local Christian communities	a) Moderate b) Low	a) Moderate b) Moderate	**a) Medium** **b) Low**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:**	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
				Habitat Provision, Shoreline Protection, Crabbing, Fishing			
Shoreline Protection and Erosion Regulation	Regulating	• Mangrove forest captures sediments along the shoreline. Mangroves and earthen sea dams are the main sea defences along the shoreline of the NDC. However, mangrove cover has been declining throughout the NDC and hard sea defence structures (rip raps) were installed along the shoreline in Maida and Tarlogie. • In 2018, NAREI established a mangrove restoration plot in Wellington Park. These mangrove seedlings died and did not regrow. NAREI plans to commence mangrove restoration in Kilmarnock and Tarlogie. • Inland mangrove cover has increased in Cromarty but there is no new growth along the shoreline.	Coastal, Mangrove Forests	Local communities **ES Linkages:** Habitat Provision, Global Climate Regulation, Crabbing, Fishing	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	High	Moderate	**High**
NDC 48 - No. 52/74 Villages – Population estimate 20,000 people (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• Landing site for approximately 20 to 25 artisanal fishing vessels at the No. 65 outfall. • Landing site for approximately 140 artisanal fishing vessels at Complex #66. During peak fishing seasons, up to 200 artisanal fishing vessels use this landing site. Fishing boats belonging to people who reside in Regions 4 and 5 and along the Corentyne Coast also use this landing site. • The landing sites at the No. 65 outfall and the Complex #66 are utilized primarily by large artisanal fishing vessels (typically snapper boats). Fishing trips undertaken by these	Marine environment; Mangroves; Drainage canals;	a) Fisherfolk who use the landing site at the No. 65 outfall. b) Fisherfolk who use the landing site at Complex #66 c) Fisherfolk using pin seines and Chinese seines d) Local communities using seines, nets and	a) Essential b) Essential c) Essential d) Essential e) Essential f) Moderate	a) Low b) Low c) Moderate d) Moderate e) Moderate f) Moderate	**a) Critical** **b) Critical** **c) Critical** **d) Critical** **e) Critical** **f) Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		vessels last for several days and fishing trips occur along the coasts of both Guyana and Suriname. • Approximately 30 small boats are used for pin seine fishing and fishing with Chinese seines (to target white belly shrimp) along the shoreline of No. 56 to No. 65. Vessels that use Chinese seines to target white belly shrimp typically land at the No. 65 outfall. Small vessels that use pin seines to fish dock along the shoreline of No. 61 to No. 63 beach. • Approximately 10 to 30 persons fish for sustenance and recreation throughout the NDC. This includes fishing along the shoreline using juk seines and lines between No. 58 to No. 65. Catch is typically used for sustenance and comprises cuirass and catfish. Pacu is also caught along the No. 63 beach. In addition, persons also fish in canals and swamps throughout the NDC on a daily basis. • Approximately 50 families fish in the reef lands along the shoreline of No. 52 village on a daily basis for sustenance. Catch includes black shrimp, coo coo belly, sheriga crabs and mullet. • Seasonally, local communities catch sardines along the shoreline of the NDC for recreation and sustenance. • More than 4,000 persons are directly indirectly employed in the fishing sector in this NDC. The number of persons engaged in fishing, both for sale and sustenance, has increased since the closure of the Skeldon Sugar Estate in 2017. • The Ministry of Agriculture has engaged the NDC to identify an area in which a shrimp hatchery could be established to support aquaculture development. A 12 hectare plot of land (30 acres) along the entire shoreline of the No. 52 village has been identified for this purpose.		lines to fish along the shoreline, and in swamps and canals. e) Families fishing in the No. 52 reef f) Local communities engaged in seasonal capture of sardines. **ES Linkages:** Socio/Economic (Boat Building)			
Crabbing	Provisioning	• Crabbing has increased significantly throughout the NDC because persons who were unemployed following the closure of the Skeldon Sugar Estate sought new employment. Crabbing occurs mainly along the shoreline of	Mangroves, beach	a) Local communities who regularly catch sheriga crabs	a) High b) Essential	a) Moderate b) Moderate	**a) Critical** **b) Critical**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		No. 65 and No. 66. Sheriga crabs are captured regularly throughout the year as a livelihood activity. • During the crabbing season, more than 50 persons catch crabs as a livelihood activity. Some persons fill the trays of small canter trucks with crabs caught at No. 65. • Crabbers travel long distances to catch crabs in the NDC. During the previous crab season, persons travelled from Canje and Linden (Region 10) to catch crabs.		b) Local communities and other persons engaged in seasonal crabbing **ES Linkage:** Mangroves, Trapping/Hunting			
Agriculture: Cultivated Crops	Provisioning	• Cash crop cultivation on sea dams throughout the NDC. There is a sand reef in No. 58 and No. 59 villages where cash crops are also cultivated. Commonly cultivated crops include coconuts, watermelon, tomatoes, eggplant, bora, etc. • Cash crop cultivation also occurs on sea dams in other areas along the shoreline has also increased as persons who were unemployed as a result of the COVID-19 pandemic sought alternative livelihoods.	Sea dams and sand reefs	Local communities engaged in crop cultivation on sea dams	High	Moderate	**High**
Trapping/Hunting: Wild Meat	Provisioning	• Hunting for iguanas and birds for sustenance and sale has increased throughout the shoreline of the NDC. Some persons capture plover birds at nights using cast nets. The increase in hunting along the shoreline is also attributed to higher levels of unemployment following the closure of the Skeldon Sugar Estate.	Mangroves, shoreline	Local communities hunting in the mangroves **ES Linkages:** Mangroves, Crabbing	High	Moderate	**High**
Agriculture: Livestock Grazing	Provisioning	• Generally, most livestock is grazed in pasturelands in the back dam of the NDC. However, following the severe floods in 2021, most livestock had to be moved, temporarily, to the shoreline area to graze. Pastures have since been rebuilt and most livestock has returned to back dam pastures. However, a few persons still use the sea dams and shoreline areas of the NDC to graze livestock including cattle, goats and sheep.	Mangroves, Sea Dam, Pastures	Local communities who graze animals on sea dams and along the shoreline	Moderate	Moderate	**Medium**
Aquatic Transportation	Provisioning	• Vessels that facilitate trading between Guyana and Suriname (mainly products for which no taxes are paid) land along the shoreline in No. 61 to No. 63, No, 68, No. 69 and No. 73.	Beach, riverine ecosystem,	a) Local communities engaged in trading with Suriname	a) Moderate b) High	a) High b) High	**a) Low** **b) Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• There is a landing site adjacent to the Complex #66 landing site that facilitates the transportation of produce (vegetables, ground provisions, fruits and freshwater fish) to local markets via the Anaboris Creek. When dams are in poor condition during the wet season, fertilizers and other inputs are also transported to farmlands via this landing site.		b) Local communities using the docking area adjacent to Complex #66 for inland transportation **ES Linkages:** Ritual/Religious, Recreation			
Social/Economic: Boat Building	Provisioning	• Boat building occurs on both sides of the dam at Complex #66. Surinamese fisherfolk also order fishing boats at the boat building sites at Complex #66 due to the quality of wood used in Guyana and the skills of the boat builders. • Facilities for boat construction and repairs are located at the No. 65 outfall.	Coastal	Local fisherfolk, boat builders, lumber dealers **ES Linkage:** Fishing	Essential	Moderate	**Critical**
Social/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Social/Economic: Fish Products	Provisioning	• Salt fish drying operation close sea dam in No. 65. • Fish glue packaging operation close to the sea dam in No. 68. • Fish drying operation close to the sea dam in No. 69.	Coastal	Local communities processing fish products **ES Linkage:** Fishing	Moderate	High	**Low**
Mangrove Materials	Provisioning	• Mangroves are harvested throughout the NDC to be used to support construction and for gardening. Harvesting of mangroves is prohibited and the NDC responds to complaints from residents about illegal mangrove harvesting. However, the NDC does not have the capacity to monitor use of mangroves.	Mangroves	Local communities harvesting mangroves	Moderate	Moderate	**Medium**
Religious/Ritual	Cultural	• Religious activities are held on the shoreline between No. 61 and No. 63 by approximately 20 to 50 persons daily and hundreds on weekends. Some families visit the No. 63 beach to scatter ashes of the deceased. • Local Christian communities also conduct baptisms in the nearshore of the No. 63 beach.	Beach, shoreline, coastland	Local communities of Hindus and Christians who conduct: a) Religious activities at No. 63 beach	a) Essential b) Moderate c) Moderate	a) Low b) Moderate c) Moderate	**a) Critical** **b) Medium** **c) Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• A Hindu temple devoted to the worship of Maha Kali is located along the access road leading to the No. 63 Beach. • Religious activities also occur at No. 73 beach with 20 persons daily and more on weekends. • In general, religious activities are held throughout the NDC where there is easy access to the shoreline including No. 69, No. 70, No. 71 and No. 73 villages.		b) Religious activities on at the Maha Kali temple c) Religious activities at other locations in the NDC **ES Linkages:** Fishing, Recreation			
Tourism and Recreation	Cultural	• Approximately 100 persons use the beach between No. 61 to No. 63 daily for recreational purposes. Persons visiting the area can drive on the beach between No. 60 to No. 63 village. • Hundreds or thousands of persons visit this area on weekends and thousands during special holidays like Easter. A regatta is also held annually around the same time as the Phagwah holidays and thousands of people visit this beach. People from outside the NDC district also visit for recreational purposes. • Recreational activities on the beach between No. 61 to No. 63 supports many livelihoods. On weekends and special holidays, some persons set up bars and mobile restaurants (BBQ and chips) along the beach. • The First Lady of Guyana plans to spearhead a project to construct a fun park at the No. 63 beach. • The beach from No. 69 to No. 70 beach is used by 20 to 50 persons daily and over 100 on weekends and holidays. • The koker at No. 73 village is used for relaxation and recreation and some persons also have cook outs in this area.	Coastal and Marine	Local communities in NDC, Region 6 and other areas of Guyana using: a) No. 63 beach b) No. 69 to 70 beach and other beaches, recreational sites in the NDC **ES Linkages:** Fishing, Ritual/Religious	a) Essential b) High	a) Low b) Moderate	**a) Critical** **b) High**
Global Climate Regulation	Regulating	• Extensive mangrove cover along some sections of the shoreline of the NDC supports carbon sequestration.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Erosion Regulation and Shoreline Protection	Regulating	• Mangrove forest covers most of the NDC offering protection and aids in capturing sediments along the shoreline. Mangroves, sand reefs and earthen dams are the primary sea defences along the shoreline of the NDC. • However, there is significant erosion along some sections of the shoreline. In particular, significant erosion required the emergency installation of rip raps from No. 60 to No. 61. According to the NDC, the Government plans to extend rip rap installations from No. 61 to No. 65.	Mangrove Forests, Coastal	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Essential	Moderate	**Critical**
Primary Production and Habitat Provision	Supporting	• Mangroves provide habitats for wild bees, birds, crabs, fish and shrimp in the mangroves.	Mangroves	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	High	Moderate	**High**
NDC 49 - Corriverton Town Council – Population estimate 15,000 people (Stable)							
Fishing: Wild-Caught Fish and Shellfish	Provisioning	• There is a landing site for approximately 20 artisanal vessels at No. 79 village. All of these vessels are licenced by the Suriname authorities to fish in the Corentyne River (BV licences). The number of vessels operating at this landing site has decreased because of challenges in obtaining licences to fish in Suriname. Vessels that are have lengths of less than 4.8 meters (16 feet) may fish without a Surinamese licence. • During the sardine season, more than nine vessels fish in the Corentyne River for sardines. These vessels land at the No. 79 fishing landing site where markets are easily accessible. During off-season for sardines, these vessels travel farther south in the Corentyne River to capture fresh water fishes. • Locals also use pin seines, hand nets or haul seines close to the shoreline to catch sardines during the season. Sardine fishing during the season is done for sustenance and for recreation.	Marine environment; Mangroves; Drainage canals;	a) Fisherfolk who use the No. 79 landing site (including use by sardine vessels seasonally) b) Local communities fishing along the shoreline c) Local communities catching sardines seasonally **ES Linkages:** Fishing, Boat Building, Recreation	a) Essential b) High c) High	a) Low b) Moderate c) Moderate	**a) Critical** **b) High** **c) High**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Approximately 30 persons fish daily using cast nets and seines catching mullet and shrimp. This type of fishing is done along the shoreline between No. 75 to No. 77.					
Food: Cultivated Crops	Provisioning	• Several persons are engaged in cash crop and fruit cultivation in most areas of the shore and sea dam at Scottsburg, Dukestown, and No. 75 Village. Crop cultivation on sea dams is decreasing and this may be attributed to improvements to sea defences with the installation of rip raps in Line Path, Springlands, Scottsburg and No. 78 to No. 79.	Sea dam	Local farmers, residents cultivating crops on sea dams **ES Linkage:** Socio/Economic (Squatting)	Low	Moderate	**Low**
Agriculture: Livestock Grazing	Provisioning	• There are fewer than 50 heads of cows, sheep and goats grazing along the shoreline and on sea dams. According to the bylaws of the Town Council, there should be no Livestock Grazing in the township. • Large poultry farm located close to the shoreline in No. 83 village.	Mangroves, Sea Dam, Pastures	a) Local communities grazing livestock on sea dams b) Owner of the poultry farm	a) Low b) Moderate	a) High b) High	**a) Low** **b) Low**
Trapping/Hunting: Wild Meat	Provisioning	• More than 10 persons are engaged in hunting of iguanas on a weekly basis along the shoreline in Scottsburg. A few rabbits are also caught for meat.	Mangroves, shoreline	Local communities hunting in the mangroves **ES Linkages:** Mangroves	Moderate	Moderate	**Medium**
Social/Economic: Markets and Commerce	Provisioning	• There are commercial activities in Corriverton comprising an open-air municipal market, wholesale and retail enterprises, restaurants and entertainment among others.	River bank and lands used for commercial purposes	Businesses and consumers relying on the commercial activities in Corriverton **ES Linkages:** Food, Tourism, Transportation	Essential	Low	**Critical**
Social/Economic: Renewal Energy	Provisioning	• A private company has installed a wind turbine of 275 KVA capacity on the riverbank, but it is not yet operational.	Coastal	Local businessmen Township	Low	Moderate	**Low**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
Social/Economic: Wharf for Passengers & Cargo	Provisioning	• The wharf located at No. 79 wharf is used by farmers and loggers for transport of their produce from Orealla and Siparuta to Corriverton. • Passengers use the 'backtrack route' at No. 78 Village to access the speedboat service to Suriname. This service was temporarily suspended due to the COVID-19 pandemic. When in operation, the ferry to Suriname lands at Moleson Creek, which is not located in the municipality. • There is a wharf operated by GUYSUCO at Skeldon.	Coastal; River	Local boatmen, Businessmen; locals; Guyanese, Surinamese using: a) Wharf in Line Path b) Speedboat service to Suriname c) GUYSUCO wharf **ES Linkage:** Transportation	a) Essential b) Low c) High	a) Moderate b) Moderate c) Moderate	**a) Critical** **b) Low** **c) High**
Social/Economic: Boat Building	Provisioning	• Boat building at No. 83 Village outfall daily (Line Path 'E'). • Boat building at Line Path 'D'. This operation is not regularly active and works based on orders.	Coastal	Local fisherfolk, boat builders, lumber dealers involved in boat building at: a) No. 83 b) Line Path 'D' **ES Linkages:** Fishing, Transportation	a) High b) Moderate	a) Moderate b) Moderate	**a) High** **b) Medium**
Socio/Economic: Housing	Provisioning	• Residential areas comprising of housing schemes developed by the Government.	Residential lands	Local communities residing in residential areas	Essential	Low	**Critical**
Social/Economic: Squatting	Provisioning	• Squatting occurs at Dukestown, Scottsburg, and No. 78 and No. 79 villages. At No. 79 village, there are approximately 20 structures on the Government reserve and the municipality has requested intervention from the relevant authorities.	Coastal	Local fisherfolk, local people squatting in the municipality **ES Linkage:** Crop Cultivation	Moderate	High	**Low**
Religious/Ritual	Cultural	• Religious activities are held by local Hindu communities along the shoreline of No. 79, Line Path, Scottsburg, Springlands, and Spring Garden. At No. 79, a shrine has been created on the sea dam. Approximately 50 persons use these areas daily and hundreds on weekends.	Coastal	a) Local Hindu communities using the shoreline area for worship b) Local Christian communities	a) High b) Moderate	a) Moderate b) Moderate	**a) High** **b) Medium**

Service	Type of Service	Description and Examples in the Study Area based on Stakeholder Input	Relevant Land Use/ Habitat Categories	Beneficiaries and ES Linkages	Importance to Beneficiaries (Low- Essential)	Replaceability (Low-High)	Priority Rating (Importance x Replaceability)
		• Some Christian groups also perform baptisms using the Scottsburg beach.		conducting baptisms along the shoreline **ES Linkage:** Recreation			
Tourism and Recreation	Cultural	• Locals use beaches and shoreline areas in the municipality for relaxation and recreation. The most commonly used area is the Scottsburg beach because of the large area available. The Line Path 'F' area is also used for recreation. • An area along the river bank of No. 79 Village is used for recreational purposes. In addition, an area in this village has been earmarked by the President for the development of an eco-friendly park for public use.	Coastal and River	Locals using beaches and shoreline areas for recreation **ES Linkage:** Ritual/Religious	High	Moderate	**High**
Shoreline Protection and Erosion Regulation	Regulating	• There has been significant erosion of mangrove cover along the river bank of the municipality. The municipality requested support from NAREI to replant mangroves in the area. However, rip rap sea defense structures have been installed along the shoreline in Line Path, Springlands, Scottsburg and No. 78 to No. 79.	Mangrove Forests, Coastal	Local communities **ES Linkages:** Habitat Provision, Shoreline Protection, Crabbing, Fishing	Moderate	Moderate	**Medium**

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ENHANCED COASTAL SENSITIVITY MAPPING

Ecosystem Services Mapbook (Regions 1 - 6)

Esso Exploration & Production Guyana Limited (EEPGL)

2022




INTRODUCTION

In June 2017, the Environmental Protection Agency (EPA) issued an Environmental Permit to Esso Exploration and Production Guyana Limited (EEPGL) for the Liza Phase 1 Development Project. A condition of the Environmental Permit required EEPGL to conduct field studies to verify (by ground truthing) selected shoreline and coastal habitat classifications that were included in coastal sensitivity maps provided in the Liza Phase 1 Development Project Environmental Impact Assessment (EIA). Subsequently, in August 2017, the EPA requested the inclusion of shoreline and coastal ecosystem services in the coastal sensitivity mapping project for Regions 1 to 4. On its own initiative, EEPGL surpassed the regulatory requirement by also mapping ecosystem services for the Regions 5 and 6.

The Enhanced Coastal Sensitivity Mapping Study – Ecosystem Services Study – Year 1 was the first study of its kind in Guyana. It contributed significantly to the existing base of knowledge on the use of resources along the shoreline and the immediate coastal areas by coastal communities in Regions 1 to 6 because these were not previously compiled comprehensively. More importantly, all of the ecosystem services were mapped. ESS-1 was implemented over the period 2017 to 2019 in two phases. The first phase entailed meetings with local stakeholders (Neighbourhood Democratic Councils [NDCs], Village Councils [VCs], Community Development Councils [CDCs], Town Councils [TCs] and community members) to gather information on the relationship between coastal communities and the natural environment. Following the meetings, ecosystem services reported by local stakeholders were ground verified by the study team. During the second phase, the maps and key findings of the first phase were presented to local stakeholders for validation.

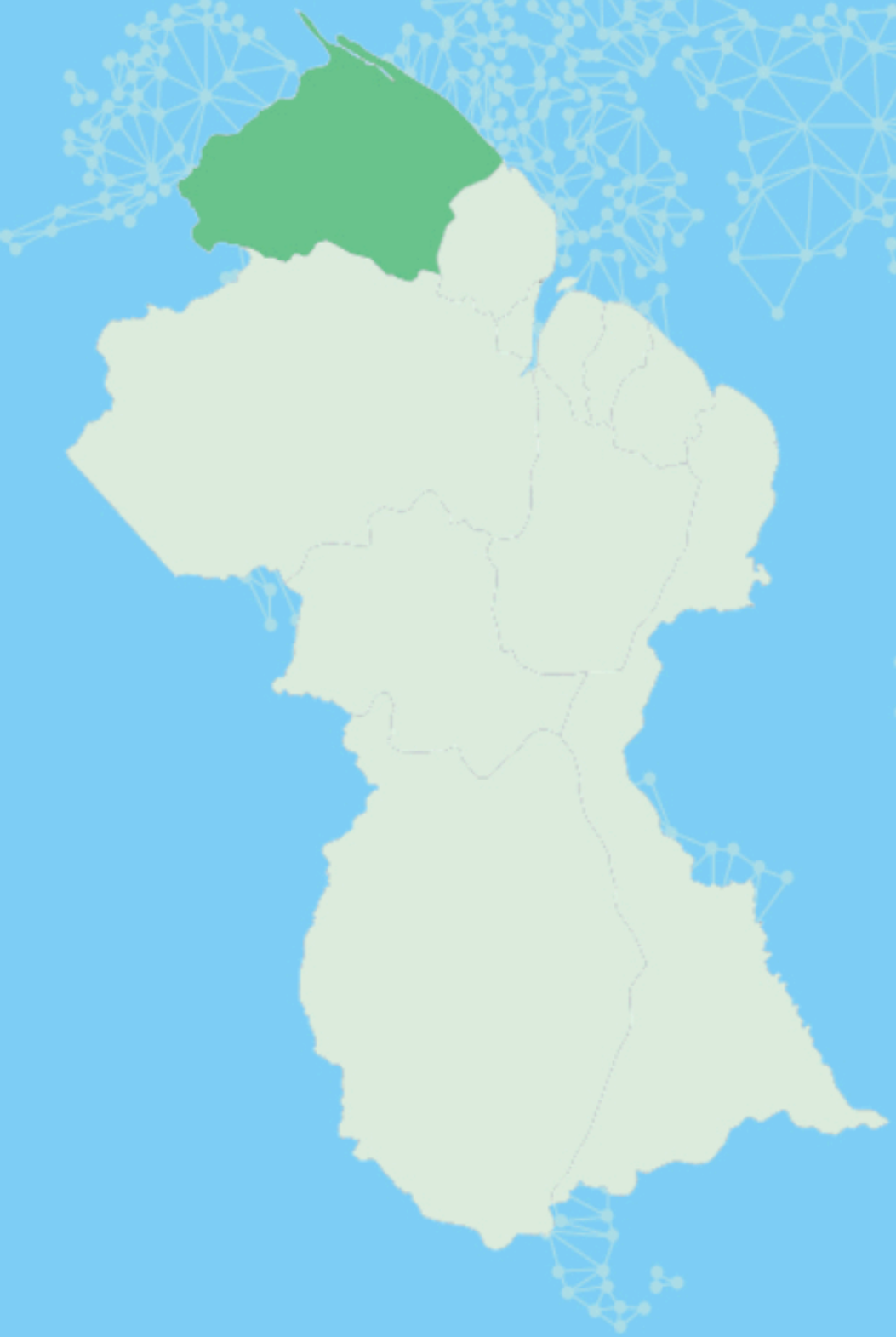
In December 2021, EEPGL contracted Environmental Management Consultants Inc. (EMC) to update the coastal sensitivity maps for Regions 1 to 6 . The updated maps were expected to build on the work completed for previous studies particularly given that the defined scopes and methodologies remain relevant. In addition, lessons learned were used to improve data collection and analysis methodologies, particularly the GIS approach.

This Map Book presents the updated coastal sensitivity maps for ecosystem services identified in the six coastal regions based on feedback provided by local stakeholders and observations by the study team during ground verification exercises. However, the approach to mapping in Region 1 was unique. Ground verification of ecosystem services reported by local stakeholders within the boundaries of the villages surveyed were limited by access and time on the ground. These include ecosystem services such as crop cultivation, livestock rearing, and traditional practices among others, which are important to villagers but are dispersed in the village. As such, points mapped within the footprint of the villages are symbolic of the types of services from which the villages benefit. These points are not location-specific and do not represent the spatial extent of these activities. However, all ESS points and polygons located along the Region 1 shoreline are location-specific and represent the spatial extent of the reported activities. Field work to update the maps was conducted over the period January to June 2022.

The following maps are presented for each region in this Map Book:

- Regional maps and maps for every district surveyed in each region of the ecosystem service locations, by type, identified by local stakeholders during the engagement process and by the study team during ground verification. Ecosystem services are represented by the color of the symbols on the map. The priority ratings (*Critical, High, Medium, or Low*) are represented by the size of symbol, and services with spatial spread that were of *Critical or High Priority* are represented by polygons.

- Regional heat maps for hotspots of priority ecosystem services (rated to be of *Critical or High Priority*).



REGION 1

(Barima-Waini)

Coastal Sensitivity Mapping - Ecosystem Services

Barima / Waini

Date of Creation: October 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region
	Guyana	1

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

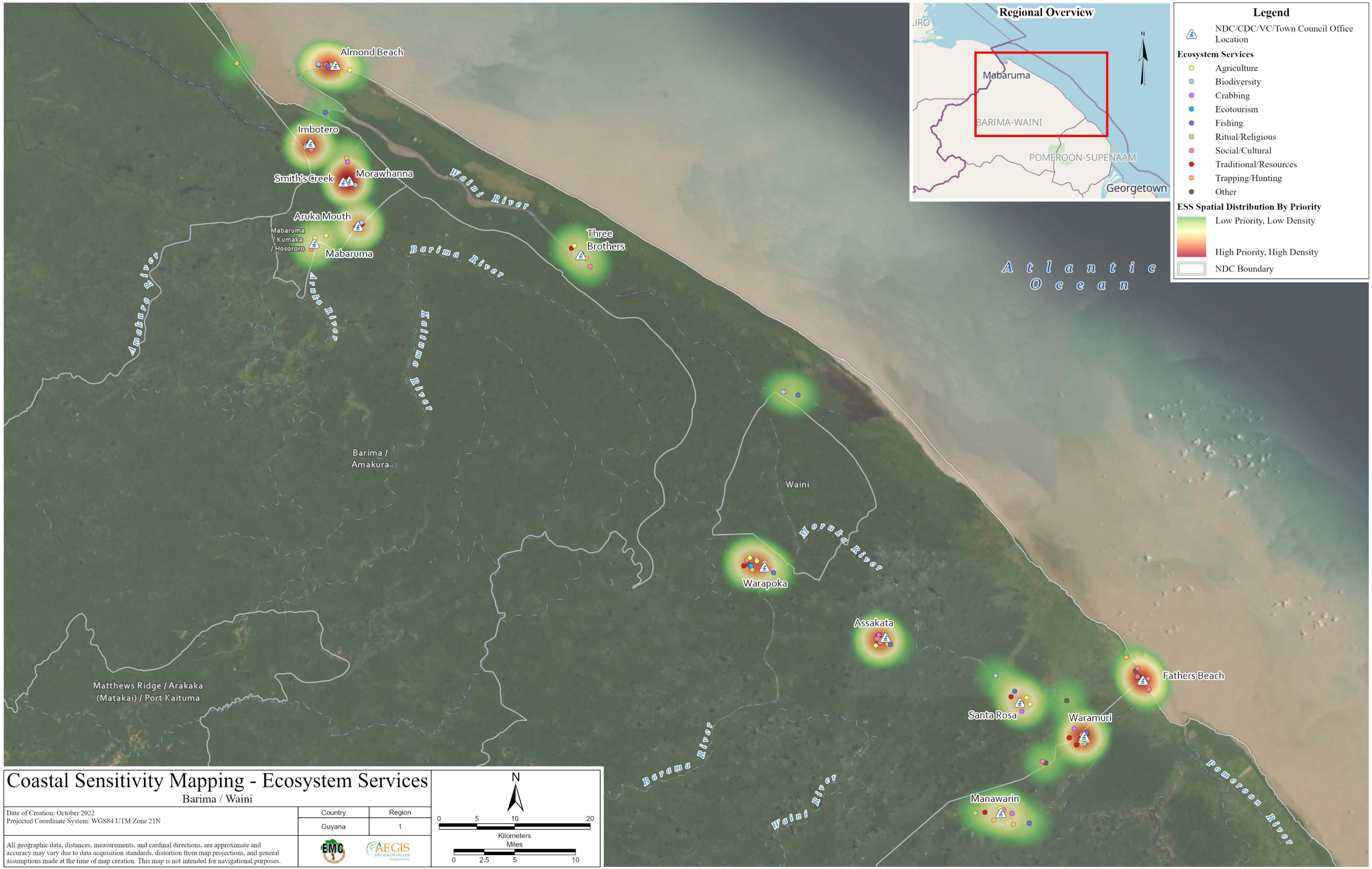
N

0 5 10 20

Kilometers

Miles

0 2.5 5 10



Coastal Sensitivity Mapping - Ecosystem Services

Barima / Waini

Date of Creation: October 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region
Guyana	1

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 5 10 20
Kilometers
Miles
0 2.5 5 10

Coastal Sensitivity Mapping - Ecosystem Services

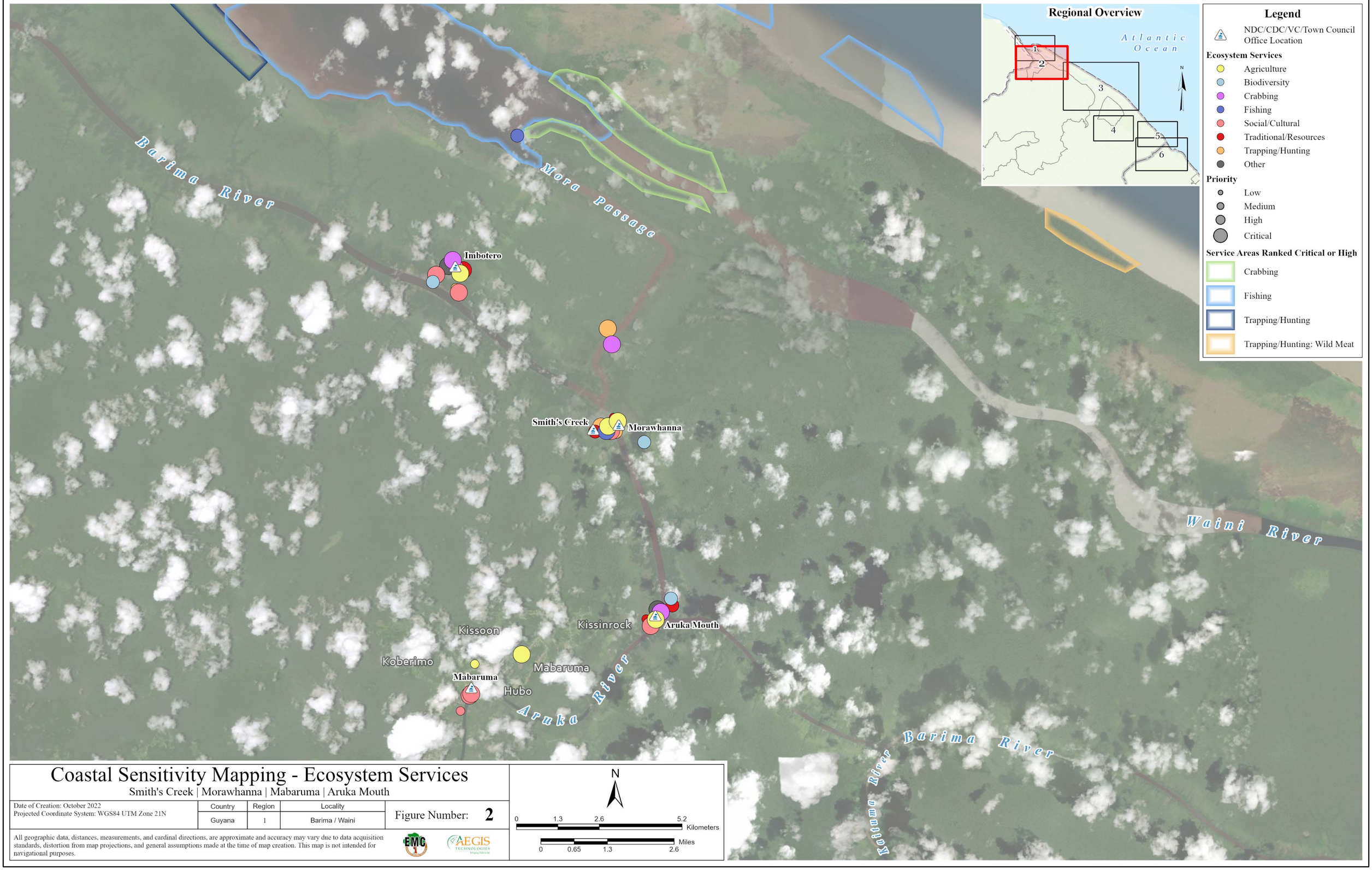
Almond Beach | Imbotero

Date of Creation: October 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	1	Barima / Waini

Figure Number: **1**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.



Coastal Sensitivity Mapping - Ecosystem Services

Smith's Creek | Morawhanna | Mabaruma | Aruka Mouth

Date of Creation: October 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	1	Barima / Waini

Figure Number: **2**

N

0 1.3 2.6 5.2 Kilometers

0 0.65 1.3 2.6 Miles

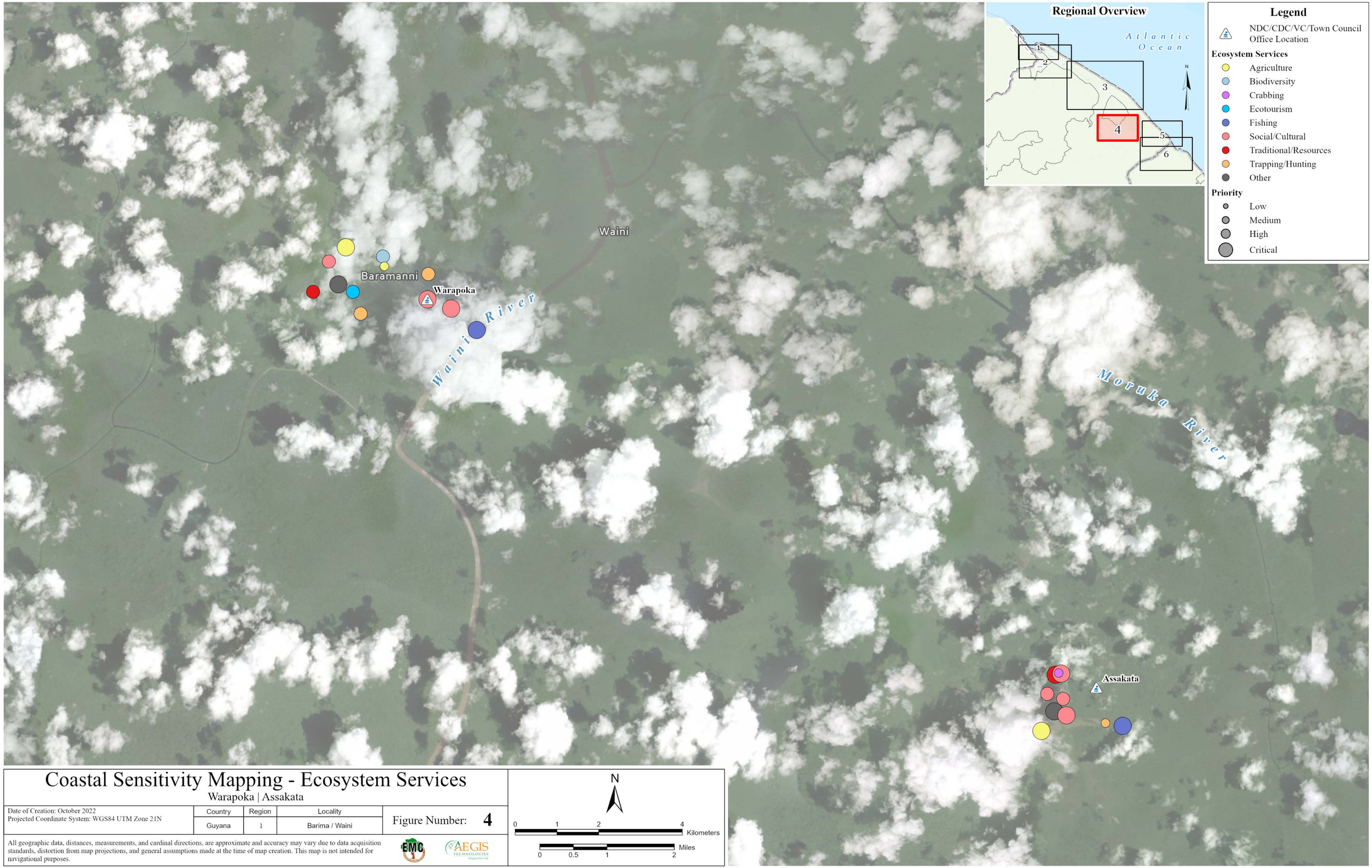
All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

Coastal Sensitivity Mapping - Ecosystem Services

Three Brothers

Date of Creation: October 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region	Locality	Figure Number: 3
	Guyana	1	Barima / Waini	

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.



Coastal Sensitivity Mapping - Ecosystem Services

Warapoka | Assakata

Date of Creation: October 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	1	Barima / Waini

Figure Number: **4**

N

0 1 2 4 Kilometers

0 0.5 1 2 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

EMC

AEGIS TECHNOLOGIES

Coastal Sensitivity Mapping - Ecosystem Services

Fathers Beach

Date of Creation: October 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	1	Barima / Waini

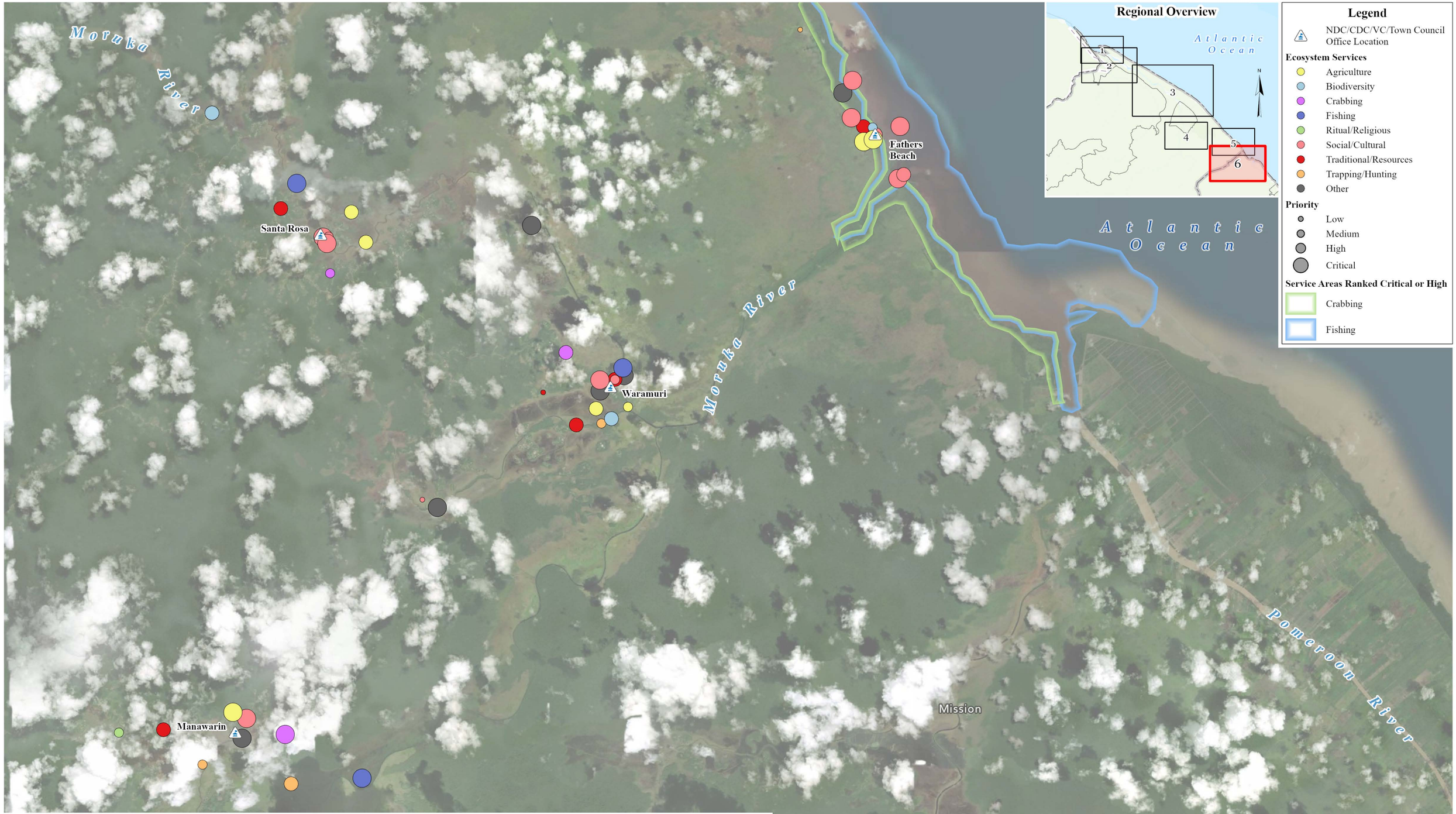
Figure Number: **5**

N

0 1 2 4 Kilometers

0 0.5 1 2 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.



Coastal Sensitivity Mapping - Ecosystem Services

Santa Rosa | Fathers Beach | Waramuri | Manawarin

Date of Creation: October 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	1	Barima / Waini

Figure Number: **6**

N

0 1.3 2.6 5.2 Kilometers

0 0.65 1.3 2.6 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

REGION 2

(Pomeroon-Supenaam)

Coastal Sensitivity Mapping - Ecosystem Services

Pomeroon / Supenam

Date of Creation: July 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region
	Guyana	2

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

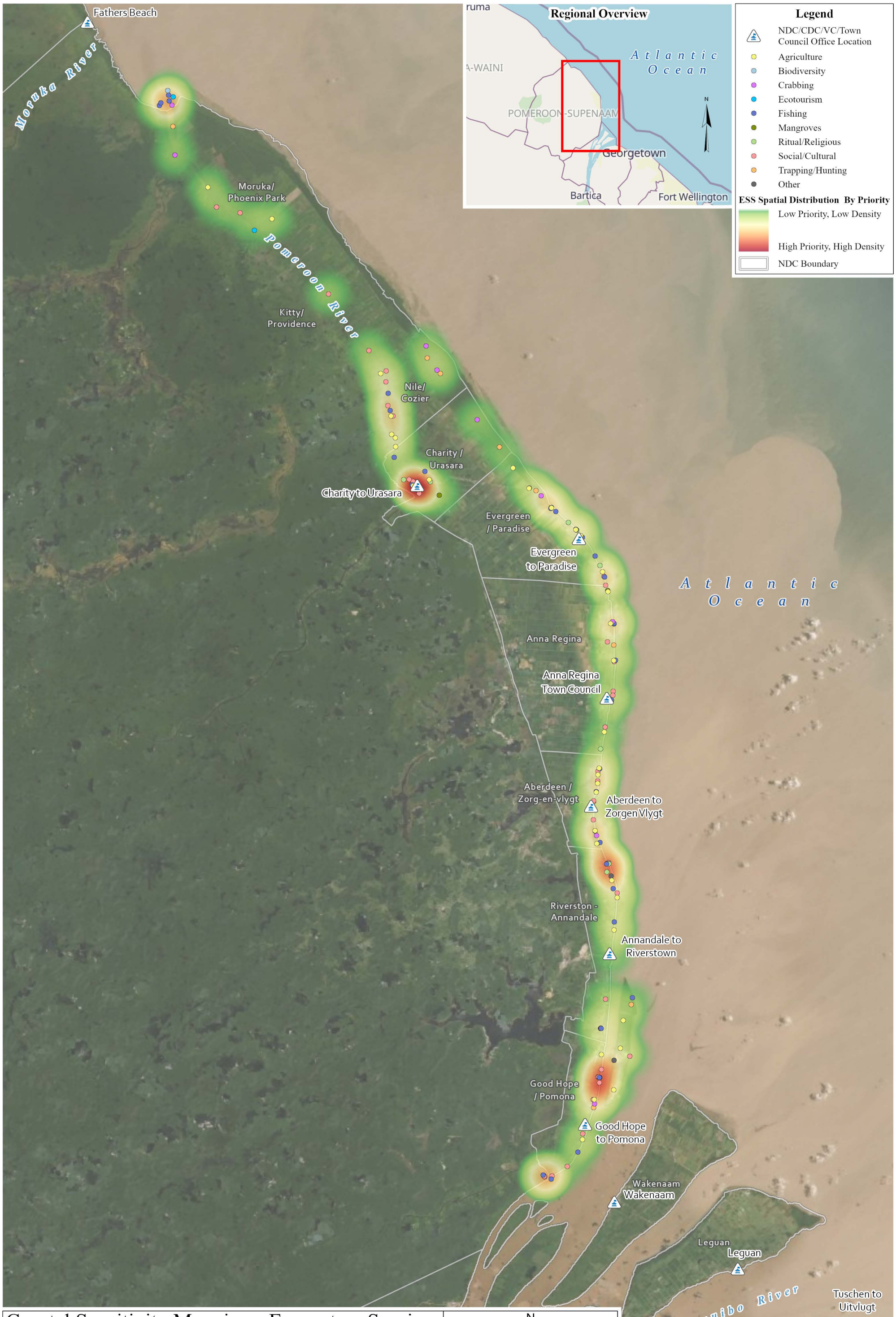
N

0 2 4 8

Kilometers

Miles

0 1 2 4



Coastal Sensitivity Mapping - Ecosystem Services

Pomeroon / Supenam

	Country	Region
Date of Creation: July 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Guyana	2

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 2 4 8

Kilometers

Miles

0 1 2 4

Fathers Beach

Waramuri

Moruka River

Moruka/Phoenix Park

Mission

The Bay

Curemeru Landing

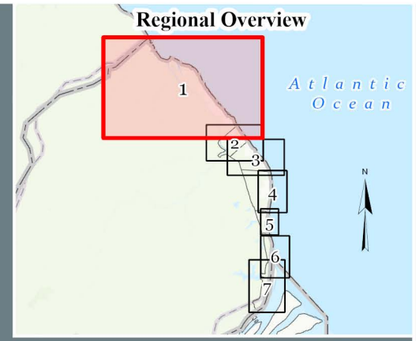
Kitty/Providence

Nile/Cozier

Pomeroon River

Atlantic Ocean

Atlantic Ocean



Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Ecotourism
- Fishing
- Social/Cultural

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Agriculture: Cultivated Crops
- Aquatic Transportation
- Crabbing, Hunting/Trapping, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision

Coastal Sensitivity Mapping - Ecosystem Services

Rest of Region 2

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	2	Pomeroon / Supenaam

Figure Number: **1**

N

0 1.4 2.8 5.6 Kilometers

0 0.7 1.4 2.8 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

EMC

AEGIS TECHNOLOGIES

Kitty/Providence

Nile/Cozier

Charity

New Road

Charity to Urasara

Amazon

Somerset & Berks

Evergreen

Maria's Delight

Better Hope

Better Success

Westbury

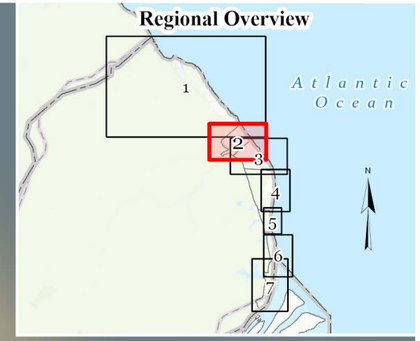
Dartmouth

Pomeroon River

Atlantic Ocean

Atlantic Ocean

Regional Overview



Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Fishing
- Mangroves
- Ritual/Religious
- Social/Cultural

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Agriculture: Cultivated Crops
- Aquatic Transportation
- Crabbing, Hunting/Trapping, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
- Wharfs and Fish Landing Site

Coastal Sensitivity Mapping - Ecosystem Services

Charity - Urasara

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	2	Pomeroon / Supenaam

Figure Number: **2**

N

0 0.5 1 2 Kilometers

0 0.25 0.5 1 Miles

EMC

AEGIS TECHNOLOGIES

Coastal Sensitivity Mapping - Ecosystem Services

Evergreen - Paradise

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	2	Pomeroon / Supenaam

Figure Number: **3**

N

0 0.5 1 2 Kilometers

0 0.25 0.5 1 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

EMC

AEGIS TECHNOLOGIES

Coastal Sensitivity Mapping - Ecosystem Services

Anna Regina

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	2	Pomeroon / Supenaam

Figure Number: **4**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.4 0.8 1.6 2.4 Kilometers

0 0.2 0.4 0.8 1.2 Miles

Coastal Sensitivity Mapping - Ecosystem Services

Aberdeen - Zorg-en-Vlygt

Date of Creation: August 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region	Locality	Figure Number: 5
	Guyana	2	Pomeroon / Supenaam	

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.25 0.5 1 1.5 Kilometers

0 0.13 0.25 0.5 0.75 Miles

Coastal Sensitivity Mapping - Ecosystem Services

Annandale - Riverstown

Date of Creation: August 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region	Locality	Figure Number: 6
	Guyana	2	Pomeroon / Supenaam	

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.4 0.8 1.6 2.4 Kilometers

0 0.2 0.4 0.8 1.2 Miles

Coastal Sensitivity Mapping - Ecosystem Services

Good Hope - Pomona

Date of Creation: August 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region	Locality	Figure Number: 7
	Guyana	2	Pomeroon / Supenaam	

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.5 1 2 3 Kilometers

0 0.25 0.5 1 1.5 Miles

REGION 3

(Essequibo Islands-West Demerara)


Regional Overview
POMEROON-SUPENAAM
Atlantic Ocean
Georgetown
Bartica
Fort Wellington
New Amsterda
N
Legend
NDC/CDC/VC/Town Council Office Location
Ecosystem Services
Agriculture
Biodiversity
Crabbing
Ecotourism
Fishing
Ritual/Religious
Social/Cultural
Trapping/Hunting
Other
Priority
Low
Medium
High
Critical
Service Areas Ranked Critical or High
Agriculture: Cultivated Crops
Aquatic Transportation
Crabbing, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
Crabbing, Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
Crabbing, Hunting/Trapping, Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
Religious/Ritual
Tourism and Recreation
NDC Boundary
Good Hope / Pomona
Good Hope to Pomona
Wakenaam
Essequibo River
Wakenaam
Leguan
Leguan
Atlantic Ocean
Essequibo River
Tuschen to Uitvlugt
Greenwich Park Vergenoegen
Hydronie to Good Hope
Mora to Parika
Hydronie / Good Hope
Greenwich Park / Vergenoegen
Mora / Parika
Uitvlught /Tuschen
Stewartville to Cornelia Ida
Hague to Blankenburg
La Jalousie to Nouvelle Flanders
Stewartville / Cornelia Ida
La Jalousie / Nouvelle Flanders
Hague / Blankenburg
Best / Klein Pouderoyen
Best to Klien Pouderoyen
City of Georgetown
Malgre Tout / Meer Zorgen
Canals Polder
Demerara River
Nismes / La Grange
Eccles / Ramsburg
Essequibo River
Sparta / Bonasika And Rest Of Essequibo Islands
Coastal Sensitivity Mapping - Ecosystem Services
Essequibo Islands / West Demerara
Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N
Country
Guyana
Region
3
All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.
N
0 1.5 3 6
Kilometers
Miles
0 0.75 1.5 3

Coastal Sensitivity Mapping - Ecosystem Services

Essequibo Islands / West Demerara

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region
Guyana	3

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 1.5 3 6

Kilometers

Miles

0 0.75 1.5 3

Regional Overview

Legend

- NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Biodiversity
- Crabbing
- Ecotourism
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting
- Other

ESS Spatial Distribution By Priority

- Low Priority, Low Density
- High Priority, High Density
- NDC Boundary

Atlantic Ocean

Essequibo River

Good Hope / Pomona

Good Hope to Pomona

Wakenaam

Wakenaam

Leguan

Leguan

Essequibo River

Mora to Parika

Hydronie to Good Hope

Greenwich Park Vergenoegen

Tuschen to Uitvlugt

Stewartville to Cornelia Ida

Hague to Blankenburg

La Jalousie to Nouvelle Flanders

Best to Klien Pouderoyen

Mora / Parika

Hydronie / Good Hope

Greenwich Park / Vergenoegen

Uitvlught /Tuschen

Stewartville / Cornelia Ida

Hague / Blankenburg

La Jalousie / Nouvelle Flanders

Best / Klein Pouderoyen

Malgre Tout / Meer Zorgen

Sparta / Bonasika And Rest Of Essequibo Islands

Canals Polder

Nismes / La Grange

Eccles / Ramsburg

City of Georgetown

Demerara River

Essequibo River

Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

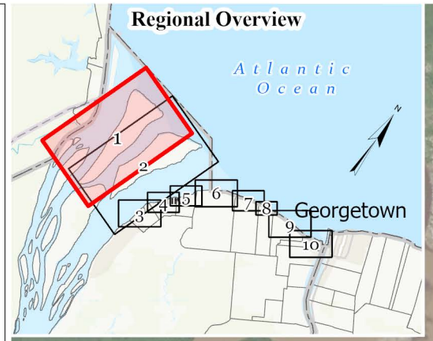
- Agriculture
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting
- Other

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Agriculture: Cultivated Crops
- Crabbing, Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision



Good Hope to Pomona
Good Intent
Supenaam
Spring Garden
Good Hope
Atlantic Ocean
Karabaru Island
Essequibo River
Wakenaam Island
Great Troolie Island
Wakenaam
Essequibo River
Leguan Island

Coastal Sensitivity Mapping - Ecosystem Services

Wakenaam

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	3	Essequibo Islands/ Left Bank Essequibo River

Figure Number: **1**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

0 0.6 1.2 2.4 Kilometers

0 0.3 0.6 1.2 Miles

Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

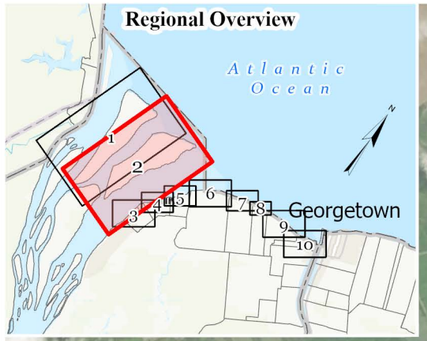
- Agriculture
- Biodiversity
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting
- Other

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

Crabbing, Hunting/Trapping, Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision



Essequibo River

Atlantic Ocean

Leguan Island

Leguan

Essequibo River

Coastal Sensitivity Mapping - Ecosystem Services

Leguan

Date of Creation: August 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region	Locality	Figure Number: 2
	Guyana	3	Essequibo Islands/ Left Bank Essequibo River	

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

EMC

AEGIS TECHNOLOGIES

0 0.6 1.2 2.4 Kilometers

0 0.3 0.6 1.2 Miles

Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

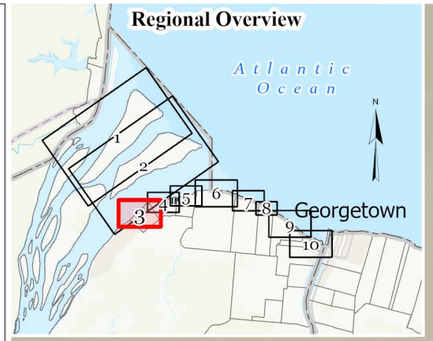
- Agriculture
- Biodiversity
- Fishing
- Ritual/Religious
- Social/Cultural
- Other

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Aquatic Transportation
- Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision



Essequibo River

Hyrdonie

Orangestein

Bushy Park

Mora to Parika

Parika

Hyde Park

Grove

Look Out

Naamryck

Salem

Mora

Coastal Sensitivity Mapping - Ecosystem Services

Mora - Parika

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	3	Essequibo Islands/ Left Bank Essequibo River

Figure Number: **3**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.2 0.4 0.8 Kilometers

0 0.1 0.2 0.4 Miles

Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision

Essequibo River

Le Destin

Farm

Hydronie to Good Hope

Ruby

Good Hope

Greenwich Park

Orangestein

Hyrdonie

Bushy Park

Coastal Sensitivity Mapping - Ecosystem Services

Hydronie - Good Hope

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	3	Essequibo Islands/ Left Bank Essequibo River

Figure Number: **4**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.15 0.3 0.6 Kilometers

0 0.07 0.15 0.3 Miles

Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

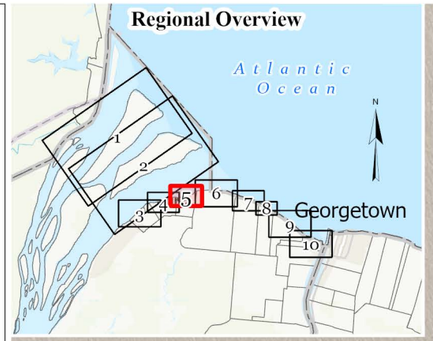
- Agriculture
- Fishing
- Ritual/Religious
- Social/Cultural

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision



Essequibo River

Vergenogen

Greenwich Park Vergenoegen

Tuschen

Philadelphia

Barnwell

Greenwich Park

Good Hope

Ruby

Farm

Hydronic to Good Hope

Tuschen de Vriended

Coastal Sensitivity Mapping - Ecosystem Services

Greenwich Park Vergenoegen

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	3	Essequibo Islands/ Left Bank Essequibo River

Figure Number: **5**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

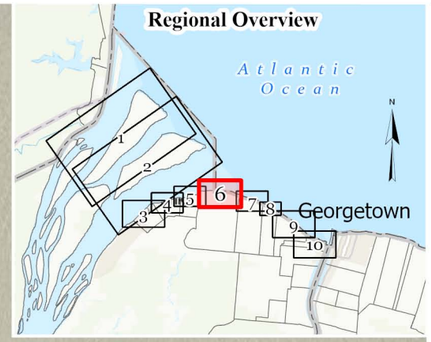
N

0 0.15 0.3 0.6 Kilometers

0 0.07 0.15 0.3 Miles

Atlantic Ocean

Essequibo River



Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Fishing
- Ritual/Religious
- Social/Cultural

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
- Religious/Ritual

Meten Meer Zorg North

Tuschen to Uitvlugt

Kastev

Meten Meer Zorg West

Meten Meer Zorg East

Tuschen

Boeraserie

De-Kinderen

Zeeburg

Uitvlugt

De Willem

Stewartville

Zeelugt

Tuschen de Vriended

Coastal Sensitivity Mapping - Ecosystem Services

Tuschen - Uitvlugt

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	3	Essequibo Islands/ Left Bank Essequibo River

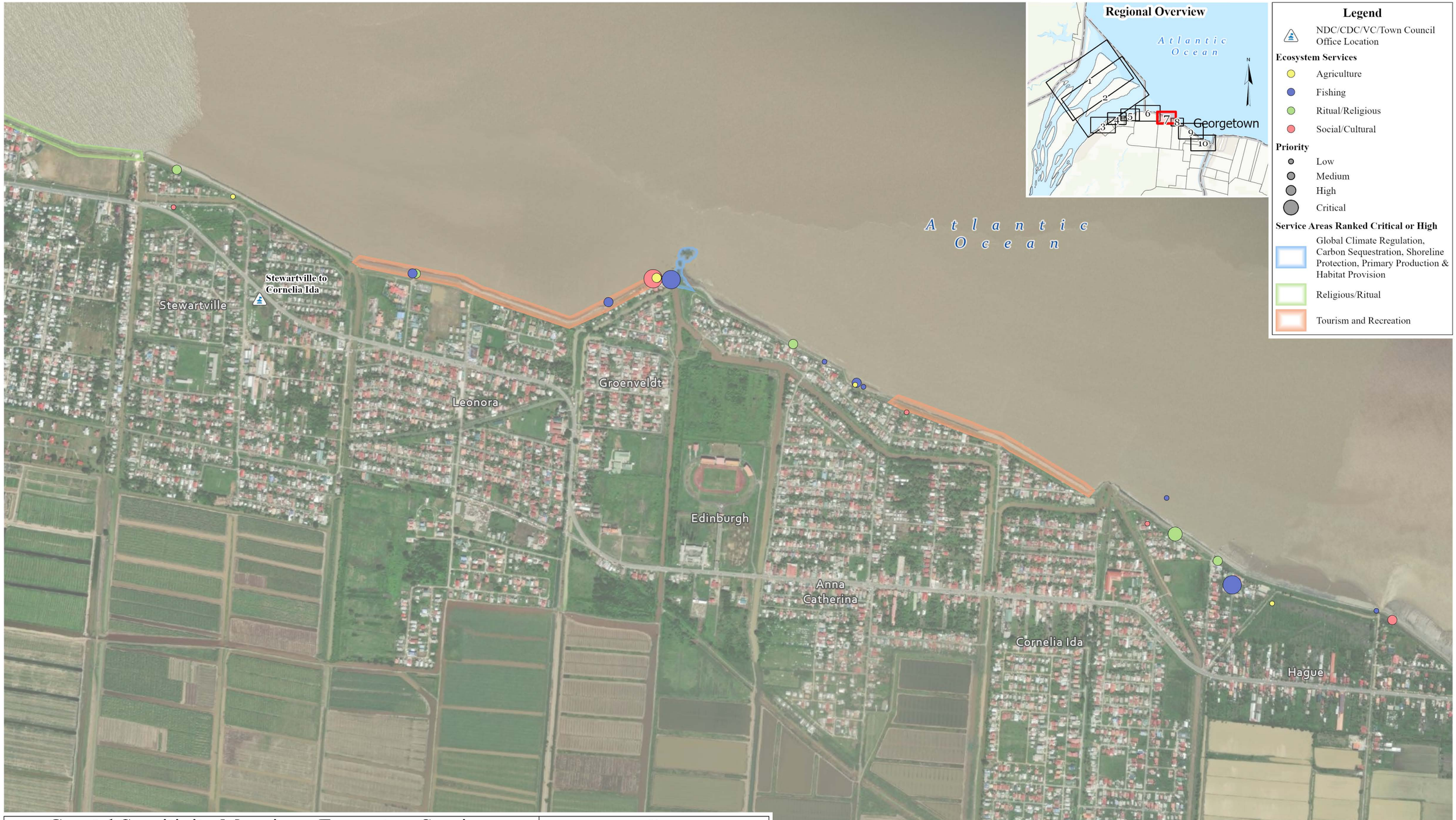
Figure Number: **6**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.2 0.4 0.8 Kilometers

0 0.1 0.2 0.4 Miles



Coastal Sensitivity Mapping - Ecosystem Services

Stewartville - Cornelia Ida

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	3	Essequibo Islands/ Left Bank Essequibo River

Figure Number: 7

N

0 0.15 0.3 0.6 Kilometers

0 0.07 0.15 0.3 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

EMC

AEGIS TECHNOLOGIES

Coastal Sensitivity Mapping - Ecosystem Services

Hague - Blankenburg

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	3	Essequibo Islands/ Left Bank Essequibo River

Figure Number: **8**

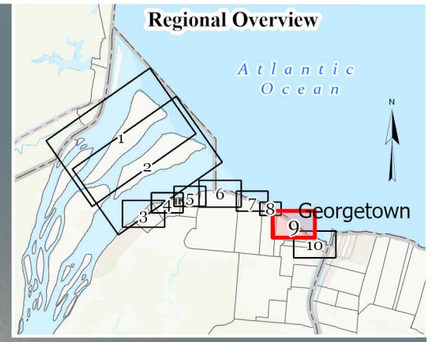
N

0 0.1 0.2 0.4 Kilometers

0 0.05 0.1 0.2 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

Blankenburg
La Jalouisie
Windsor Forrest
Ruimzigt
La Jalousie to
Nouvelle Flanders
Waller's Delight
Mary & Harlem
Rotterdam
Union
Georgetown
A t l a n t i c
O c e a n



Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Fishing
- Ritual/Religious
- Social/Cultural

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

Crabbing, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision

Coastal Sensitivity Mapping - Ecosystem Services

La Jalousie - Nouvelle Flanders

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	3	Essequibo Islands/ Left Bank Essequibo River

Figure Number: **9**

N

0 0.2 0.4 0.8 Kilometers

0 0.1 0.2 0.4 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

Coastal Sensitivity Mapping - Ecosystem Services

Best - Klien Pouderoyen

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	3	Essequibo Islands/ Left Bank Essequibo River

Figure Number: **10**

N

0 0.2 0.4 0.8 Kilometers

0 0.1 0.2 0.4 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

REGION 4

(Demerara-Mahaica)

Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Crabbing
- Ecotourism
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting
- Other

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Agriculture: Livestock Grazing
- Livestock Farming/Recreation/ Religious/Ritual
- Ports and Wharfs
- Religious/Ritual
- Tourism and Recreation
- Carbon Sequestration, Shoreline Protection, Primary Production
- NDC Boundary

Coastal Sensitivity Mapping - Ecosystem Services

Demerara / Mahaica

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region
Guyana	4

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 2 4
Kilometers
Miles
0 1 2

Atlantic Ocean

Industry to Plaisance

BetterHope to LBI

Beterverwagting toTriumph

Mon Repos to La Reconnaissance

Buxton to Foulis

Enmore to Hope

Haslington to Golden Grove

Best to Klien Pouderoyen

City of Georgetown

Demerara River

Industry / Plaisance

Better Hope / LBI

Beterverwagting / Triumph

Mon Repos / La Reconnaissance

Buxton / Foulis

Enmore / Hope

Haslington / Grove

Eccles / Ramsburg

Little Diamond / Herstelling

Mocha / Arcadia

Diamond / Golden Grove

Demerara Conservancy

Mahaica River

Unity / Vereeniging

Unity to Vereeniging

Cane Grove Land Development Scheme

Regional Overview

Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Crabbing
- Ecotourism
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting
- Other

ESS Spatial Distribution By Priority

Low Priority, Low Density

High Priority, High Density

NDC Boundary

Coastal Sensitivity Mapping - Ecosystem Services

Demerara / Mahaica

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region
Guyana	4

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 2 4

Kilometers

Miles

0 1 2

Coastal Sensitivity Mapping - Ecosystem Services

Western Georgetown

Date of Creation: August 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region	Locality	Figure Number: 1
	Guyana	4	City of Georgetown	

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.15 0.3 0.6 0.9 Kilometers

0 0.07 0.15 0.3 0.45 Miles

Coastal Sensitivity Mapping - Ecosystem Services

Northwestern Georgetown

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	4	City of Georgetown

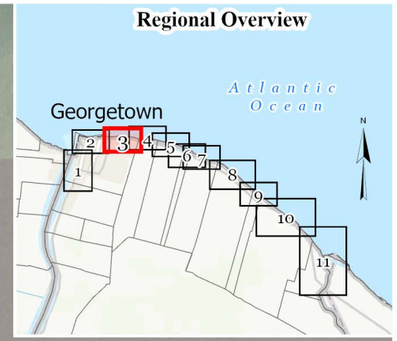
Figure Number: **2**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

Atlantic Ocean

Liliendaal

Regional Overview



Legend

Ecosystem Services

- Fishing
- Social/Cultural

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Religious/Ritual
- Carbon Sequestration, Shoreline Protection, Primary Production

Coastal Sensitivity Mapping - Ecosystem Services

Northeastern Georgetown

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	4	City of Georgetown

Figure Number: **3**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.13 0.25 0.5 Kilometers

0 0.07 0.13 0.26 Miles

Coastal Sensitivity Mapping - Ecosystem Services

Industry - Plaisance

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	4	Industry / Plaisance

Figure Number: **4**

N

0 0.13 0.25 0.5 Kilometers

0 0.07 0.13 0.26 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

EMC

AEGIS TECHNOLOGIES

Atlantic Ocean

Better Hope North

BetterHope to LBI

Felicity

Atlantic Garden

Better Hope

Brothers

Montrose

Le Ressouvenir

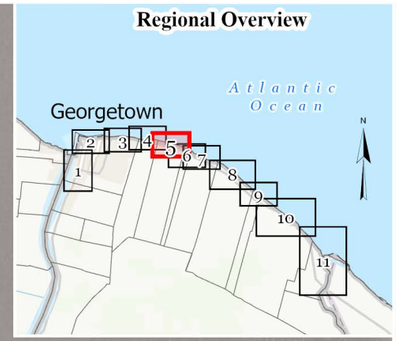
Chateau Margot

Success

La Bonne Intention

Triumph

Regional Overview



Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Crabbing
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

Carbon Sequestration, Shoreline Protection, Primary Production

Coastal Sensitivity Mapping - Ecosystem Services

Better Hope - LBI

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	4	Better Hope/ LBI

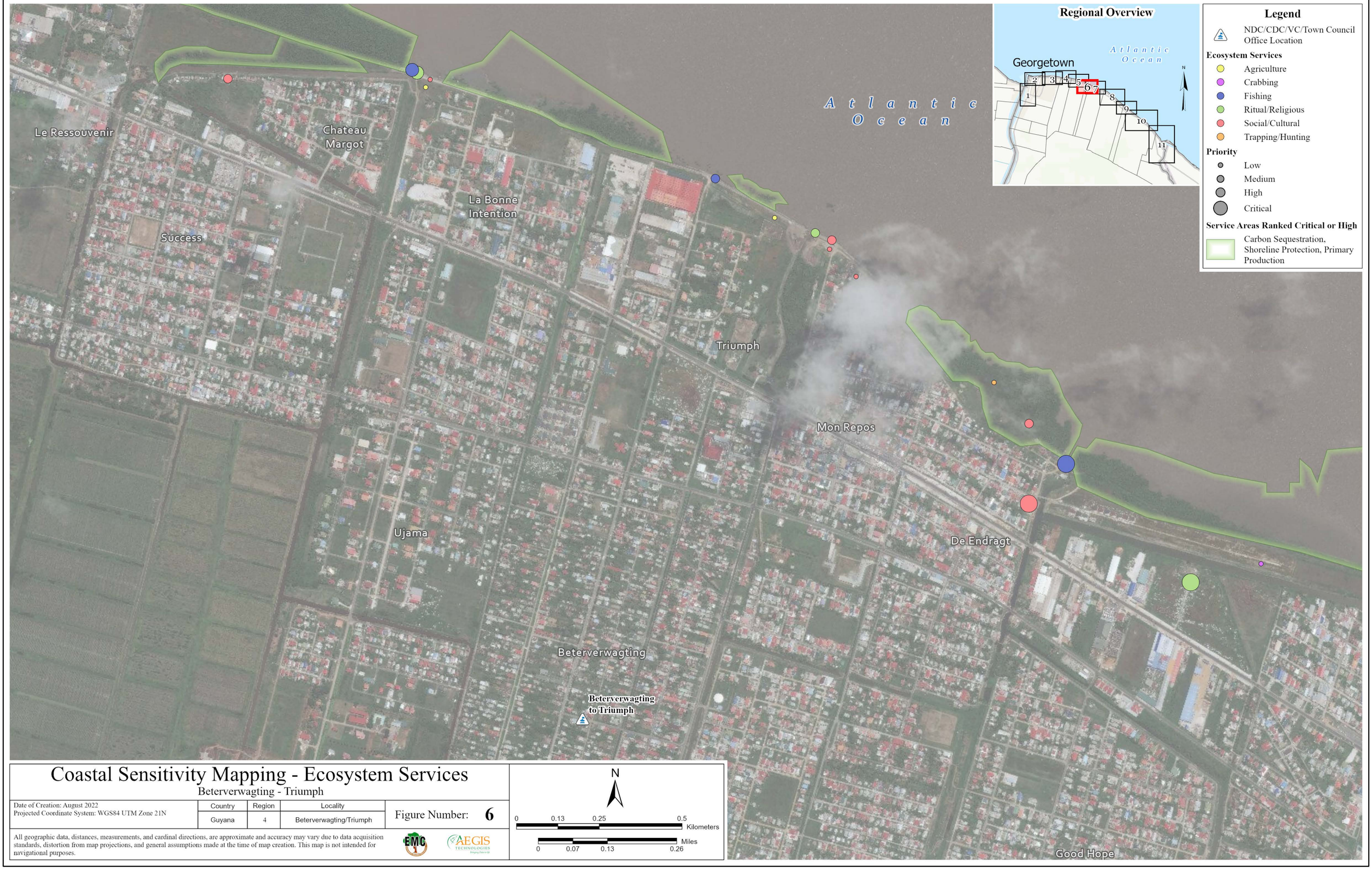
Figure Number: **5**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.13 0.25 0.5 Kilometers

0 0.07 0.13 0.26 Miles



Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Crabbing
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

Carbon Sequestration, Shoreline Protection, Primary Production

Coastal Sensitivity Mapping - Ecosystem Services

Beterverwagting - Triumph

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	4	Beterverwagting/Triumph

Figure Number: **6**

N

0 0.13 0.25 0.5 Kilometers

0 0.07 0.13 0.26 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

EMC

AEGIS TECHNOLOGIES

Coastal Sensitivity Mapping - Ecosystem Services

Mon Repos - La Reconnaissance

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	4	Man Repos / La Reconnaissance

Figure Number: 7

N

0 0.13 0.25 0.5 Kilometers

0 0.07 0.13 0.26 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

Coastal Sensitivity Mapping - Ecosystem Services

Buxton - Foulis

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	4	Buxton / Foulis

Figure Number: **8**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

Bachelors Adventure

Paradise

Foulis

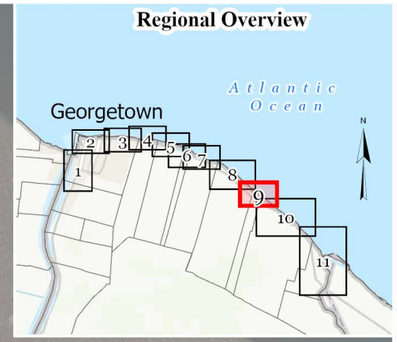
Enmore

Enmore to Hope

Golden Grove

Atlantic Ocean

Regional Overview



Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Agriculture: Livestock Grazing
- Carbon Sequestration, Shoreline Protection, Primary Production

Coastal Sensitivity Mapping - Ecosystem Services

Enmore - Hope

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	4	Enmore / Hope

Figure Number: **9**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

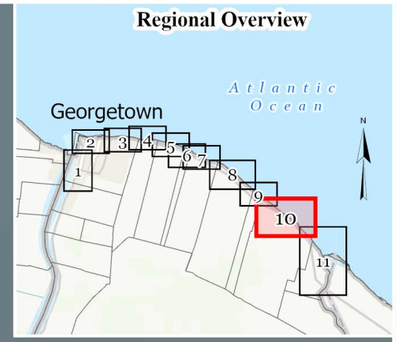
N

0 0.13 0.25 0.5 Kilometers

0 0.07 0.13 0.26 Miles

Haslington
Golden Grove
Haslington to Golden Grove
Nabaclis
Cove & John
Craig Milne
Nooten Zuil
Victoria
Lowlands
Hope
Two Friends
Annsgrove
Clonbrook
Bee Hive
Atlantic Ocean

Regional Overview



Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Crabbing
- Ecotourism
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting
- Other

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Agriculture: Livestock Grazing
- Carbon Sequestration, Shoreline Protection, Primary Production

Coastal Sensitivity Mapping - Ecosystem Services

Haslington - Grove

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	4	Haslington / Grove

Figure Number: **10**

N

0 0.4 0.8 Kilometers

0 0.2 0.4 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

EMC

AEGIS TECHNOLOGIES

Coastal Sensitivity Mapping - Ecosystem Services

Unity - Vereeniging

Date of Creation: August 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region	Locality	Figure Number: 11
	Guyana	4	Unity / Vereeniging	

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.25 0.5 1 1.5 Kilometers

0 0.13 0.25 0.5 0.75 Miles

REGION 5

(Mahaica-Berbice)


Regional Overview
Atlantic Ocean
Georgetown
Bartica
Fort Wellington
New Amsterdam
Linden
Legend
NDC/CDC/VC/Town Council Office Location
Ecosystem Services
Agriculture
Crabbing
Fishing
Mangroves
Ritual/Religious
Social/Cultural
Trapping/Hunting
Priority
Low
Medium
High
Critical
Service Areas Ranked Critical or High
Agriculture: Livestock Grazing
Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
Crabbing, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
Fishing: Wild-Caught Fish and Shellfish
NDC Boundary
Unity to Vereeniging
Cane Grove Land Development Scheme
Woodlands / Farm
Woodlands to Farm
St. Cuthberts / Orange Nassau (Mahaica River)
Mahaica River
Hamlet to Chance
Hamlet-Chance
Mahaicony to Abary
Mahaicony / Abary
Profit to RisingSun
Profit / Rising Sun
Seafield /Tempie
Seafield toTempie
Union to Naarstigheid
Union / Naarstigheid
Rest of Region 5
Mahaicony River
Abary River
Bath / Woodley Park
Bath to Woodley Park
Woodlands - Bell Air
Woodlands to BelAir
Zeelust / Rosignol
Zeelugt to Rosignol
Blairmont / Gelderland
West Bank Berbice
St Francis Mission
Berbice River
Corentyne River
Enfield / New Doe Park
Coastal Sensitivity Mapping - Ecosystem Services
Mahaica / Berbice
Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N
Country
Region
Guyana
5
All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.
N
0 2 4 8
Kilometers
Miles
0 1 2 4

Coastal Sensitivity Mapping - Ecosystem Services

Mahaica / Berbice

Date of Creation: July 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region
	Guyana	5

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 2 4 8

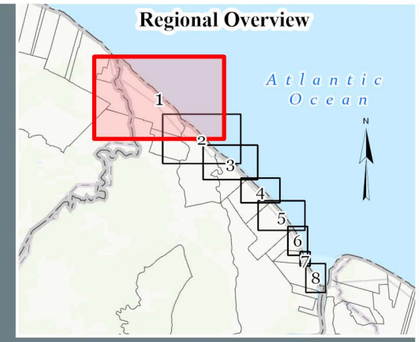
Kilometers

Miles

0 1 2 4

Unity
Mosquito Hall
Lancaster
Hand-En-Veldt
Mahaica
Good Hope
Unity to Vereeniging
Belmonte
Vereeniging
Mahaica River
Belvidere
Mes Delices
De Hoop
Strathavon
Bagatelle
Columbia
Klyzenaar
Highdam
Fredericka Johanna
Fairfiled
Virginia
Flagstaff
Zealand
Le Bon Pere
Grove
Belmont
Mulheim
Sarah
Drill
Yorkshire Hall
Farm
Mahaicony River
Mahaicony
Woodlands to Farm
Hamlet
Grove
Atlantic Ocean

Regional Overview



Legend

- NDC/CDC/VC/Town Council Office Location
- Agriculture
- Crabbing
- Fishing
- Mangroves
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Agriculture: Livestock Grazing
- Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
- Crabbing, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision

Coastal Sensitivity Mapping - Ecosystem Services

Woodlands - Farm

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	5	Mahaica / Mahaicony

Figure Number: **1**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

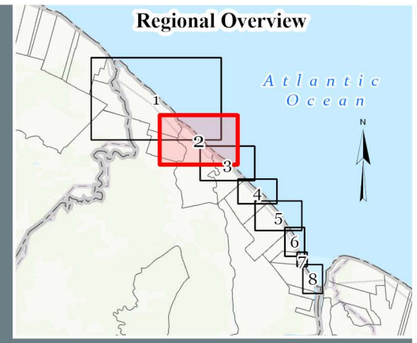
N

0 0.8 1.6 3.2 Kilometers

0 0.4 0.8 1.6 Miles

Sarah
Drill
Ormsary
Taymouth Manor
Farm
Mary
Blenheim
Woodlands to Farm
Park
Mahaicony
Sophia
Hamlet
Grove
Huntley
Airy Hall
Dundee
Hamlet to Chance
Adventure
Mahaicony to Abary
Fortitude
Santuary
Novar
Good Faith
Mahaicony River
Giuana Grove
Calcutta
Catherine
Felicity
Abary
Champagne
Chance
Adventure
Abary River
Abary No. 1
Foulis
Atlantic Ocean

Regional Overview



Legend

- NDC/CDC/VC/Town Council Office Location
- Agriculture
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Agriculture: Livestock Grazing
- Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
- Crabbing, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision

Coastal Sensitivity Mapping - Ecosystem Services

Mahaicony - Abary

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	5	Mahaica / Mahaicony

Figure Number: **2**

N

0 0.5 1 2 Kilometers

0 0.25 0.5 1 Miles

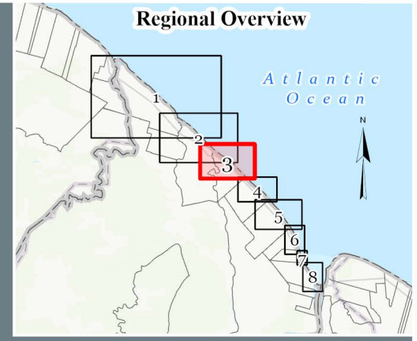
All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

EMC 1

AEGIS TECHNOLOGIES

Calcutta
Catherine
Abary
Sans Souci
Adventure
Foulis
Eldorado
Belladrum
Profit to RisingSun
Paradise
Golden Fleece
Weldaad
Hope
Washington
Rising Sun
First Point
Abary River
Atlantic Ocean

Regional Overview



Legend

- NDC/CDC/VC/Town Council Office Location
- Agriculture
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Agriculture: Livestock Grazing
- Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
- Crabbing, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision

Coastal Sensitivity Mapping - Ecosystem Services

Profit - RisingSun

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	5	Mahaica / Mahaicony

Figure Number: **3**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.35 0.7 1.4 Kilometers

0 0.17 0.35 0.7 Miles

Coastal Sensitivity Mapping - Ecosystem Services

Seafield - Tempie

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	5	Mahaica / Mahaicony

Figure Number: **4**

N

0 0.25 0.5 1 Kilometers

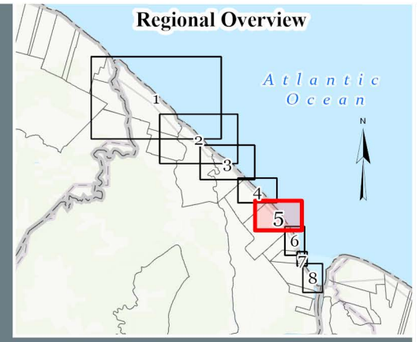
0 0.13 0.25 0.5 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

Chester
Seafield to Tempie
Britania
Temple
Union
Trafalgar
Onverwagt
Lovely Lass
Golden Grove
Bush Lot
Union to Naarstigheid
Bel Air
Armadale
St. John
Hopetown
Onderneeming
Fort Wellington
Naarstigheid

A t l a n t i c
O c e a n

Regional Overview



Legend

- NDC/CDC/VC/Town Council Office Location
- Agriculture
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Crabbing, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision

Coastal Sensitivity Mapping - Ecosystem Services

Union - Naarstigheid

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	5	Mahaica / Mahaicony

Figure Number: **5**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

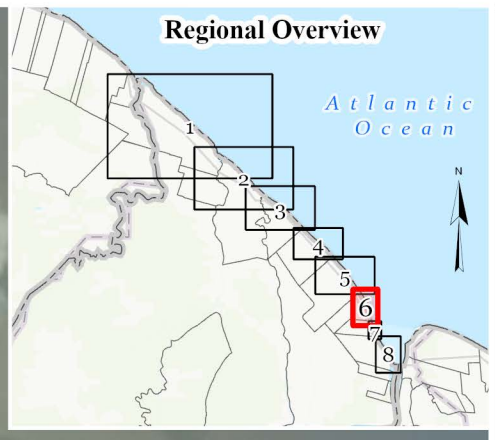
N

0 0.3 0.6 1.2 Kilometers

0 0.15 0.3 0.6 Miles

Fort Wellington
Naarstigheid
Bath
Hope
Waterloo
Waterloo Jib
Experiment
Woodley Park
Bath to Woodley Park
Woodlands
Friends Retreat
Expectation
Atlantic Ocean
Atlantic Ocean

Regional Overview



Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Fishing
- Ritual/Religious
- Social/Cultural

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
- Crabbing, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
- Fishing: Wild-Caught Fish and Shellfish

Coastal Sensitivity Mapping - Ecosystem Services

Bath - Woodley Park

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	5	Mahaica / Mahaicony

Figure Number: **6**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.2 0.4 0.8 1.2 Kilometers

0 0.1 0.2 0.4 0.6 Miles

Coastal Sensitivity Mapping - Ecosystem Services

Woodlands - Bel Air

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	5	Mahaica / Mahaicony

Figure Number: 7

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.1 0.2 0.4 0.6 Kilometers

0 0.05 0.1 0.2 0.3 Miles

Coastal Sensitivity Mapping - Ecosystem Services

Zeelugt - Rosignol

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	5	Mahaica / Mahaicony

Figure Number: **8**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.2 0.4 0.8 1.2 Kilometers

0 0.1 0.2 0.4 0.6 Miles

REGION 6

(East Berbice-Corentyne)

Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Crabbing
- Fishing
- Mangroves
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting
- Other

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Cultivated Crops
- Fishing
- Crabbing, Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
- Fishing, Crabbing, Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
- Hunting/Trapping, Crabbing, Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
- Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision
- NDC Boundary

Coastal Sensitivity Mapping - Ecosystem Services

East Berbice / Corentyne

Date of Creation: July 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region
Guyana	6

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 2.5 5 10
Kilometers
Miles
0 1.25 2.5 5

Coastal Sensitivity Mapping - Ecosystem Services

East Berbice / Corentyne

Date of Creation: July 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region
	Guyana	6

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

EMC

AEGIS TECHNOLOGIES

N

0 2.5 5 10

Kilometers

Miles

0 1.25 2.5 5

Regional Overview

Legend

- NDC/CDC/VC/Town Council Office Location

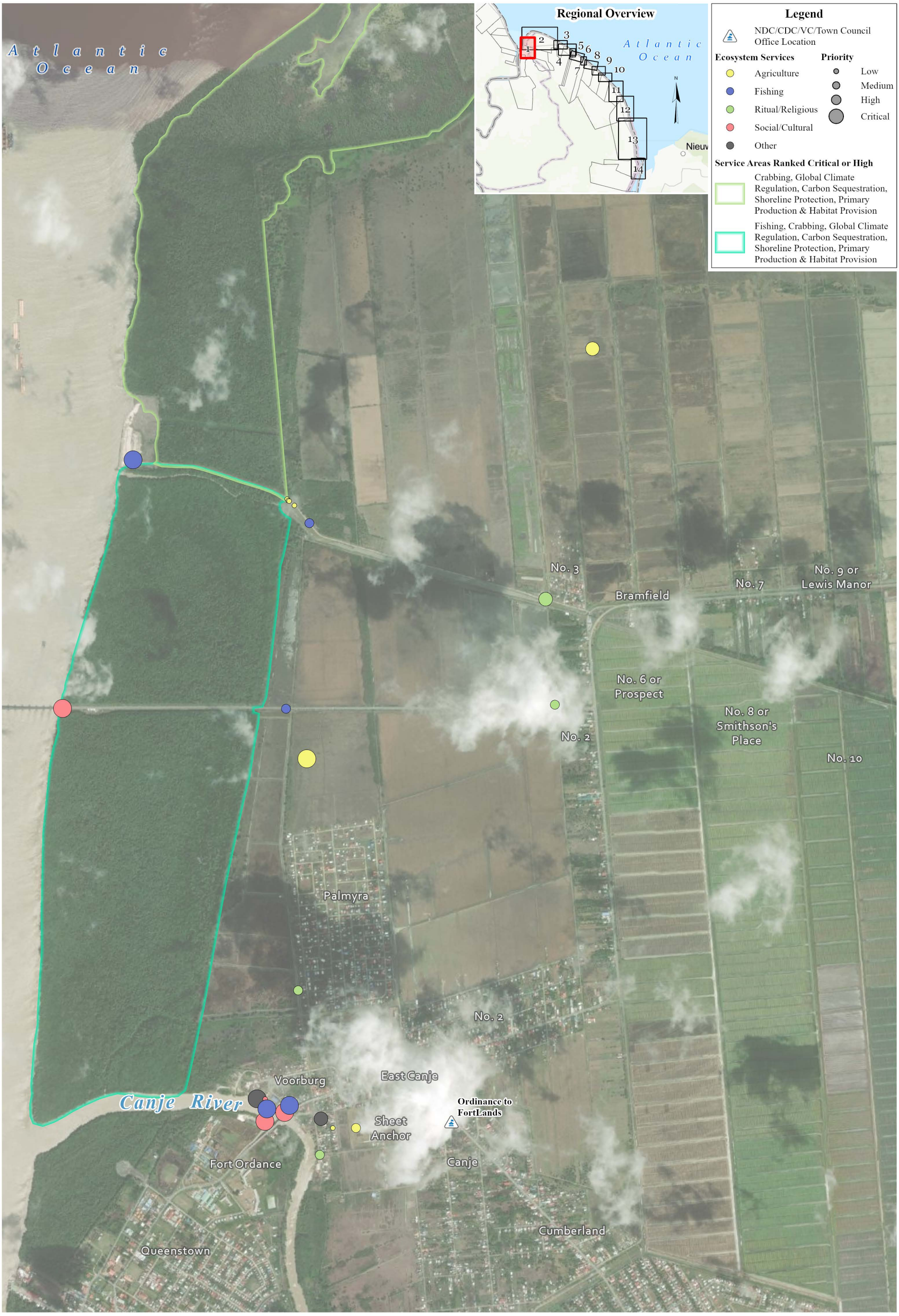
Ecosystem Services

- Agriculture
- Biodiversity
- Carbon Sequestration
- Crabbing
- Ecotourism
- Fishing
- Mangroves
- Ritual/Religious
- Social/Cultural
- Traditional/Resources
- Trapping/Hunting
- Other

ESS Spatial Distribution By Priority

- Low Priority, Low Density
- High Priority, High Density
- NDC Boundary

Bath to Woodley Park
Woodlands - Bell Air
Woodlands to BelAir
Zeelust / Rosignol
Zeelugt to Rosignol
Blairmont / Gelderland
Abary River
Borlam (No 37) / Kintyre
Kintyre to No37
Ordinance to FortLands
Ordnance / Fortlands
Cane Field / Enterprise
New Amsterdam
Berbice River
West Bank Berbice
Enfield / New Doe Park
Gibraltar to Fyrish
Kilcoy to Hampshire
Rose Hall Town Council
Port Mourant to John
Bloomfield to Whim
Lancaster to Hogstye
Bush lot to Adventure
Hogstye / Lancaster
Maida to Tarlogie
John / Port Mourant
Whim / Bloomfield
Bush Lot / Adventure
Tarlogie / Maida
Joppa / Macedonia
Macedonia Joppa
Black Bush Polder land Development Scheme
Good Hope No 51
No.51 Village / Good Hope
No52 No74
Canje River
Corriverton
Corriverton Town Council
Jackson Creek / Crabwood Creek
Corentyne River
Atlantic Ocean



Coastal Sensitivity Mapping - Ecosystem Services

Ordinance - FortLands

Date of Creation: August 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region	Locality	Figure Number: 1
	Guyana	6	Upper Corentyne	

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.25 0.5 1 1.5 Kilometers

0 0.13 0.25 0.5 0.75 Miles

Coastal Sensitivity Mapping - Ecosystem Services

Kintyre - No37

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	6	Upper Corentyne

Figure Number: **2**

N

0 0.4 0.8 1.6 Kilometers

0 0.2 0.4 0.8 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

Atlantic Ocean

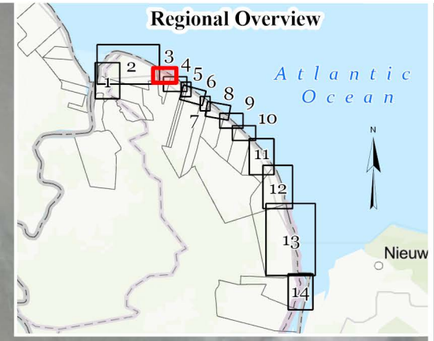
No. 33 East Lothian

No. 35 Marysburg

No. 37 Borlam

Gibraltar to Fyrish

Regional Overview



Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Crabbing
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

- Fishing
- Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision

Coastal Sensitivity Mapping - Ecosystem Services

Gibraltar - Fyrish

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	6	Upper Corentyne

Figure Number: **3**

N

0 0.15 0.3 0.6 Kilometers

0 0.07 0.15 0.3 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

Coastal Sensitivity Mapping - Ecosystem Services

Kilcoy - Hampshire

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	6	Upper Corentyne

Figure Number: **4**

N

0 0.2 0.4 0.8 Kilometers

0 0.1 0.2 0.4 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

EMC

AEGIS TECHNOLOGIES

Coastal Sensitivity Mapping - Ecosystem Services

Rose Hall Town Council

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	6	Upper Corentyne

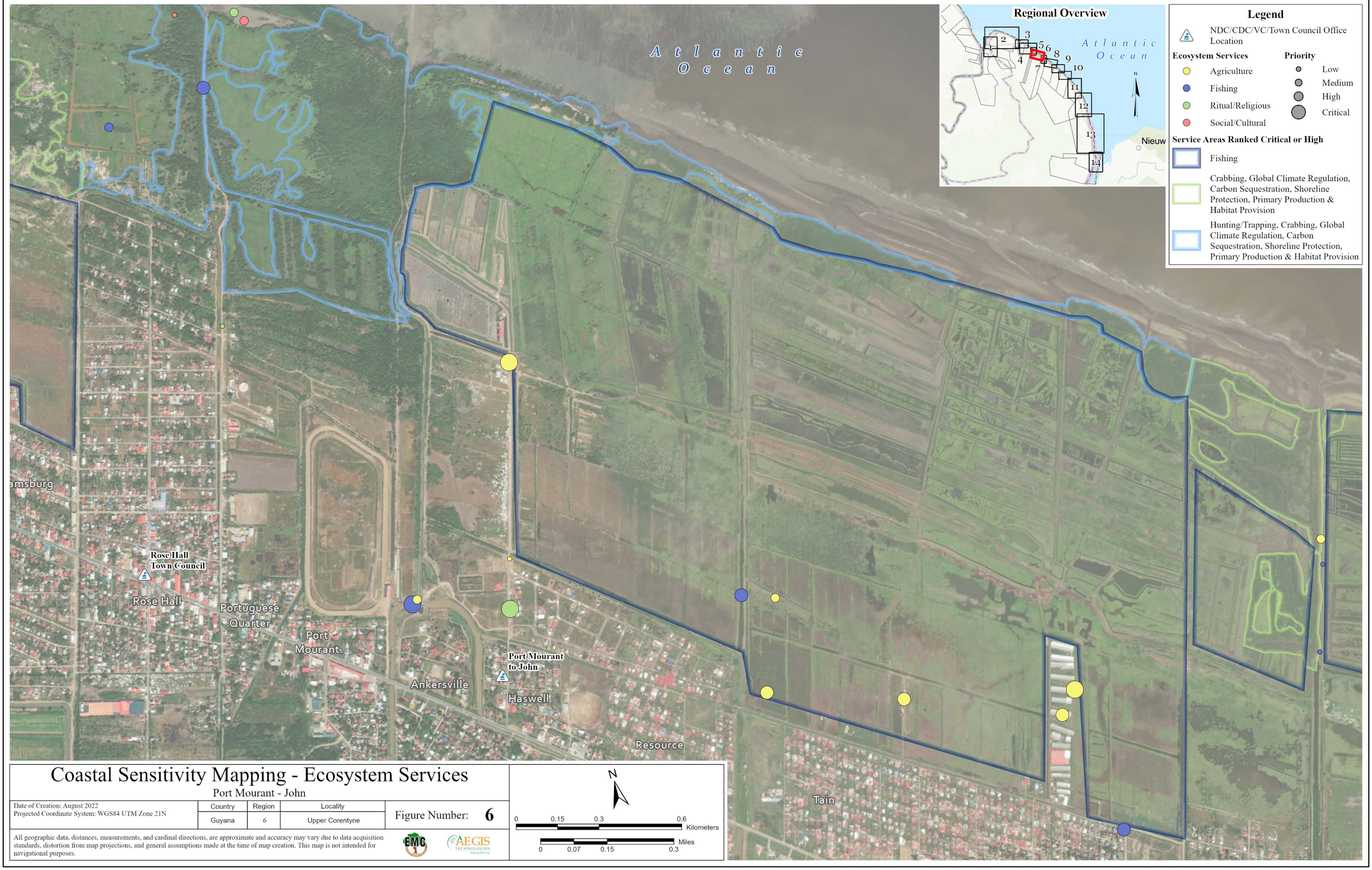
Figure Number: **5**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.1 0.2 0.4 0.6 Kilometers

0 0.05 0.1 0.2 0.3 Miles



Coastal Sensitivity Mapping - Ecosystem Services

Port Mourant - John

Date of Creation: August 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region	Locality	Figure Number: 6
	Guyana	6	Upper Corentyne	

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.15 0.3 0.6 Kilometers

0 0.07 0.15 0.3 Miles

Coastal Sensitivity Mapping - Ecosystem Services

Bloomfield - Whim

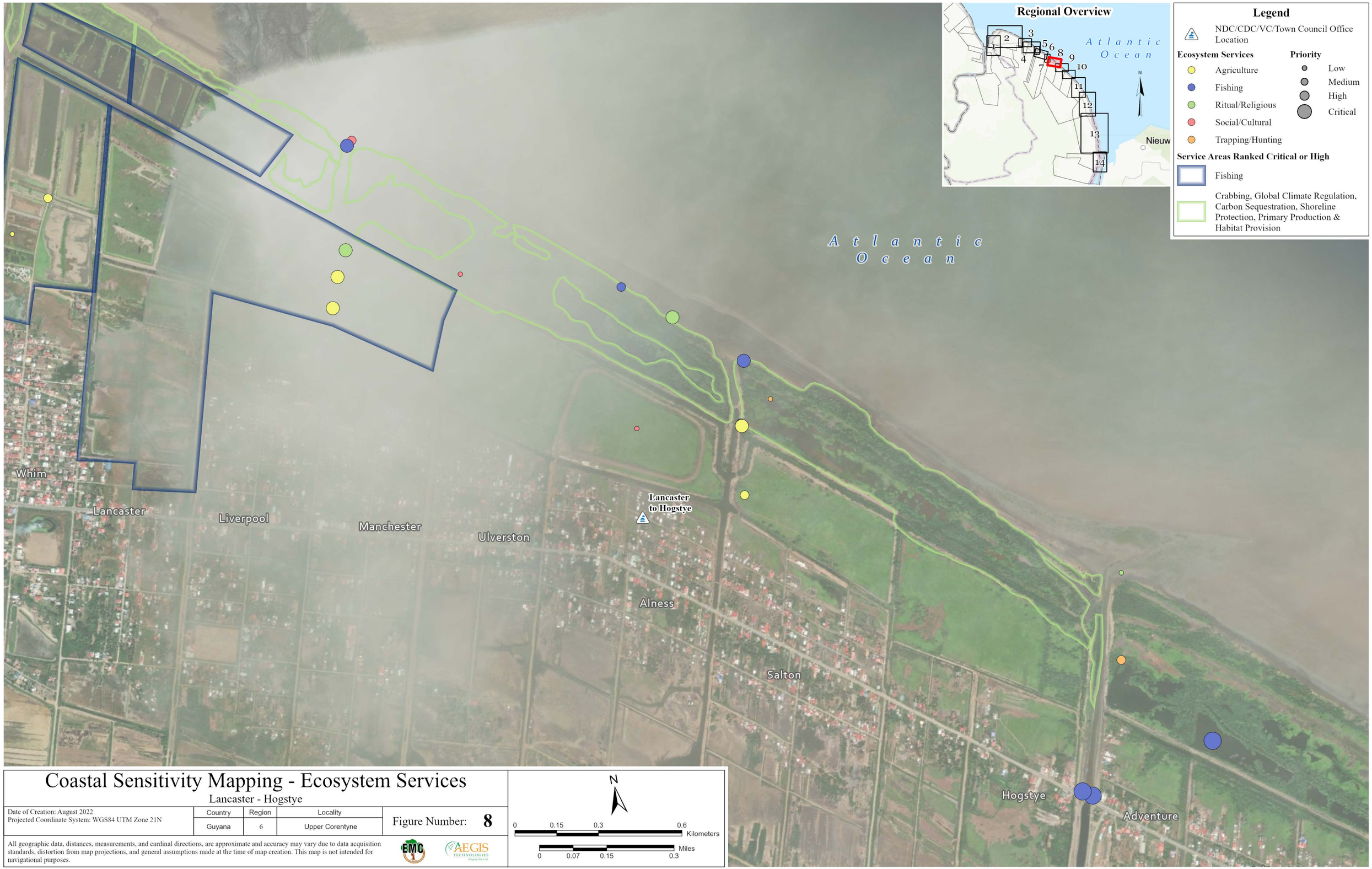
Date of Creation: August 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region	Locality	Figure Number: 7
	Guyana	6	Upper Corentyne	

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.1 0.2 0.4 0.6 Kilometers

0 0.05 0.1 0.2 0.3 Miles



Coastal Sensitivity Mapping - Ecosystem Services

Lancaster - Hogstye

Date of Creation: August 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region	Locality	Figure Number: 8
	Guyana	6	Upper Corentyne	

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

Coastal Sensitivity Mapping - Ecosystem Services

Bush lot - Adventure

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	6	Upper Corentyne

Figure Number: **9**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.15 0.3 0.6 Kilometers

0 0.07 0.15 0.3 Miles

Bush Lot

Bush Lot Farm

Maida

Kilmarnock

Maida to Tarlogie

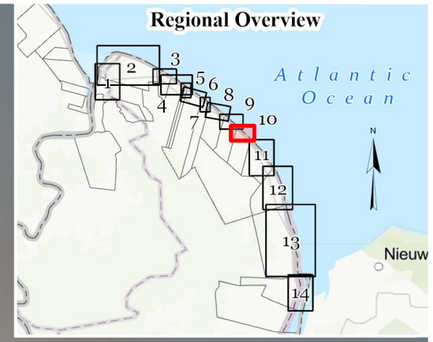
No. 31 or Phiilippi

No. 32 or Cromarty

No. 33 or Wellington Park

Atlantic Ocean

Regional Overview



Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

Fishing, Crabbing, Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision

Coastal Sensitivity Mapping - Ecosystem Services

Maida - Tarlogie

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	6	Upper Corentyne

Figure Number: **10**

N

0 0.15 0.3 0.6 Kilometers

0 0.07 0.15 0.3 Miles

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

EMC

AEGIS TECHNOLOGIES

Coastal Sensitivity Mapping - Ecosystem Services

Macedonia Joppa

Date of Creation: August 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region	Locality	Figure Number: 11
	Guyana	6	Upper Corentyne	

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.25 0.5 1 1.5 Kilometers

0 0.13 0.25 0.5 0.75 Miles

Macedonia
Joppa

No. 41 Java

No. 42 Bengal

No. 43
or Jappa

No. 44 or
Good Hope

Number 45
Village

No. 46

Good Hope
No 51

No. 47 or
Rising Sun

No. 48 or
Floyd Ward

No. 49 or
Mary's Hope

No. 50
or Leeds

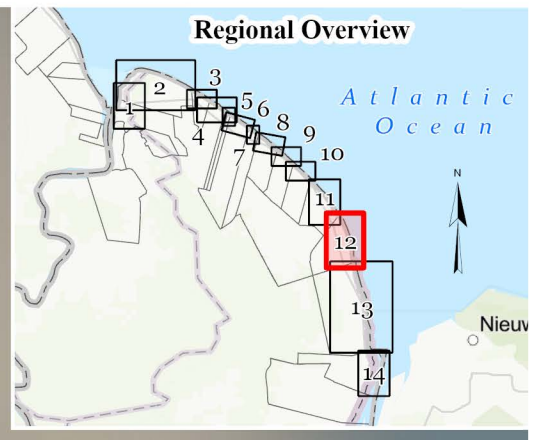
No. 51

No. 52

Atlantic
Ocean

Atlantic
Ocean

Regional Overview



Legend

NDC/CDC/VC/Town Council Office Location

Ecosystem Services

- Agriculture
- Fishing
- Ritual/Religious
- Social/Cultural
- Trapping/Hunting

Priority

- Low
- Medium
- High
- Critical

Service Areas Ranked Critical or High

Crabbing, Global Climate Regulation, Carbon Sequestration, Shoreline Protection, Primary Production & Habitat Provision

Coastal Sensitivity Mapping - Ecosystem Services

Good Hope No 51

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	6	Upper Corentyne

Figure Number: **12**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.3 0.6 1.2 1.8 Kilometers

0 0.15 0.3 0.6 0.9 Miles

Coastal Sensitivity Mapping - Ecosystem Services

No52 No74

Date of Creation: August 2022 Projected Coordinate System: WGS84 UTM Zone 21N	Country	Region	Locality	Figure Number: 13
	Guyana	6	Upper Corentyne	

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.5 1 2 3 Kilometers

0 0.25 0.5 1 1.5 Miles

Coastal Sensitivity Mapping - Ecosystem Services

Corriverton Town Council

Date of Creation: August 2022
Projected Coordinate System: WGS84 UTM Zone 21N

Country	Region	Locality
Guyana	6	Upper Corentyne

Figure Number: **14**

All geographic data, distances, measurements, and cardinal directions, are approximate and accuracy may vary due to data acquisition standards, distortion from map projections, and general assumptions made at the time of map creation. This map is not intended for navigational purposes.

N

0 0.25 0.5 1 1.5 Kilometers

0 0.13 0.25 0.5 0.75 Miles

PARTICIPATORY FISH STUDY

PFS-2 Summary Report: April 2021 - March 2022

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ACRONYMS

CPUE	Catch Per Unit Effort
EEPGL	Esso Exploration and Production Guyana Limited
EMC	Environmental Management Consultants Inc.
EPA	Environmental Protection Agency
ERM	Environmental Resources Management
ETP	Endangered Threatened and Protected
GIS	Geographic Information System
IUCN	International Union for Conservation
JHA	Job Hazard Assessment

1.0 INTRODUCTION

In June 2017, the Guyana Environmental Protection Agency (EPA) issued an Environmental Permit for the Liza Phase 1 Development Project to ExxonMobil's affiliate Esso Exploration and Production Guyana Limited (EEPGL). One of the conditions of the Environmental Permit required EEPGL to *"conduct fishery-dependent studies in the nearshore zone augmented by fishery-independent studies in the nearshore and offshore zones to develop a more complete understanding of the marine fish community outside the Liza Area of Interest."* EEPGL complied with this requirement by conducting two studies. One of these studies was the Participatory Fish Study (herein referred to as the "PFS-1") focused on fishery-dependent information.

PFS-1 was implemented through a collaboration between Environmental Resources Management (ERM) and Environmental Management Consultants Inc. (EMC), a local Guyanese firm. In this partnership, ERM provided international expertise on the methodology and the approach to data collection and analysis, including marine biology, socioeconomics, and imagery. EMC led field engagements with artisanal fisherfolks, data analysis and reporting. PFS-1 executed a program that focused primarily on engagement with the artisanal fishing community in Regions 1 to 6. As part of the study, EMC engaged with local artisanal fisherfolk who agreed to participate on a volunteer basis (with a small stipend offered to cover any expenses) and provide data on their catch. PFS-1 was completed in March 2020.

PFS-1 was the first study of its kind in Guyana and contributed significantly to the existing base of knowledge on the characterization of the nektonic community (with a focus on fisheries). This included characterizations of artisanal fishing gear, vessel types and commercial species which were not previously compiled comprehensively. More importantly, PFS-1 identified trends related to relationships between gear type and target species, fishing effort and haul volumes, haul composition and species diversity, seasonality of artisanal fishing activities, pricing and marketing, and basic biometric measurements (lengths and weights only) of hauls. The principal fishing grounds used by artisanal fisheries activities offshore Guyana's coastline was also mapped by PFS-1.

In March 2021, EEPGL contracted EMC to resume the implementation of the Participatory Fish Study (herein referred to as "the study"). The study is intended to build on the knowledge base created by PFS-1 and continue to critically examine observed and emerging trends related to the artisanal fisheries in Guyana. For PFS-2, the scope was expanded to capture activities in industrial fisheries (trawling). The study has three primary components:

1. **The Coastal Landing Site Assessment** focuses on data and photos of overall daily catch and catch characteristics (number of species, sizes, weights, etc.) at various coastal landing sites. Landing sites are the areas where fishing vessels depart for fishing trips, offload catch and dock. Seine mending, and vessel maintenance and repair also typically occur at the landing sites. There are six regional supervisors from different landing sites in all six of the coastal regions are participating in the study. The regional supervisors had extensive prior experience in the area and knowledge of native species.

2. **The Local Artisanal Fishing Activities Assessment** focuses on data, Global Positioning System (GPS) information, and photos of individual artisanal fishing activities, including daily catch, catch characteristics (number of species, sizes, weights, etc.), and routes to preferred fishing zones. Twelve onboard supervisors from two separate landing sites in each of the six coastal regions are participating in the study.

3. **The Industrial Fishing Assessment:** focuses on improving understanding of catch, fishing techniques, equipment/gear type, and locations fished, including the continental shelf and deep water. Ideally, up to two industrial supervisors will volunteer to participate in the study.

This report presents a summary of the key trends observed in PFS-2 and compares these with the PFS-1 trends. Specifically, the report provides the following:

- A description of the methodology and approach to data collection.

- A comparative analysis of data collected from supervisors in PFS-1 and PFS-2 to identify trends in gear types utilized, productivity and seasonality of hauls, species diversity of hauls, maturity of key target species and prices for which key target species are sold. In this report, all species were referred to by their Guyanese common names but scientific names are used also following the first mention of a species. Data was disaggregated into three-month quarters for analysis. The first quarter was aligned with the commencement of the data collection periods for PFS-1 and PFS-2. The four reporting quarters in PFS-2 and the corresponding PFS-1 reference periods are:

    - **Quarter 1 (Q1)**: April to June 2021 (PFS-2) and April to June 2019 (PFS-1).
    - **Quarter 2 (Q2)**: July to September 2021 (PFS-2) and July to September 2019 (PFS-1).
    - **Quarter 3 (Q3)**: October to December 2021 (PFS-2) and October to December 2019 (PFS-1).
    - **Quarter 4 (Q4):** January to March 2022 (PFS-2) and January to March 2020 (PFS-1).

- Maps of fishing grounds (area where fishing activities occur) used by onboard supervisors based on geographic information system (GIS) data collected while fishing. The GIS data was utilized to establish the fishing grounds used by onboard supervisors.

- Encounters reported with ETP species reported by the supervisors throughout PFS-2.

- Species identification summary table with photos to aid in fish identification (see Appendix A).

2.0 APPROACH AND METHODOLOGY

2.1 Landing Site Selection

Sixteen unique landing sites were selected for inclusion in PFS-1. The selection of landing sites was guided by several factors. Ultimately, the goal was to select landing sites that provided a representative spread of artisanal fishing activities based on the types of vessels, fishing gear used, target species, the duration of fishing trips and the number of fisherfolk using the landing site. Initially, in PFS-1, the landing sites were shortlisted based on the knowledge and experience of the study team as well as the findings of an Ecosystem Services Study conducted as part of the Liza Phase 1 post-permit studies (ERM/EMC 2018). The selection process was finalized after the study team visited each of the landing sites to collect baseline data in 2019.

The 16 landing sites selected for PFS-1 were not changed in Q2 and Q1 (Table 2-1). However, activities at the Rose Hall landing site consistently declined and by the time the study resumed execution in 2021, only one fisherfolk was operating at the site. Significant challenges experienced in Q2 and Q1 during the data collection period (foremost of which were the deterioration of the access dam leading to the landing site, the accretion of mud along the shoreline and rough seas) resulted in all fishing activities halting indefinitely. The sole fisherfolk who was still operating at Rose Hall has relocated to another landing site. As a consequence, PFS-2, the Rose Hall landing site was replaced with the landing site at the Adventure beach. The Adventure landing site is located east of Rose Hall. During an initial site visit the study team confirmed that the landing site at Adventure beach was dedicated to pin seine fishing, the same fishing technique which was used at Rose Hall. By contrast to the dwindling activities at Rose Hall, the landing site at Adventure beach had pin seine pole structures established for shared use by four fisherfolk. As such, data collected by the regional supervisor at the Adventure landing site are considered to be an accurate representation of the catch produced using the pin seine fishing method.

Figure 2-1 provides a map showing the locations of the landing sites.

Table 2-1: Landing Sites Selected in Regions 1 to 6

Landing Sites Selected for Regional Supervisors	Landing Sites Selected for Onboard Supervisors
Region 1—Smith's Creek/Morahwanna[1]	Region 1—Smith's Creek[1]; Waramuri/Haimokabra
Region 2—Charity	Region 2—Lima; Hampton Court
Region 3—Zeeburg	Region 3—La Grange; Windsor Forest
Region 4—Riverview (Unity, Mahaica)	Region 4—Riverview (Unity, Mahaica); Ogle
Region 5—Mahaicony Bridge	Region 5—Rosignol; Bushlot
Region 6—Adventure	Region 6—Complex 66; Albion

[1] The regional supervisor in Region 1 collected data from both Smith's Creek and Morahwanna. The onboard supervisor operating from Smith's Creek only operated from Smith's Creek; no onboard supervisor was located in Morahwanna.

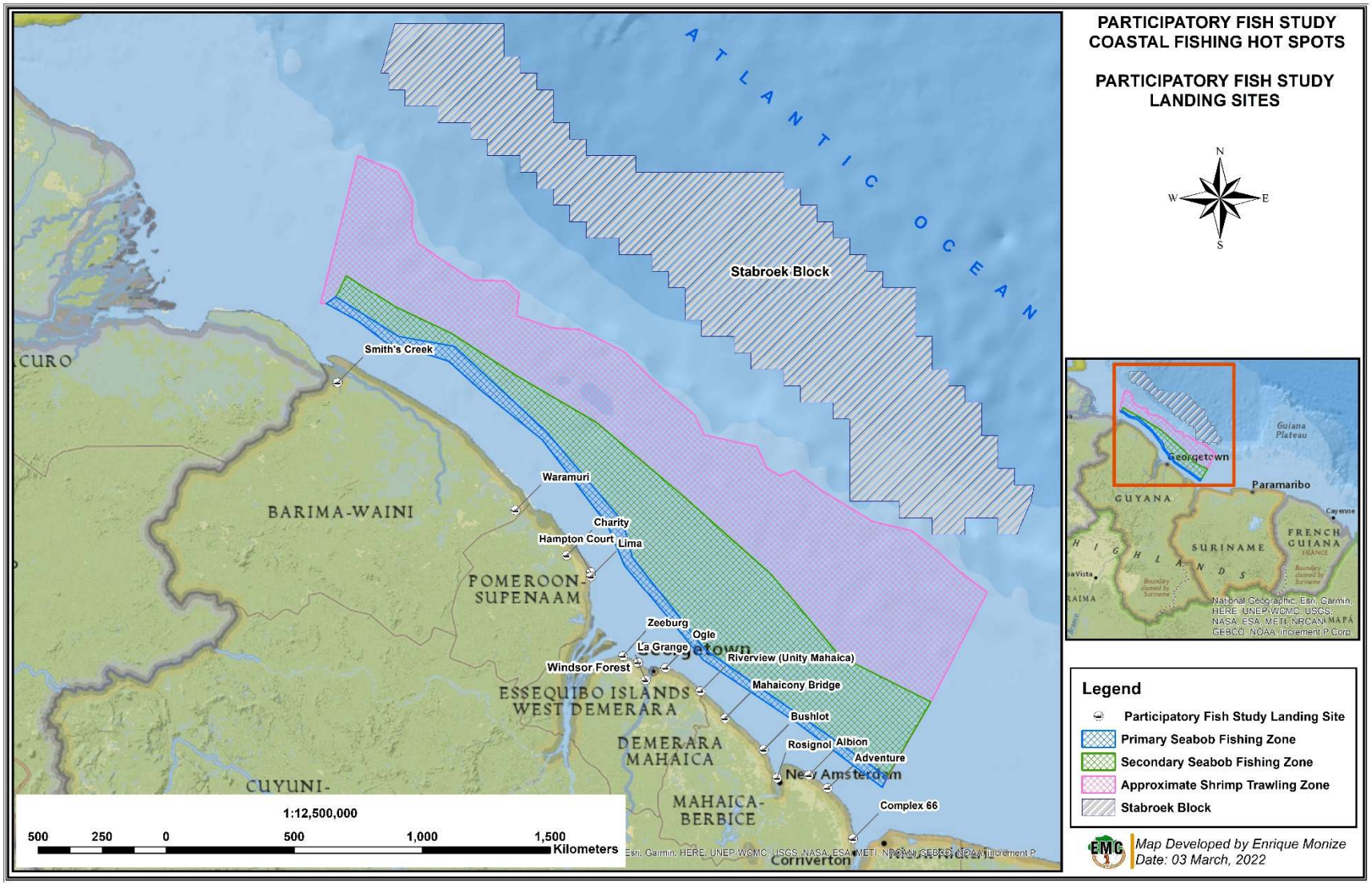


Figure 2-1: Locations of Landing Sites in Regions 1 to 6

2.2 Selection and Training of Regional and Onboard Supervisors

In PFS-1, two sets of supervisors were selected to support data collection from the artisanal fishing sector. Regional supervisors were selected for the Coastal Landing Sites Assessment and onboard supervisors were selected for the Local Artisanal Fishing Activities Assessment. Regional and onboard supervisors who participated in PFS-1 and who were available to recommence data collection were prioritized for selection. This approach supported and expedited the recommencement of data collection because these supervisors had received multiple rounds of training in the use of equipment and completion of datasheets thereby enabling them to begin their tasks as soon as feasible. In addition, the participation of these supervisors would also improve the accuracy of data collected in the initial months of the study as they had benefited from continuous feedback from the study team during PFS 1. Finally, cordial and cooperative working relationships had been created between EMC and these supervisors.

The first step in the selection process was to contact the PFS-1 supervisors, via telephone, to determine their willingness and availability to volunteer in this study. The study team also took advantage of this early opportunity to obtain updates from these supervisors on the condition of their equipment and whether replacements will be required. Overall, 15 supervisors who participated in PFS-1 were available to participate in this study. However, the regional supervisor from the Charity landing site (Region 2), and onboard supervisors from Rosignol (Region 5) and Complex #66 (Region 6) had to be replaced.

The methodology for supervisor selection in PFS-1 was utilized. During the initial field exercises to each of these three landing sites, during April and May 2021, the study team interviewed fisherfolk to determine interest level and relevant experience for participating in the study. Individuals selected as onboard supervisors were nominated by the members of the fishing co-ops at the Rosignol and Complex #66 landing sites. At Charity, where there was no co-op, the fishing community nominated an individual as regional supervisor. A questionnaire was administered to the nominated individuals to assess their level of experience and knowledge against a set of criteria. Once the nominee had satisfactorily met the requirements outlined in the questionnaire, he/she was selected as a supervisor. If the nominee at a landing site did not satisfy the requirements, there was further engagement with the fisherfolk or co-ops to identify another suitable candidate. All nominated supervisors at the landing sites met the criteria and successfully completed the questionnaires. The questionnaires used for these selection processes are provided in Appendix B.

Over the period April to May, 2021, the study team conducted field visits to all landing sites included in the study. The purpose of the visits was to re-engage PFS 1 supervisors and select new supervisors for the three landing sites discussed above. All supervisors were required to sign a Volunteer Agreement (see Appendix C). Subsequently, the study team provided training to all supervisors on the completion of the data sheets and the use of the equipment relevant to their tasks. Specifically, regional and onboard supervisors were trained in datasheet completion and the use of the digital camera, scale and tape measure. Onboard supervisors were also trained in the use of GPS units.

2.2.1 Replacement of Regional and Onboard Supervisors During PFS-2 Execution

In Q2, the study team ascertained that the regional supervisor at the Zeeburg landing site (Region 3) was underreporting landed hauls. This was based on observations of activities at the landing site during monthly site visits as well as through engagements with fisherfolk who routinely operate at the landing site. Moreover, in Q4, following two cycles of QA/QC activities the study team ascertained that the data being collected by the regional supervisor at Mahaicony Bridge (Region 5) was not credible. Accordingly, new regional supervisors was selected and trained to collect data at Zeeburg and in Mahaicony Bridge following the process outlined above. Figure 2-2 shows training exercises conducted with the new supervisor at Zeeburg.

Figure 2-2: Training Exercise with the Zeeburg Regional Supervisor

The onboard supervisor at Ogle (Region 4) ceased fishing activities because of consecutive low hauls experienced for more than a year. The supervisor subsequently migrated to Trinidad to work on a sardine fishing vessel and a new onboard supervisor was selected at this landing site in Q3.

2.3 Data Collection by Regional and Onboard Supervisors

Two unique sets of data were collected from the supervisors:

- Regional supervisors collected data from vessels that had landed at each of the six coastal landing sites. For each landed vessel, data collected included fishing ground locations, total catch (including species and quantities), prices per species and by-products, and the number of days spent at sea. In addition, regional supervisors also collected data on seaweed (*Sargassum sp.*), bycatch, and collecting swim bladders ("glue") for separate sale along with other observations such as sightings of Endangered Threatened and Protected (ETP) species; all of which were important issues arising from PFS 1. Regional supervisors also collected biometric data (weights and lengths only) of representative fish per landed species. The regional supervisors took photographs of fishes for which biometric data were recorded and of activities at their landing sites.

- Onboard supervisors provided data that had been collected on vessels they own or on which they are employed. These data included total catch per soaking[1] including species and quantities, GPS tracks showing the routes taken to fishing grounds, and GPS waypoints for the locations where fishing occurred. Data was also collected on market prices of fish and fish by-products such as the swim bladders ("glue") and fish eggs, by-catch, interactions with ETP

[1] "Soaking" refers to the period of time for which seines or lines are set before being hauled.

species, and other observations. Onboard supervisors also measured and weighed the average-sized fish of each species caught per soaking and took photographs of their activities.

During the data collection period the study team conducted monthly visits to each landing site. The purpose of these visits was to:

- Review completed datasheets from the regional and onboard supervisors.
- Meet with the supervisors to discuss data collected, trends, challenges, health and safety, and other information pertinent to the study.
- Provide refresher training to regional and onboard supervisors either by request or based on observations of the study team.
- Collect photographs taken by regional and onboard supervisors.
- Collect GPS tracks and fishing waypoints from onboard supervisors.
- Replenish supplies, including new datasheets and batteries for cameras and GPS units.
- Check the status of equipment provided to the supervisors and replace any equipment found to be defective and provide volunteer stipends to supervisors based on the number of data sheets completed.

2.4 Landing Site Assessments

Landing sites assessments were conducted by the study team to update baseline data on the landing sites collected in PFS-1. Landing site assessments entailed interviews with fisherfolk to determine the number of vessels operating at the landing site, target species, typical catch composition, frequency of fishing trips, preferred fishing ground, markets for landed catch, interactions with ETP species and fishing practices amidst the COVID-19 pandemic. Landing site assessments were repeated each time QA/QC exercises were conducted. The outcomes of the landing site assessment were used to ensure that activities at the landing sites remained consistent with the characteristics which formed the basis for landing site selection.

2.5 Industrial Fishing Assessment

Industrial fishing began in the late 1950s when expatriate companies established bases in Guyana and other neighbouring countries to exploit the four available species of *Penaeus* (prawns). Due to reductions in catch volumes in the late 1970s, the companies decided to close their operations and their vessels were sold to local entities. These vessels were converted to trawlers to target seabob (coarse shrimp).[2] These trawlers comprise the majority of industrial fishing in Guyana. Currently, most of the industrial fishing operations are located along the eastern bank of the Demerara River close to Georgetown. According to EMC's Fisheries Specialist, there are currently 116 trawlers and 8 processing plants. There are three main companies engaged in trawling and processing activities namely, Pritipaul Singh Investments Inc., Noble House Seafoods Limited and Gopie Investments Inc. In March 2021, Grandeast Inc. commenced trawling and processing activities.

In Q1 and Q2 of PFS-2, EMC's Fisheries Specialist attempted to initiate dialogue with a major industrial fishing operator to determine their willingness to participate in the study. In Q3, the operator agreed to participate in a meeting that was convened by EMC's Fisheries Specialist to facilitate dialogue between the study team and the operator's management team. The objectives of this meeting were to brief the industrial operators about the project (via a PowerPoint presentation), explain the scope of data collection for the industrial sector and provide feedback to any questions or other issues of concern. Upon conclusion of the meeting, the industrial operator indicated that management will consider their involvement in the study.

[2] United Nations Food and Agricultural Organization (FAO). 2005. Fishery Country Profile: The Republic of Guyana.

In December 2021, the industrial operator agreed to participate in the study. In this regard, an experienced trawler captain who has worked with the company for more than ten years was identified to volunteer as 'Industrial Supervisor'. However, data collection did not commence at that time since, according to the operator, no fishing trips were being conducted because it was not economically feasible due to persistent low haul volumes. In Q4, the industrial operator, with whom the study team had engaged, experienced significant challenges which resulted in the indefinite grounding of the fleet. As such, no data was collected on industrial fisheries during PFS-2. Given these challenges, the study team has commenced engagement with other industrial operators to determine their willingness to participate in the study.

2.6 Quality Analysis/Quality Control

The objective of the Quality Analysis/Quality Control (QA/QC) exercises were to standardize data collection methods by regional and onboard supervisors and identify potential data deviations. Two QA/QC exercises were conducted. One over the period of October 28, 2021 to February 07, 2022 and the other over the period April 04 to May 16, 2022. Activities conducted as part of the QA/QC exercise included:

- Updating the landing site assessment. This assessment was conducted to obtain information on fishing dynamics and significant events that were experienced at the sites. The landing site assessment was conducted based on by interviewing fisherfolk who were present at the landing site when the study team visited. The engagements between the study team and fisherfolk during the landing site assessment can be seen in Figure 2-3.

- Completing a datasheet for landed vessels, at all landing sites surveyed. The data collected by the study team was compared with the mean values of datasets collected by the regional and onboard supervisors using a linear correlation. Three variables were assessed, namely, catch composition, species prices per kilogram and biometric measurements. The results of a linear correlation analysis indicated the strength of the relationship between the two datasets[3] thereby supporting conclusions by the study team on the credibility and accuracy of data collected by the regional and onboard supervisors.

- Installing a high-resolution (GoPro) camera to vessels operated by selected onboard supervisors to conduct quality monitoring on how fishing activities are conducted. This aspect of the QA/QC exercise could only be conducted on vessels that spent fewer than 12 hours at sea due to constraints on camera battery life and memory storage. The GoPro camera was only attached to the onboard supervisor's vessel at the Lima landing site (Region 2) in the PFS-2 QA/QC exercise. The video provided the study team with insight into the specific challenges which were encountered by this onboard supervisor. Operational constraints hindered the camera from being attached to vessels operated by other suitable onboard supervisors.

[3] In linear correlation analysis, strong positive relationships are near 1, weak relationships are near 0 and a negative relationship approaches -1.

Figure 2-3: Conducting Interviews with Fisherfolk for the Landing Site Assessment at Hampton Court (Left), and Albion (Right)

Figure 2-4: Conducting Biometric Measurements at Rosignol (Left), and Morahwanna (Right)

2.7 Job Safety

A Job Hazard Assessment (JHA) was prepared for every field visit conducted by the study team. The JHA outlines potential sources of hazards or risks and subsequent measures that should be taken to prevent hazards. The JHA also included measures to ensure that fieldwork can continue safely amidst the COVID-19 pandemic.

3.0 GEAR TYPE AND ABUNDANT SPECIES CAUGHT

Fisherfolk use different types of fishing gear and different types of fishing vessels to target specific species of fishes independent of ecological zones or locations across Guyana's coastal regions. As a result, one of the key findings of PFS-1 was that the type of fishing gear used is, in general, a good indicator of the most abundant species caught, the species composition of hauls, the species diversity of hauls, and whether the species caught are juveniles or mature. However, species composition and species diversity of hauls may also be influenced by the proximity of fishing grounds to the shoreline and the commercial viability of species at the various landing sites surveyed. The following relationship between gear type and hauls was established in PFS-1:

- Drift seines with mesh sizes of 17.78 to 20 centimetres (7 to 8 inches) target snapper *(Cynoscion acoupa).* These seines are commonly referred to as "snapper seines" by fisherfolk. Secondary target species typically include other large species like trout *(Cynoscion virescens*) and gillbacker *(Sciades parkeri).* Species diversity using these seines are typically low as these large meshes only capture larger fishes, most of which have reached sexual maturity.

- Drift seines with mesh sizes of 6.5 to 7 centimetres (2.5 to 2.75 inches) are used to target bangamary *(Macrodon ancylodon*). These seines are commonly referred to as "bangamary seines" by fisherfolk. The second and third most abundant species caught using the bangamary seines were butterfish *(Nebris microps)* and trout. Species diversity of hauls from this seine type is typically high but the diversity of landed catch varies based on the commercial viability at the landing site. Species that are not commercially viable are typically discarded at sea as bycatch. Bangamary, butterfish and trout caught utilizing this fishing gear are generally mature.

- Chinese seines are open-faced squares that taper at one end into a funnel-like projection. Mesh sizes vary significantly with large mesh sizes ranging from 10.16 to 17.78 centimeters (4 to 7 inches) at the opening of the seine tapering to 0.65 to 3.81 centimeters (1 to 1.5 inches) around the funnel. Given the small mesh sizes of the seine around the funnel, Chinese seines are used to target shrimp species including white belly shrimp *(Nematopalaemon schmitti)* and coarse shrimp *(Xiphopenaeus kroyeri).* Species diversity of hauls from Chinese seines is usually high but the majority of fishes caught do not achieved sexual maturity. As such, bangamary and cuirass *(Cathorops sp and Sciades sp)* are typically also abundantly caught using Chinese seines. As a consequence, significant proportions of the haul are typically discarded as bycatch.

- Pin seines also have smaller mesh sizes of 0.64 to 2.54 centimetres (0.25 to 1 inch) and are typically used to target shrimp. Similar to the catch composition of Chinese seines, bangamary and cuirass are typically also abundantly caught with pin seines. Pin seines are set close to the shoreline and catches are retrieved with catamarangs (modified surfboards). Only species considered by fisherfolk to be commercially viable are retrieved from the seines. Therefore, comprehensive characterization of species composition, species diversity and maturity of haul is not possible.

- Cadell lines are used to target sea catfish *(Bagre bagre).* Catch compositions of species like cuirass and gillbacker. Other abundant species caught by this gear type is determined by the fishing grounds. Fishing trips father offshore catch species like bangamary, trout and a veriety of shark. Species diversity of Cadell lines are typically low and generally, depending on the size of hooks used, most species caught have reached sexual maturity.

- Drift seines with mesh sizes of 2.5, 5, 7.5, 10 and 12.7 centimetres (1, 2, 3, 4 and 5 inches) are used when there is no defined target species and this is considered a generalist approach to fishing. Maturity varies depending on the size of seine used and the species caught.

In addition, most artisanal fishing vessels are categorized as an inboard cruiser or outboard cruiser based on the size and position of the engine although there are other types of fishing vessels which do not require engine power. In addition, there is a direct relationship between the type of fishing gear used and type of fishing vessels used. The characterization of the types of fishing vessels used by artisanal fisherfolk is as follows:

- **Inboard cruisers** are the largest artisanal fishing vessels with haul capacities of approximately 18,000 kilograms (39,600 pounds). Engines for these vessels can exceed 100 horsepower and are built into the vessel. These vessels spend extended periods at sea, at least two weeks, because the hauls are designed to store large quantities of ice which is used to preserve the catch. These vessels use drift seines with mesh sizes of 19 centimeters (7.5 inches) and generally target snapper and other large, high-value species.

- **Outboard cruisers** are the most commonly used type of artisanal fishing vessel and the engine is placed at the rear of the vessel. The size of the vessels and engines used vary based on the type of fishing gear used by the fisherfolk. Outboard cruisers on which Chinese seines are used are typically the smallest engine powered vessels and typically have engines of 15 horsepower and haul capacities of approximately 500 kilograms (1,100 pounds). These vessels spend approximately 6 to 12 hours at sea and catch is rarely iced at sea. Outboard cruisers on which bangamary seines are used have engines that range from 15 to 48 horsepower and haul capacities of up to 2,045 kilograms (4,500 pounds). The duration of fishing trips ranges from 12 hours to about 3 days at sea, and catch is generally preserved on ice for longer trips. Finally, outboard cruisers on which snapper seines are used are the largest of this type of vessel used with engines that range from 48 to 60 horsepower and haul capacities of approximately 4,545 kilograms (10,000 pounds). Fishing trips last for one to three weeks and all catch is preserved on ice.

- **Sailboats** are not engine powered and depend on the wind to travel to their fishing grounds. However, some sailboats also have 15 horsepower outboard engines that are used when the wind is not sufficient to power the vessel or the direction of the wind is not suitable for fishing activities. These vessels have haul capacities of approximately 450 kilograms (1,000 pounds) and fishing trips last for approximately 24 hours. Sailboats usually have a generalist approach to fishing by using drift seines with varying mesh sizess.

- Vessels used for pin seine fishing are the smallest vessels used by artisanal fisherfolk in Guyana. These vessels are modified surfboards, called **catamarangs**. These vessels can land up to 90 kilograms (200 pounds) of catch from the seines.

Fisherfolk reported that the productivity of fishing trips consistently declined in the intervening period between PFS-1 and PFS-2. In particular, hauls of target species and other abundant species caught by different gear types were reported to be too low to provide the profit margins required to cover expenses incurred for fishing trips. During the PFS-2 period, increased prices of fuel and rations also challenged the economic viability of fishing trips. As a consequence, when data collection for PFS-2 resumed in April 2022, fishing practices at the surveyed landing sites were evolving and fisherfolk were exploring alternative fishing practices in pursuit of increasing productivity.

In light of these dynamic conditions in Q1 of PFS-2, fisherfolk at several landing sites switched to alternative gear types based on two factors. First, haul volumes per fishing trip were reported to be consistently and substantially lower than target volumes. Secondly, the prices for fishes and their by-

products at the landing site incentivized the targeting of high-value species. These conditions prevailed throughout PFS-2. In an isolated instance, the switch of gear type also resulted in a switch of vessel type. However, in Q3 and Q4, the haul volumes of some target species showed signs of increase and many fisherfolk reverted to their fishing practices as reported in PFS-1. The exception was at landing sites where the change or modification in fishing gear type was influenced by the market prices for species caught with alternative types of gear and in these cases, the alternative practices were virtually fully integrated into routine operations.

Based on these practices, it is evident that fisherfolk have preferences in the types of fishing gear utilized and the species captured. However, the practice of changing or modifying fishing gear indicated that artisanal fisherfolk typically own, or have easy access to, multiple types of seines to be used whenever they believe alternative practices may be necessary. In addition, the use and maintenance of multiple types of fishing gear also suggested that fishing practices are flexible and fisherfolk may be influenced to change their preferred fishing methods so as to ensure that fishing trips are economically viable.

Although some fisherfolk adapted their fishing practices to the prevailing conditions, several others opted to reduce effort by conducting fewer or, in some cases, no fishing trips. The fishing practices and the species composition observed in data collection by the regional supervisors and onboard supervisors is discussed below.

3.1 Regional Supervisors

At the landing sites where regional supervisors collected data, there was general consistency in fishing techniques as reported in PFS-1. The landing sites where fishing practices remained consistent with PFS-1 were:

- Snapper seines were the primary gear type at the Charity landing site (Region 2). Snapper was the most abundant species caught in each quarter of PFS-1 and PFS-2. However, the proportion of the haul represented by snapper declined to 54 percent of the total haul relative to 60 percent of the total haul in PFS-1. Other abundant species caught included trout, gillbacker and cuirass. Jewfish *(Epinephelus itajara)* and shark, both ETP species, were also reported in hauls with both species being juveniles of these species, whenever caught. All vessels from which data was collected were inboard cruisers.

- Bangamary seines were the primary gear types at the landing sites in Riverview (Region 4) and Mahaicony Bridge (Region 5). Bangamary was the most abundant species caught at the Riverview landing site but its proportion in the haul was about 30 percent of lower in Q1 to Q3. In Q4, bangamary accounted for approximately 43 percent of the total haul. However, there was a significant change in the other species where cuirass was the second most abundant species caught instead of trout or bangamary. Cuirass is typically most abundantly caught by fisherfolk whose fishing practices are generalised with no defined target species. Bangamary was also the most abundant species caught at the Mahaicony Bridge landing site in Q1 and Q2. In Q3 and Q4, butterfish was the reported to be the most abundant species caught. However, the study team had significant concerns about the credibility of the data collected by this regional supervisor in the final 2 quarters of PFS-2. All vessels at the Riverview and Mahaicony Bridge landing sites were outboard cruisers.

- Chinese seines were the primary gear type used at the Zeeburg landing site (Region 3) to target white belly shrimp. White belly shrimp was the most abundant species caught accounting for more than approximately 82 percent of the total haul, a slight decline from 85 percent of the total haul recorded in PFS-1. The high representation of the target species in the haul is not a signal of highly selective fishing gear but rather reflects the practice of

discarding bycatch at sea. During the PFS-2 period, there was a sharp decline in the productivity of white belly shrimping. Fisherfolk adapted by exploring new fishing grounds but did not change the type of fishing gear they used. Thus, when productivity dipped so low as to make trips economically unfeasible, fisherfolk conducted fewer fishing trips and some fisherfolk temporarily stopped making fishing trips entirely. All vessels at the Zeeburg landing site were outboard cruisers.

- Pin seines were used at landing sites in Region 6 (Rose Hall and the replacement in Adventure). Shrimp species, both white belly shrimp and coarse shrimp, were typically the most abundant species caught. Fisherfolk retrieved catch using catamarangs and outboard cruisers. At the Smith's Creek landing site (Region 1), most of the fisherfolk used drift seines with mesh sizes of 5.08 to 17.78 centimetres (2 to 7 inches) during PFS-2. By contrast, in PFS-1 when fisherfolk utilized Cadell lines and pin seines 0.64 to 2.54 centimetres (0.25 to 1 inch) most frequently. Given the range of gear type used, fishing practices at this landing site are not specialized. As a consequence, cuirass was the most abundant species caught in PFS-1. However, in PFS-2, snapper was the most abundant species caught in all quarters. In PFS-1, snapper was sold intact and the glue was not harvested separately at this landing site. The abundance of snapper in the haul throughout PFS-2 is a signal that several fisherfolk were consistently using snapper seines. Snapper is a highly valued species and snapper glue was the most valuable component of all hauls, including at the Smith's Creek. The new market for glue and the associated high prices may have significantly influenced the emerging specialization observed at this landing site in PFS-2.

The type of fishing gear, and the type and number of vessels used at the landing sites where data was collected by regional supervisors is presented in Table 3-1.

Table 3-1: Type of Fishing Gear, Type of Vessel and Number of Vessels at Landing Sites with Regional Supervisors in PFS-1 and PFS-2

Region	Landing Sites	Type of Fishing Gear		Type of Vessels	Number of Vessels Docked Based on Fisherfolk Estimates	
		PFS-1	PFS-1		PFS-1	PFS-2
Region 1	Smith's Creek/ Morahwanna	Cadell, Pin seines and Drift seines of several sizes (Generalist)	Drift seines of several sizes (Generalist)	Outboard cruisers	6 at Smith's Creek; 30 at Morahwanna (including Venezuelan vessels)	5 at Smith's Creek; 30 at Morahwanna (including Venezuelan vessels)
Region 2	Charity	Snapper seines	Snapper seines	Inboard cruisers	70	70
Region 3	Zeeburg	Chinese seines	Chinese seines	Outboard cruisers	30	20
Region 4	Riverview	Bangamary seines	Bangamary seines	Outboard cruisers	30	30
Region 5	Mahiacony Bridge	Bangamary seines	Bangamary seines	Outboard cruisers	15	15
Region 6	Adventure	Not included in PFS-1	Pin seines	Catamarangs and outboard cruisers	Not included in PFS-1	4

3.2 Onboard Supervisors

The types of fishing gear used by 50 percent of the onboard supervisors continued unchanged from PFS-1. These were:

- Snapper seines were by the onboard supervisor at the Complex #66 landing site (Region 6). Snapper was consistently the most abundant species caught by the onboard supervisor. However, the proportion of the total haul represented by snapper declined to approximately 61 percent as compared with 65 percent in PFS-1. Other abundant species caught included trout and cuirass.

- Bangamary seines were used by the onboard supervisors at the landing sites in Riverview (Region 4) and Albion (Region 6). Bangamary was the most abundant species caught throughout PFS-2 at both landing sites. However, the proportion of the total haul slightly declined at both landing sites relative to PFS-1. At Riverview, bangamary accounted for 53 percent of the total haul in PFS-1 but reduced to 50 percent in PFS-2. At Albion, bangamary accounted for 75 percent of the total haul in PFS-1 but marginally reduced to almost 74 percent in PFS-2. Other abundant species caught were butterfish and trout.

- Chinese seines were used to target coarse shrimp by the onboard supervisor at the Ogle landing site (Region 4). The productivity of shrimping significantly declined in PFS-2 and the target species was not the most abundantly caught in Q1 and Q4. Overall, the proportion of the total haul represented by coarse shrimp drastically declined from 71 percent in PFS-1 to 55 percent in PFS-2. The onboard supervisor at this landing site adapted by decreasing effort and fewer or, occasionally, no fishing trips were conducted monthly.

- Cadell lines were used by the onboard supervisors at Waramuri/Haimokabra (Region 1) and La Grange (Region 3). Sea catfish was the most abundant species caught at both landing sites. However, the proportion of the total haul represented by the target species significantly declined at both landing sites relative to PFS-1. At Waramuri/Haimokabra, sea catfish accounted for 75 percent of the total haul in PFS-1 but reduced to 55 percent in PFS-2. At La Grange, bangamary accounted for 85 percent of the total haul in PFS-1 but reduced to almost 71 percent in PFS-2. Other abundant species caught varied at these landing sites and this was influenced by the distance offshore with which the fishing trips were conducted.

The types of fishing gear and, in one instance, fishing vessel used by onboard supervisors at the remaining 50 percent of the landing sites changed both in comparison to PFS-1 and throughout the PFS-2 study period. At most landing sites, these changes were principally driven by the reduced productivity of target species which, in turn, reduced the profitability of fishing trips. Modified fishing practices were reported at the following landing sites:

- Smith's Creek (Region 1) where the onboard supervisor had a generalised approach to fishing in which there was no defined target species. In PFS-1, the supervisor regularly alternated among drift seines with mesh sizes of 2.5 to 12.7 centimetres (1 inch to 5 inches) on fishing trips and this approach was consistently used in Q1 and Q2. However, in the final two quarters of PFS-2, the onboard supervisor stopped using drift seines with mesh sizes of 2.5 and 5 centimetres (1 and 2 inches). Limiting the use of seines with smaller mesh sizes is likely to have been an attempt by the onboard supervisor to catch larger, high-value species such as gillbacker, which was the most abundant species caught in Q1 and Q2. However, this change in fishing practices resulted in cuirass and sea catfish being the most abundant species captured in Q3 and Q4, respectively.

- Lima (Region 2) where the onboard supervisor utilized a Chinese seine almost exclusively during PFS-1 to target shrimp (both white belly shrimp and coarse shrimp). In PFS-2, the onboard supervisor alternated among a variety of gear types including Chinese seines, pin seines, and drift seines with mesh sizes of 10.16 and 12.7 centimetres (4 and 5 inches). The reason for the changes in the fishing practice was two-fold. Firstly, the supervisor reported that shrimp hauls from Chinese seine fishing, which represented 71 percent of the total catch in PFS-1, had declined so significantly that the use of this gear was not feasible. In addition, ongoing maintenance works on hard sea defences structures at the landing site disrupted fishing activities and prompted to onboard supervisor to regularly use pin seines so that fishing trips could be conducted close to the shore. The result of the altered practices was that this supervisor now has a generalised approach to fishing for which there is no clear target species. Accordingly, the most abundant species varied throughout PFS-2 and included blinka (*Sciades couma*) (Q1), highwater (*Hypophthalmus edentates*) (Q2 and Q3) and mullet (*Mugil liza*) (Q4).

- Hampton Court (Region 2) where the onboard supervisor utilized drift seines with mesh sizes of 20.32 to 22.86 centimetres (8 to 9 inches) to target large species like snapper and gillbacker during PFS-1. Collectively, these two species accounted for 96 percent of the onboard supervisor's catch in PFS-1. Persistent low hauls, which were reportedly experienced prior to the commencement of PFS-2, saw a drastic evolution in the supervisor's fishing practices as follows:
    - In Q2, the supervisor utilized new types of fishing gear namely drift seines with mesh sizes of 7.62 centimetres (3 inches) and Cadell lines affixed with 500 hooks.
    - In the latter part of Q3 and throughout Q4, the supervisor changed to a smaller outboard cruiser which had a significantly lower haul capacity but required lower inputs of fuel and fewer crew to operate. When this vessel is used, drift seines with mesh sizes of 6.06, 6.99, and 7.62 centimetres (2.5, 2.75, and 3 inches) are utilized to target bangamary and mullet.

- Windsor Forest (Region 3) where onboard supervisor utilized a Chinese seine almost exclusively during PFS-1 to target white belly shrimp. On most fishing trips in PFS-1, Cadell lines were also used to augment hauls from the Chinese seine and both types of gear were soaked simultaneously. Although white belly shrimp was the target species in PFS-1, bangamary was the most abundant species caught in the total haul. In PFS-2, the onboard supervisor radically changed fishing practices and Cadell lines were exclusively used on most of the fishing trips, particularly in Q2 and Q3. This decision was influenced by consecutive months of low hauls of white belly shrimp. In Q4, following signs that the productivity of shrimps was on the rise, Chinese seines were used more often but there were also fishing trips where Cadell lines were exclusively used. Cadell lines capture gillbacker, the most expensive fish per kilogram at most landing sites surveyed. Given the price incentive of targeting gillbacker, the exclusive use of Cadell lines on fishing trips is expected to continue.

- Bushlot (Region 5) where the onboard supervisor utilized drift seines with mesh sizes of 11, 13 and 18 centimetres (4.5, 5 and 7 inches) in PFS-1 but the most frequently used gear type was the drift seine with mesh sizes of 18 centimetres (7 inches) for targeting snapper. In PFS-2, the supervisor continued to use all gear types previously referenced by the drift seine with mesh sizes of 13 centimetres (5 inches) the most frequently utilized. Since PFS-1, the overall approach to fishing at this landing site was generalised and at that time, the most abundant species caught was cuirass. Declining hauls of snapper and other large species which are typically captured by snapper seines were the driving factors in the change in fishing approach. Due to the modified fishing practice, paggie (*Lobotes surinamensis*) was the most abundant species caught in PFS-2.

- Rosignol (Region 5) where the onboard supervisor used drift seines with mesh sizes of 17.78 and 19.05 centimetres (7 and 7.5 inches) to target snapper throughout PFS-1 as well as in Q1 and Q2 of PFS-2. However, persistent low catches of snapper led to the supervisor to start to use bangamary seines (drift seines with mesh sizes of 6.35 centimetres [2.5 inches]) in Q3 and Q4. The onboard supervisor also continued to use snapper seines with the result the snapper was the most abundant species caught throughout PFS-2.

All onboard supervisors used outboard cruisers. The exception was the Bushlot onboard supervisor whose primary vessel type was a sailboat. However, the sailboat was also affixed with a 15-horsepower engine, in an outboard cruiser position, which was used whenever winds were too low to move the sails.

A summary of these key findings at each landing site where data was collected by an onboard supervisor is presented in Table 3-2.

Table 3-2: Gear Type and Most Abundant Species Caught by Onboard Supervisors during PFS-1 and PFS-2

Landing Site	Quarter	PFS-1			PFS-2		
		Most Frequently Used Gear Type	Most Abundant Species Caught	Haul Percentage	Most Frequently Used Gear Type	Most Abundant Species Caught	Haul Percentage
Smith's Creek	Q1	Vessel was not operational			Drift seines with mesh sizes of 2.5, 5, 7.5, 10 and 12.7 centimetres (1, 2, 3, 4 and 5 inches) used alternatingly	Gillbacker	10.91
	Q2	Vessel was not operational			Drift seines with mesh sizes of 2.5, 5, 7.5, 10 and 12.7 centimetres (1, 2, 3, 4 and 5 inches) used alternatingly	Gillbacker	10.57
	Q3	Drift seines with mesh sizes of 2.5, 5, 7.5, 10 and 12.7 centimetres (1, 2, 3, 4 and 5 inches) used alternatingly	Snapper	7.70	Drift seines with mesh sizes 7.62, 10.16 and 12.7 centimetres (3, 4, and 5 inches) used alternatingly	Cuirass	11.95
	Q4	Vessel was not operational			Drift seines with mesh sizes 7.62, 10.16 and 12.7 centimetres (3, 4, and 5 inches) used alternatingly	Sea Catfish	10.32
Waramuri	Q1	Cadell lines	Sea Catfish	79.85	Cadell lines	Sea Catfish	53.59
	Q2	Cadell lines		74.26	Cadell lines	Sea Catfish	48.6
	Q3	Cadell lines	No data collected for Q3 and Q4		Cadell lines	Sea Catfish	68.50
	Q4	Cadell lines			Cadell lines	Sea Catfish	48.5
Hampton Court	Q1	Drift seines with mesh sizes of 20.32 to 22.86 centimetres (8 to 9 inches)	Gillbacker	62.24	Drift seines with mesh sizes of 20.32 to 22.86 centimetres (8 to 9 inches) used alternatingly	Snapper	52.25

Landing Site	Quarter	PFS-1			PFS-2		
		Most Frequently Used Gear Type	Most Abundant Species Caught	Haul Percentage	Most Frequently Used Gear Type	Most Abundant Species Caught	Haul Percentage
	Q2	Drift seines with mesh sizes of 20.32 to 22.86 centimetres (8 to 9 inches)	Gillbacker	52.17	Drift seines with mesh sizes of 20.32 to 22.86 centimetres (8 to 9 inches) used alternatingly	Gillbacker	39
	Q3	Drift seines with mesh sizes of 20.32 to 22.86 centimetres (8 to 9 inches)	Gillbacker	52.52	Drift seines with mesh sizes of 20.32 to 22.86 centimetres (8 to 9 inches) used alternatingly	Gillbacker	35.10
	Q4	Drift seines with mesh sizes of 20.32 to 22.86 centimetres (8 to 9 inches)	Snapper	59.36	Drift seine 6.985, 7.62 and 12.7 centimetres (2.75, 3 and 5 inches) used alternatingly	Mullet	49.42
Lima	Q1	Chinese seine	Cuirass	26.43	Chinese seine	Blinka	24.86
	Q2	Chinese seine	Highwater	22.18	Chinese seine	Highwater	34
	Q3	Chinese seine	Coarse Shrimp	30.58	Drift seine 10.16 centimetres (4 inches) and pin seine	Highwater	29.84
	Q4	Chinese seine	Coarse Shrimp	55.69	Pin seine	Mullet	28.78
Windsor Forest	Q1	Chinese seine	Bangamary	36.07	Chinese seine	Cuirass	24.81
	Q2	Chinese seine	Bangamary	36.35	Cadell lines	Cuirass	35.2
	Q3	Chinese seine	Bangamary	50.32	Cadell lines	Sea Catfish	25.55
	Q4	Chinese seine	Bangamary	44.9	Chinese seine	Sea Catfish	21.48
La Grange	Q1	Cadell lines	Sea Catfish	90.70	Cadell lines	Sea Catfish	92
	Q2	Cadell lines	Sea Catfish	75.84	Cadell lines	Sea Catfish	59.37
	Q3	Cadell lines	Sea Catfish	83.25	Cadell lines	Sea Catfish	66.76
	Q4	Cadell lines	Sea Catfish	96.12	Cadell lines	Sea Catfish	65.78

Landing Site	Quarter	PFS-1			PFS-2		
		Most Frequently Used Gear Type	Most Abundant Species Caught	Haul Percentage	Most Frequently Used Gear Type	Most Abundant Species Caught	Haul Percentage
Riverview	Q1	Bangamary seine	Bangamary	58.26	Bangamary seine	Bangamary	58.04
	Q2	Bangamary seine	Bangamary	56.38	Bangamary seine	Bangamary	52.25
	Q3	Bangamary seine	Bangamary	49.08	Bangamary seine	Bangamary	43.19
	Q4	Bangamary seine	Bangamary	41.49	Bangamary seine	Bangamary	45.71
Ogle	Q1	Chinese seine	Coarse Shrimp	43.07	Chinese seine	White b\Belly Shrimp	65.61
	Q2	Chinese seine	Coarse Shrimp	68.18	Chinese seine	Coarse Shrimp	54.26
	Q3	Chinese seine	Coarse Shrimp	86.77	Chinese seine	Coarse Shrimp	63.43
	Q4	Chinese seine	Coarse Shrimp	60.24	Chinese seine	White Belly Shrimp	35.89
Bushlot	Q1	Drift seine with mesh sizes of 11.43 centimetres (4.5 inches)	Cuirass	48.34	Drift seine with mesh sizes of 12.7 centimetres (5 inches)	Cuirass	38.07
	Q2	Snapper seine	Snapper	74.06	Drift seine with mesh sizes of 12.7 centimetres (5 inches)	Bangamary	56.70
	Q3	Drift seine with mesh sizes of 12.7 centimetres (5 inches)	Cuirass	20.33	Drift seine with mesh sizes of 12.7 centimetres (5 inches)	Paggie	39.71
	Q4	Drift seine with mesh sizes of 12.7 centimetres (5 inches)	Cuirass	39.60	Drift seine with mesh sizes of 12.7 centimetres (5 inches)	Paggie	43.70
Rosignol	Q1	Drift seine with mesh sizes of 11.43, 12.7, and 19.05 centimetres (4.5, 5, 7.5 inches)	Basha	36.37	Snapper seine	Snapper	64.99
	Q2	Snapper seine	Snapper	54.12	Snapper seine	Snapper	58.59

Landing Site	Quarter	PFS-1			PFS-2		
		Most Frequently Used Gear Type	Most Abundant Species Caught	Haul Percentage	Most Frequently Used Gear Type	Most Abundant Species Caught	Haul Percentage
	Q3	Snapper seine	Snapper	71.44	Bangamary seine	Snapper	52.28
	Q4	Snapper seine	Snapper	82.54	Snapper seine	Snapper	51.60
Albion	Q1	Bangamary seine	Bangamary	73.83	Bangamary seine	Bangamary	77
	Q2	Bangamary seine	Bangamary	82	Bangamary seine	Bangamary	70
	Q3	Bangamary seine	Bangamary	67.26	Bangamary seine	Bangamary	67.41
	Q4	Bangamary seine	Bangamary	75.61	Bangamary seine	Bangamary	79.88
Complex #66	Q1	Snapper seine	Snapper	70.46	Snapper seine	Snapper	82.19
	Q2	Snapper seine	Snapper	63.92	Snapper seine	Snapper	45.11
	Q3	Snapper seine	Snapper	52.49	Snapper seine	Snapper	50.37
	Q4	Snapper seine	Snapper	72.08	Snapper seine	Snapper	65.90

4.0 PRODUCTIVITY AND SEASONALITY

The productivity of a fishing trip is determined by a complex interplay of several factors, including effort, total haul and seasonal variations (fishing seasons and climatic variations). The type of fishing vessel and fishing gear used are directly associated with both effort and haul. Larger vessels have greater haul capacities, typically travel farther from the landing site to access preferred fishing grounds and are capable of spending prolonged periods at sea per fishing trip. Moreover, larger vessels typically use drift seines with the largest mesh sizes to capture high-value species. Generally, larger predatory fishes like snapper and trout require greater effect to catch. By contrast, smaller vessels use a range of gear types to target several species or often, have no defined target species. These vessels typically make trips that are shorter than a day and have low expenses or no expenses.

In theory, higher levels of effort expended may be reasonably expected to produce greater hauls. However, this relationship is not linear and effort is not a reliable indicator of haul. In PFS-2, fisherfolks at landing sites surveyed switched gear types and explored new fishing grounds (in some instances considerably farther away from the landing site) with the overarching objective of increasing the productivity of fishing trips. It was recognized that altered practices did not always result in the anticipated increases of productivity. In PFS-1, onboard supervisors at most of the landing sites surveyed increased their effort during the periods with the lowest productivity (the “hard season”) so as to achieve target haul volumes. These attempts did not produce greater hauls because the productivity of a soaking was lower during the hard seasons. In reality, the productivity of fishing trips are influenced by a variety of factors which include seasonal variations, externalities pertaining to weather and environmental conditions, and possibly, competition amongst fisherfolks for the same resources.

The productivity of fishing trips at the landing sites surveyed was assessed using the catch per unit effort (CPUE). According to the FAO (1969), “catch per unit effort” represents the total amount of effort used to harvest catch. In this study, catch is represented by the total combined haul weight of commercially viable species. Effort is represented by the total amount of time taken to conduct fishing activities and takes account of the total duration of the fishing trip between departure from and return to the landing site. Generally, seines with smaller mesh sizes (like Chinese seines and bangamary seines) are more productive and have higher CPUE due to the lower effort required to catch these species as well as the relatively low selectively of the seines. On the other hand, fishing gear with higher selectivity (like snapper seines) typically are less productive and have lower CPUE values.

Seasonal Productivity

PFS-1 outlined fisherfolks beliefs pertaining to seasonal variations in productivity of fishing trips. In particular, the peak season (commonly called the “good season”) is believed to commence in May and peak in July to September. The off-peak season (commonly called the “hard season”) is believed to run from October to April of the following year. The good season is believed to occur during periods of the year when waters are warmer (which is believed to lead to an abundance of fishes) and calmer (which is less dangerous and requires less effort to fish). The hard season is believed to occur when waters become colder and rougher. The findings of PFS-1 confirmed that the average haul weight per fishing trip was higher during the good season relative to the hard season at most landing sites surveyed.

In addition, PFS-1 explored the relationship between Guyana’s climatic seasons and the productivity of fishing trips. Guyana’s climate, particularly its precipitation patterns, is influenced primarily by the seasonal migration of the Inter-Tropical Convergence Zone (ITCZ) which is a cloud and rain-bearing belt of rising air where south-easterly and north-easterly trade winds converge. Guyana’s coastal regions experience a bimodal annual cycle of precipitation with distinct wet seasons. The primary wet season commences from mid-April to the end of July and the secondary wet season occurs from mid-

November to January. The intervening periods are known as the primary and secondary dry seasons respectively. Rainfall occurs in all seasons but typically more frequent and intense during the wet seasons. The findings of PFS-1 suggested that the productivity of fishing activities is greatest during the primary wet season (May to July). This period overlaps with the three months of the period believed to be the good season for fishing.

Moreover, based on the findings of PFS-2, the most productive periods for shrimping are the dry seasons when offshore fishing grounds are most saline. Inclement weather results in discharges of large volumes of freshwater from Guyana's river system into the offshore environment and white belly shrimp, which have a low tolerance for freshwater, are expected to move farther offshore to areas out-of-range of the fishing grounds used for shrimping by artisanal fisherfolk.

The alignment of the periods for fishing productivity, the climatic seasons and the periods of the PFS reporting quarters is presented in Table 4-1. The findings of this study were reported quarterly and the PFS reporting periods intersects with the seasons outlined above as follows:

- Q1 (April to June) – The end of the hard season and the beginning of the good season as well as part of the primary wet season. Fishing activities may be expected to be productive during this quarter.
- Q2 (July to September) – The peak period of the good season and the end of the beginning of the primary dry season. Fishing and shrimping may be expected to be productive in this quarter.
- Q3 (October to December) – The start of the hard season. This is also end of the dry season and the beginning of the secondary wet season. Productivity of fishing and shrimping may be expected to decline during this quarter.
- Q4 (January to March) – The continuation of the hard season and the beginning of the secondary dry season. Productivity during this quarter may be expected to be lower than Q1 and Q2 but may trend upwards in comparison to Q3.

Table 4-1: Alignment among Seasons for Fishing Productivity, Climatic Seasons and the PFS Quarters

Anecdotal Seasons of Fishing Productivity	PFS Quarters	Climatic Seasons
Good (Peak) Season – May to September	Q1 – April to June	▪ Primary Wet Season – May to July ▪ Primary Dry Season – August to October ▪ Secondary Wet Season – November to January ▪ Secondary Dry Season – February to April
	Q2 – July to September	
Hard (Off-Peak) Season – October to April	Q3 – October to December	
	Q4 – January to March	

Overall, there were major declines in productivity of various types of fishing gear during PFS-2 in comparison to PFS-1. This section presents the productivity of fishing trips based on the type of fishing gear used (seine type) for the four reporting periods in PFS-1 and PFS-2.

4.1 Productivity of Snapper Seines

Data was collected by supervisors at four landing sites where the primary gear type utilized was snapper seines namely, Charity (Region 2), Hampton Court (Region 2), Rosignol (Region 5) and Complex #66 (Region 6). Snapper seines, which have large meshes, typically have lower productivity than seines with smaller mesh sizes because of higher selectivity of the species being captured. Overall, the productivity of fishing trips using snapper seines declined relative to PFS-1. Moreover, at 50 percent of these landing sites, effort significantly changed in an attempt to increase productivity of fishing trips. There were evident overlaps of the most productive quarters with seasonality. At 75 percent of the landing sites the most productive quarters were Q1 and Q2 which overlap with the good season. Within the good season, productivity was most commonly higher during Q1 which overlaps with the primary wet season. A comparison of quarterly productivity at landing sites using snapper seines can be seen in Figure 4-1 (A-D).

The productivity of fishing trips at the Charity landing site is presented in Figure 4-1 (A). Productivity in Q1 of PFS-2 increased by 80 percent in comparison to PFS-1. This was the most productive period at this landing site and high productivity was anticipated during this period. This was the most productive quarter ever recorded by the regional supervisor at this landing site with CPUE being 4.96 kilograms per normal. Typically, the upper range for CPUE is lower than 3 kilograms per hour. However, the reason for the sharp increase in productivity in PFS-2 relative to PFS-1 is not known as effort and fishing grounds were consistent with fishing practices reported in PFS-1 and in the remaining quarters of PFS-2. However, in Q2 to Q4 of PFS-2, productivity sharply declined and was consistently lower in comparison to the PFS-1 reference periods by 21 percent in Q2, 6 percent in Q3 and 24 percent in Q4. In both PFS-1 and PFS-2, the lowest productivity was reported in Q3 which overlaps with the beginning of the hard season.

The productivity of fishing trips at the Hampton Court landing site is presented in Figure 4-1 (B). Productivity was significantly lower in Q1 and Q2 of PFS-2 as compared with the PFS-1 reference periods. In Q1, productivity was lower by 50 percent and in Q2, by 65 percent. According to the onboard supervisor, similar sharp dips in productivity were being experienced prior to the start of data collection for PFS-2. In an attempt to increase productivity, the onboard supervisor drastically increased effort by travelling to fishing grounds more than 70 kilometres northwest of this landing site. By contrast, in PFS-1, fishing grounds were typically located within a 20-kilometre radius of the landing site. Increased effort in PFS-2 did not yield the desired results of increased haul volumes, prompting the onboard supervisor to drastically change fishing gear and target species in Q3 in an attempt to increase productivity as well as reduce the expenses incurred per fishing trip. These changes led to increased productivity. However, the CPUE in Q3 and Q4 of PFS-2 remained marginally to moderately low compared to PFS-1.

As presented in Figure 4-1 (C), no comparison was made to PFS-1 reference periods at the Rosignol landing site because the onboard supervisor was replaced at the commencement of PFS-2. The type of fishing gear by both supervisors was comparable but effort varied between the supervisors. As such, this does not provide a robust basis for comparisons of CPUE. At Rosignol, the most productive quarter was Q2. However, in Q3, productivity was higher than in Q1. According to the onboard supervisor, the drastic dip in productivity of snapper seines were making fishing trips economically unfeasible and the supervisor started to use bangamary seines on fishing trips in Q3. However, the supervisor reduced use of bangamary seines in Q4 and productivity sharply dipped to 0.77 kilograms per hour. This is comparable to the same period during PFS-1 when the onboard supervisor at Rosignol recorded a CPUE of 0.62 kilograms per hour. The decrease during PFS-1 was likely a result of exporatory fishing which led to the onboard supervisor having a significatlt larger fising range then the new supervisor utilized during PFS-2. During PFS-1 the onboard supervisor at the Rosignol landing site saw decreases in productivity from Q1 – Q4. During Q1 the supervisor recorded the highest catch

per unit effort for the year. This may have been likely a result of the use of the smaller mesh sizes of 11.43, 12.7, and 19.05 centimetres (4.5, 5 and 7.5 inches).

At the Complex #66 landing site, in PFS-2, productivity was highest in Q1 and thereafter sharply dipped in Q2 (Figure 4-1 [D]). The productivity of the Q1 and Q2 periods inversely mirror the PFS-1 reference periods with when the highest productivity was recorded in Q2. Following the dip in Q2, productivity increased in Q3 before dipping again in Q4. However, in both Q3 and Q4, productivity was higher in comparison to the PFS-1 reference periods by 4 percent and 5 percent respectively. This is unlike the productivity reported at the other three landing sites where snapper was the target species. The onboard supervisor did not make any significant changes in effort either by using new fishing gear or travelling to new fishing grounds.

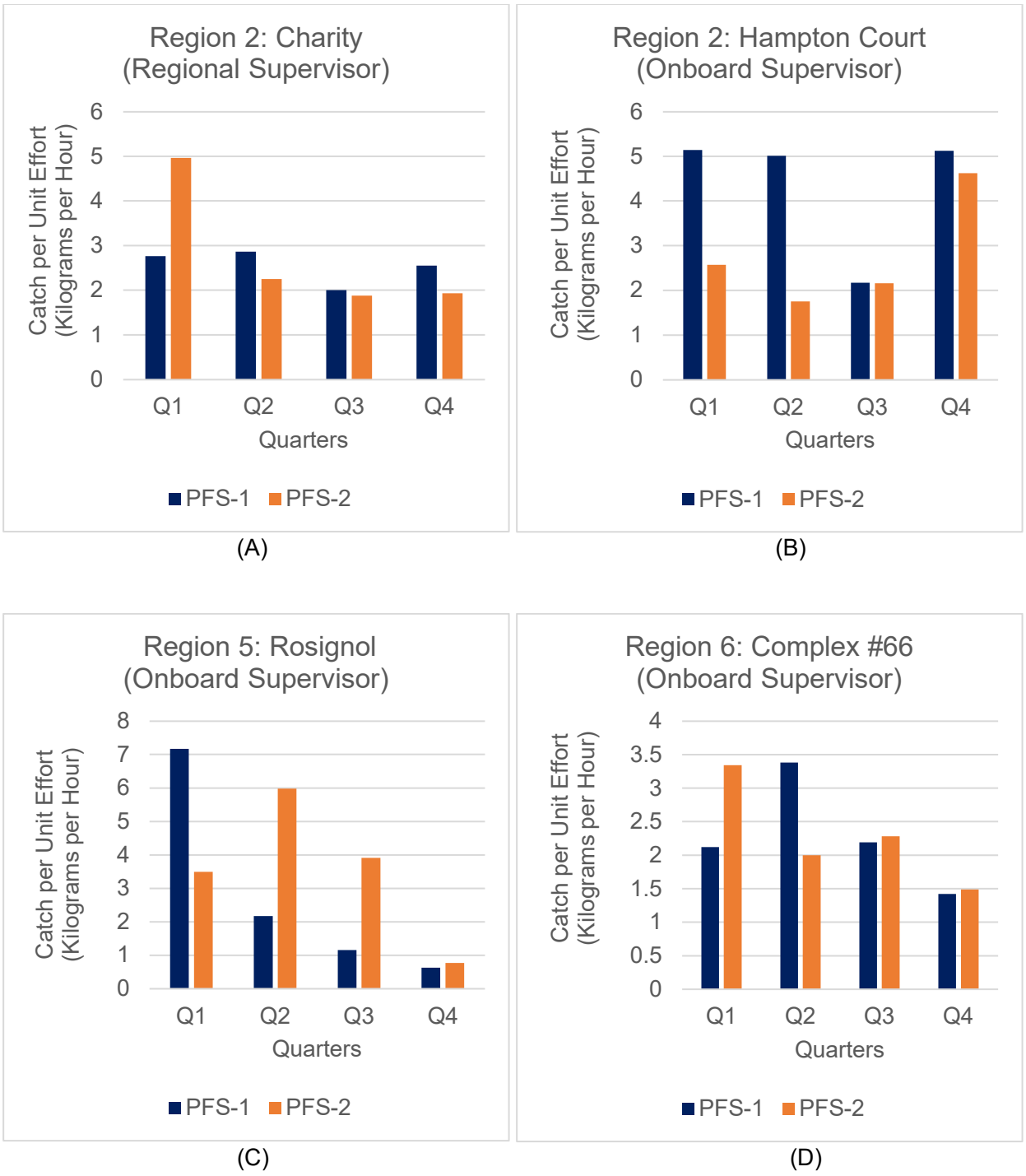


Figure 4-1 (A-D): Comparison of Catch per Unit Effort during PFS-1 and PFS-2 for Landing Sites Using Snapper Seines at Charity (A), Hampton Court (B), Rosignol (C) and Complex #66 (D)

4.2 Productivity of Bangamary Seines

Data was collected by supervisors at four landing sites where bangamary seines were the primary gear type utilized namely, Riverview (Region 4) where data was collected by a regional supervisor and

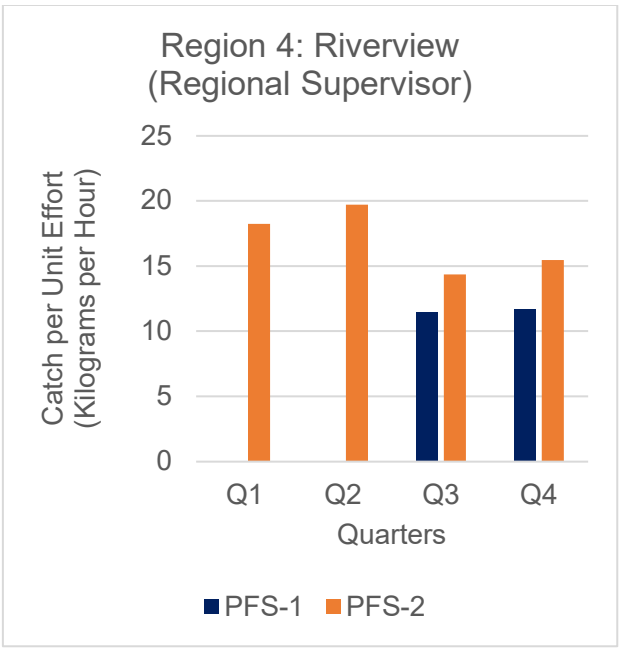
an onboard supervisor, Mahaicony Bridge (Region 5), Albion (Region 6). Overall, bangamary fishing experienced a downturn in PFS-2. The exception is the increase in productivity reported by the onboard supervisor at the Riverview landing site but this was influenced by the capture of cuirass, a low-effort species, which is not a target species of this gear type. Despite the productivity declines, no attempts were by made by fisherfolk to adapt or augment their fishing practice. As observed at landing sites were snapper seines were used, there were evident overlaps of the most productive quarters with seasonality. At all landing sites, with the exception of Mahaicony Bridge for which a complete PFS-2 dataset is not available, the most productive quarters were Q1 and Q2 which overlap with the good season. Within the good season, productivity was most commonly higher during Q1 which overlaps with the primary wet season. A comparison of quarterly productivity at landing sites using bangamary seines can be seen in Figure 4-2.

At the Riverview landing site, the regional supervisor reported increased productivity relative to the PFS-1 reference periods for Q1, Q3 and Q4 as seen in Figure 4-2 (A). There is no data for the PFS-1 reference period for Q2 because the data collected by regional supervisor who was volunteering at the landing site during that period was not considered to be credible following QA/QC by the study team. The reasons for increased productivity in Q1 of PFS-2 cannot be determined. However, it is likely that the increased productivity in Q3 and Q4 were associated with changes in the catch composition. Specifically, in these quarters, cuirass was the second most abundant species reported by the regional supervisor. Cuirass is typically among the most abundant species caught by fishing practices that are generalist where there is no defined target species. The second and third most abundant species caught by bangamary seines are butterfish and trout as observed throughout PFS-1 at this landing site and, in PFS-1 and PFS-2 at all landing sites where bangamary is the target species. Therefore, the increased capture of a low-effort species like cuirass may have played a role in the increased productivity of fishing trips reported by the regional supervisor.

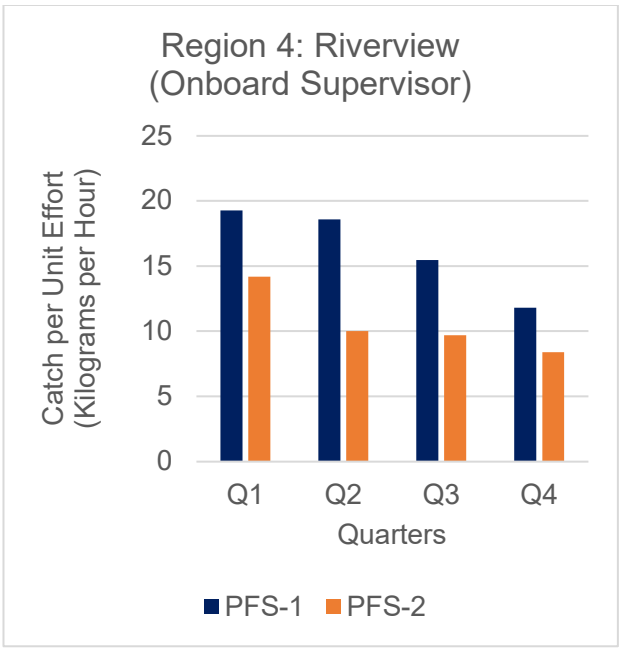
By contrast, productivity of fishing trips conducted by the onboard supervisor at the Riverview landing site consistently declined throughout the PFS-2 relative to PFS-1 (Figure 4-2 [B]). Indeed, the highest productivity was reported in Q1 after which there were progressive declines in the remaining quarters. Moreover, in PFS-2, productivity was lower in all quarters in comparison to the PFS-1 reference periods. Specifically, productivity declined by 26 percent in Q1, 46 percent in Q2, 37 percent in Q3 and 29 percent in Q4. Unlike the trend in the data collected by the regional supervisor, there was no variation in the species composition of the hauls from the onboard supervisor.

At the Mahaicony Bridge landing site, productivity decreased in Q1 and Q2 by 8.33 and 22 percent respectively when compared with the PFS-1 reference periods (Figure 4-2 [C]). There is no comparable data for the PFS-2 quarters in Q3 and Q4 because the data collected by the regional supervisor was not found to be credible by the study team during the QA/QC exercise. The regional supervisor at this landing site has since been replaced. However, based on the trends observed in PFS-1, productivity may have dipped moderately in Q3 and then steeply in Q4. Based on the Q1 and Q2 trends at this landing sites targeting bangamary, productivity during the final two quarters of PFS-2 is likely to have been lower than the PFS-1 reference periods.

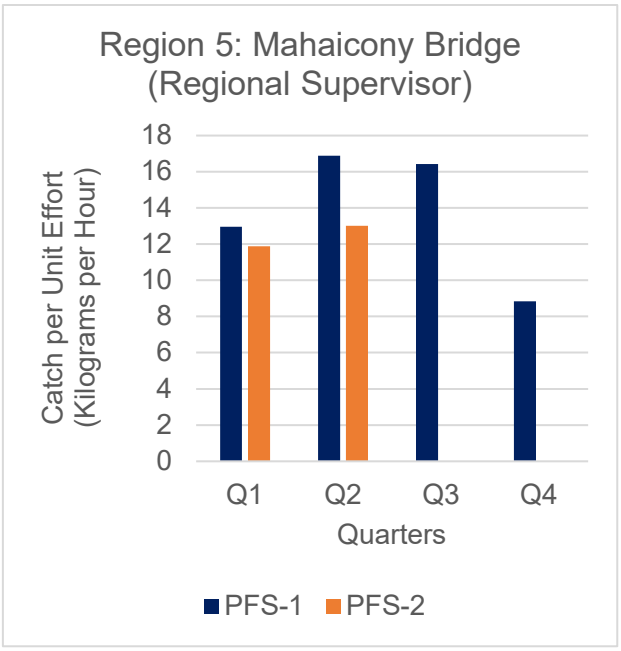
At the Albion landing site, productivity was significantly higher in Q1, by 40 percent, in comparison to the PFS-1 reference period (Figure 4-2 [D]). The productivity achieved during this quarter was 8.22 kilograms per hour, higher than in any of the other reporting periods in PFS-1 or PFS-2. Previously, the highest CPUE was 7 kilograms per hour which was achieved in Q2 of PFS-1. However, productivity declined in Q2 and Q3 before trending upwards again in Q4. Nonetheless, with the exception of Q1, productivity was consistently lower than the PFS-1 reference periods. Specifically, CPUE declined by 9 percent in Q2, 22 percent in Q3, and 4 percent in Q4 in comparison to PFS-1.



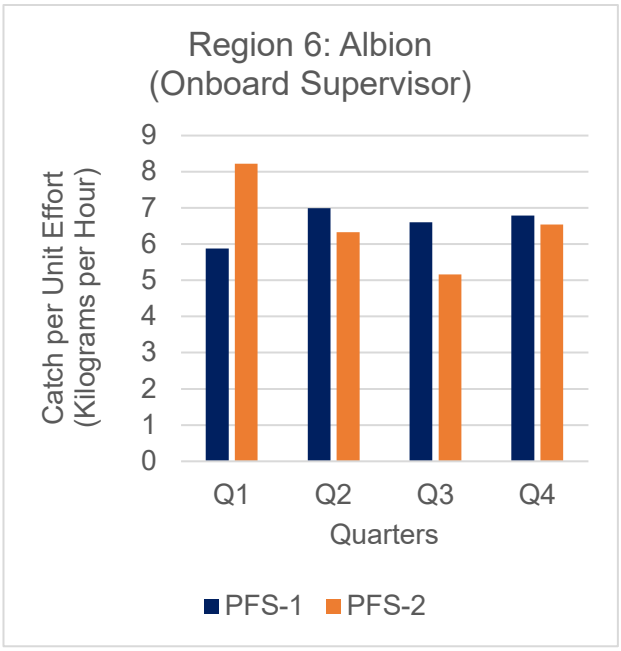
(A)



(B)



(C)



(D)

Figure 4-2 (A-D): Comparison of Catch per Unit Effort during PFS-1 and PFS-2 for Landing Sites Using Bangamary Seines at Riverview Regional supervisor (A), Riverview Onboard supervisor (B), Mahaicony Bridge (C) and Albion (D)

4.3 Productivity of Shrimping

Regional and onboard supervisors collected data from five landing sites where shrimp (white belly shrimp or coarse shrimp) were the target species. Specifically, Chinese seines were used to target shrimp at Lima (Region 2), Zeeburg (Region 3), Windsor Forest (Region 3) and Ogle (Region 4). In

addition, data was collected from pin seine fishing from the Adventure landing site (Region 6). During PFS-2, there were significant downturns in the productivity of shrimping and productivity ass generally lower in comparison to the PFS-1 reference periods. At two landing sites, the onboard supervisors altered fishing practices by using alternative fishing gear in an effort to improve productivity. At the other landing sites, no modifications in fishing gear was made but effort was tremendously reduced because fishing trips were not deemed to be economically feasible. One of the key contributing factors to this downturn has been the prolonged periods of intense precipitation which increased the freshwater loading of the fishing grounds. Altered environment conditions offshore, particularly low salinity, is not conducive to shrimp (mainly white belly shrimp) which have low tolerance for freshwater and adapt by moving farther offshore to more suitable habitats. Given the altered fishing practices (gear type change and effort reduction), no discernable seasonal trend for shrimping has emerged.

At the Zeeburg landing site, there were decreases in the capture of white belly shrimp, the target species, across all quarters of PFS-2 relative to the PFS-1 reference periods (Figure 4-3 [A]). Specifically, CPUE declined by 10.70 percent in Q1, 67.55 percent in Q2, 39 percent in Q3 and 13 percent in Q4. Moreover, Q2 was the most productive in PFS-1 but was the least productive period in PFS-2. According to the regional supervisor, the decline was associated with unusually heavy rainfall. Sustained inclement weather created challenging work conditions and increased freshwater loads which were not conducive to shrimping. White belly shrimp, the target species, prefers saline conditions and move farther offshore during periods when freshwater loads are high. Chinese seines are typically set about one-kilometre from shore and therefore, may be too close to the shore to capture target populations when offshore conditions are not suitable to these species. Fisherfolk at this landing site opted to conduct fewer or no fishing trips when there was sustained heavy rainfall. On several fishing trips, total hauls yielded few commercial species and, in some instances, none of the target species was captured. For example, during the QA/QC exercise in Q3, the study team visited the landing site on three occasions when vessels were scheduled to land but no trips were conducted by any vessel on those days. On the fourth visit to the landing site, only one vessel landed and its haul comprised two sea catfish individuals.

At the Ogle landing site, there were also drastic decreases in CPUE as compared to PFS-1 because hauls of coarse shrimp, the target species, plummeted (Figure 4-3 [B]). Specifically, CPUE declined by 57 percent in Q1, 65 percent in Q2, and 66 percent in Q3. The trends at Ogle are similar to what was observed at the Zeeburg landing site where fisherfolk opted to stop fishing activities because of low yields. For example, in light of consecutive low hauls experienced for more than a year, in Q3, the onboard supervisor indicated that fishing is no longer a viable livelihood option. Thereafter, the supervisor stopped fishing activities and migrated to Trinidad to work on sardine fishing vessel. The new onboard supervisor conducted only one fishing trip in Q4 which does not provide sufficient data to estimate CPUE. QA/QC exercises validated reports from the new onboard supervisor that fishing trips were not being made. In particular, the study team made several attempts to collect data to facilitate the QA/QC exercise but the fisherfolk with whom the study team made arrangements did not fish on the selected dates as they believed that the trips would not have been economically feasible.

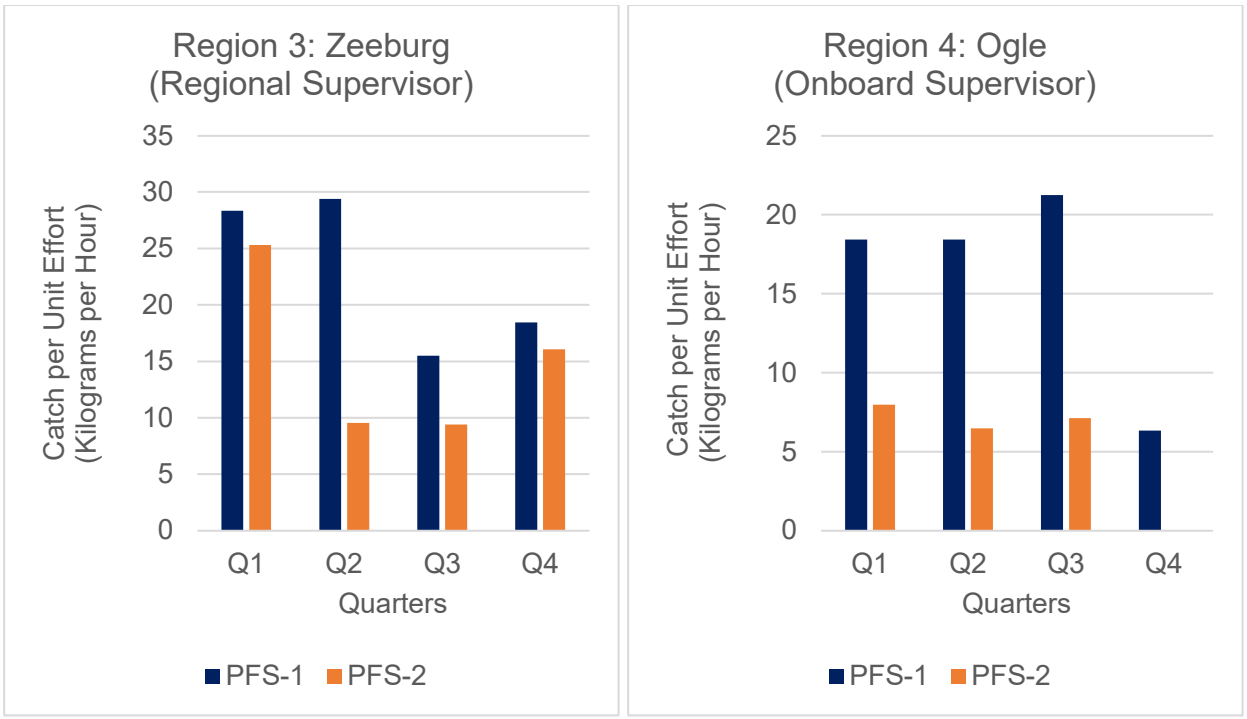
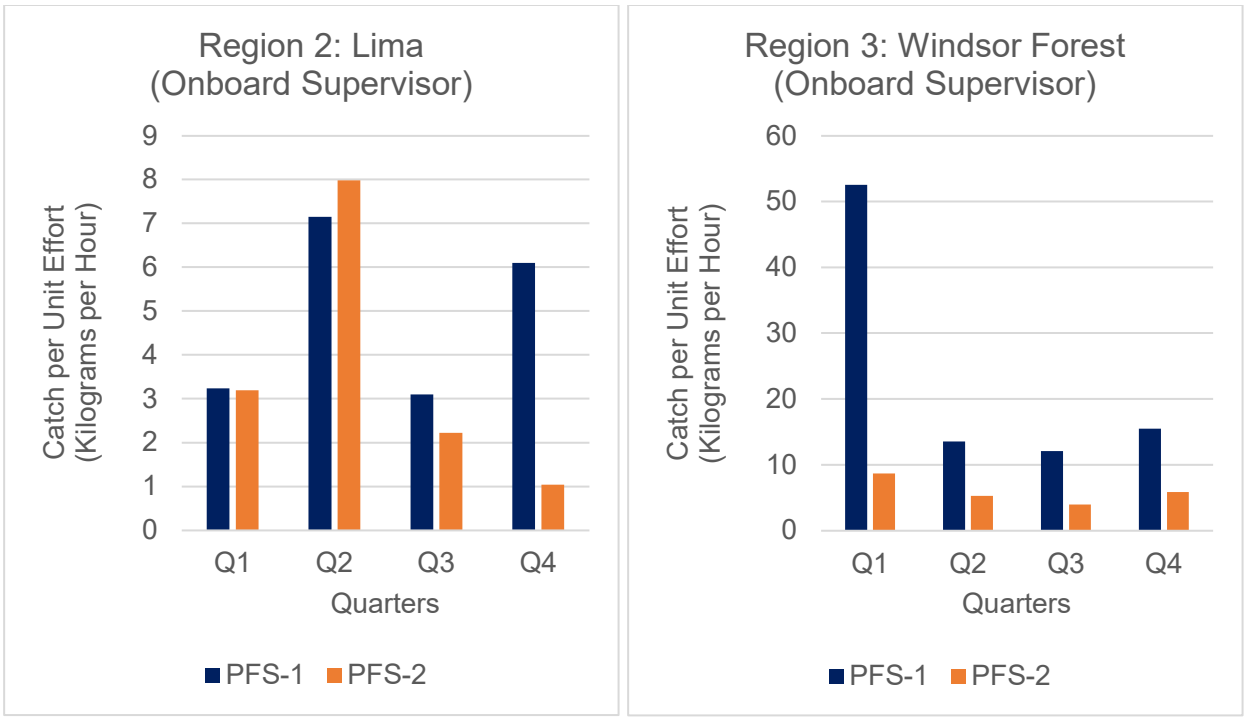


Figure 4-3 (A-B): Comparison of Catch per Unit Effort during PFS-1 and PFS-2 for Landing Sites Using Chinese Seines Exclusively Zeeburg (A) and Ogle (B)

At the Lima landing site, the onboard supervisor has also had a flexible approach to the types of fishing gear used. In PFS-1, Chinese seines were the primary gear type used and shrimp was the most abundant species caught. However, during periods of low shrimp haul a variety of gear types were used to augment the fishing practice. In PFS-2, due to persistent low hauls of shrimp in the period leading up to the resumption of the study, the supervisor's fishing practices had changed drastically and in Q1, drift seines with mesh sizes of 10 centimeters (4 inches) were the gear type which was used on the majority of fishing trips. Subsequently, construction work to rehabilitate the koker at which the landing site is situated caused blockage of the access canal and in response, the supervisor further adapted fishing practices to use pin seines more frequently so as to allow easy access to and from the landing site. The result of this improvised approach was variable productivity with fish species being the most abundantly caught while shrimp volumes were substantially lower than typical yields of Chinese seines. Productivity peaked in Q2 and this was also the only period during which CPUE was higher than the PFS-1 reference period. By comparison, CPUE was lower in PFS-2 by 1.5 percent in Q1, 28 percent in Q3 and 83 percent in Q4.

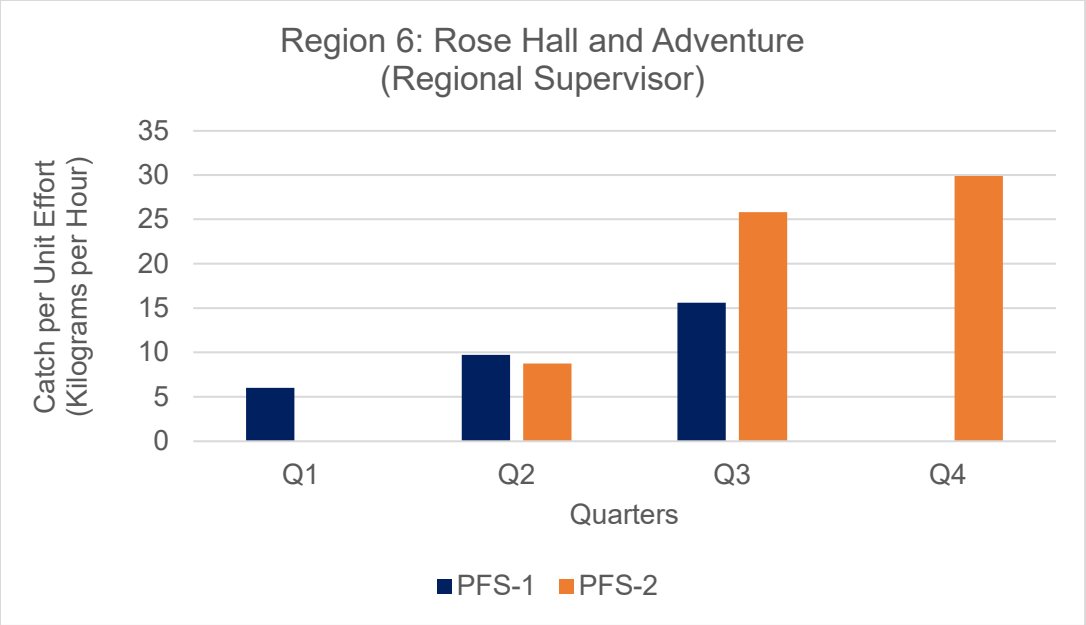
At the Windsor Forest landing site, significant reductions in hauls of white belly shrimp prior to the commencement of PFS-2 led the onboard supervisor to change fishing practices. Whereas in PFS-1 Cadell lines were used in complement with Chinese seines, by Q1 of PFS-2 fishing trips were being conducted exclusively using Cadell lines. By Q2 and Q3, Cadell lines were being exclusively used on most fishing trips. In Q4, the supervisor reverted to Chinese seines as the primary gear type but several fishing trips were still conducted using Cadell lines exclusively. Generally, Cadell lines have significantly lower productivity than Chinese seines due to higher selectively of catch. As a consequence of the change in fishing practices at this landing site, CPUE was substantially lower in all quarters of PFS-2 as compared with PFS-1. Specifically, CPUE declined by 83 percent in Q1, 61 percent in Q2, 42 percent in Q3 and 56 percent in Q4.



(A) (B)

Figure 4-4 (A-B): Comparison of Catch per Unit Effort during PFS-1 and PFS-2 for Landing Sites at Lima (A) and Windsor Forest (B)

At the Adventure landing site, pin seines were used to target shrimp. In PFS-1, the regional supervisor collected data from the Rose Hall landing. However, in Q3, the Rose Hall landing site was replaced with the Adventure landing site due to significant challenges that reduced fishing activities at the former. In particular, the earthen access dam leading to the Rose Hall landing site significantly deteriorates during inclement weather with the result that some sections of the dam are virtually impassable restricting access to the landing site. Moreover, the conditions at the landing site changed and the substrate is sandy (instead of muddy) which is unsuitable for setting pin seines. As a result, the number of persons using the landing site diminished as did the frequency with which fishing trips were conducted. Due to these challenges, there are no comparable datasets for Q4 of PFS-1 (when no fishing trips were conducted at) and Q1 of PFS-2 (when only one fishing trip was conducted) from the Rose Hall landing site. In Q2, when data was collected from Rose Hall for both comparative periods, CPUE was 10 percent lower for PFS-2. In Q3, when data collection commenced at the Adventure landing site, CPUE was 65 percent greater in PFS-2 relative to PFS-1. Given the challenges surrounding data collection at these landing sites, no clear trends in productivity have emerged. CPUE trends for the Rose Hall and Adventure landing sites can be seen in Figure 4-5.



Notes:

i. Data collected from the Rose Hall landing site is presented for all quarter in PFS-1 and for Q2 in PFS-2.

ii. Data collected from the Adventure landing site is presented for Q3 and Q4 of PFS-2.

iii. There are no available or suitable datasets for the Rose Hall landing site to be used for Q4 of PFS-1 (when there were no fishing trips) or Q1 of PFS-2 (when there was one fishing trip).

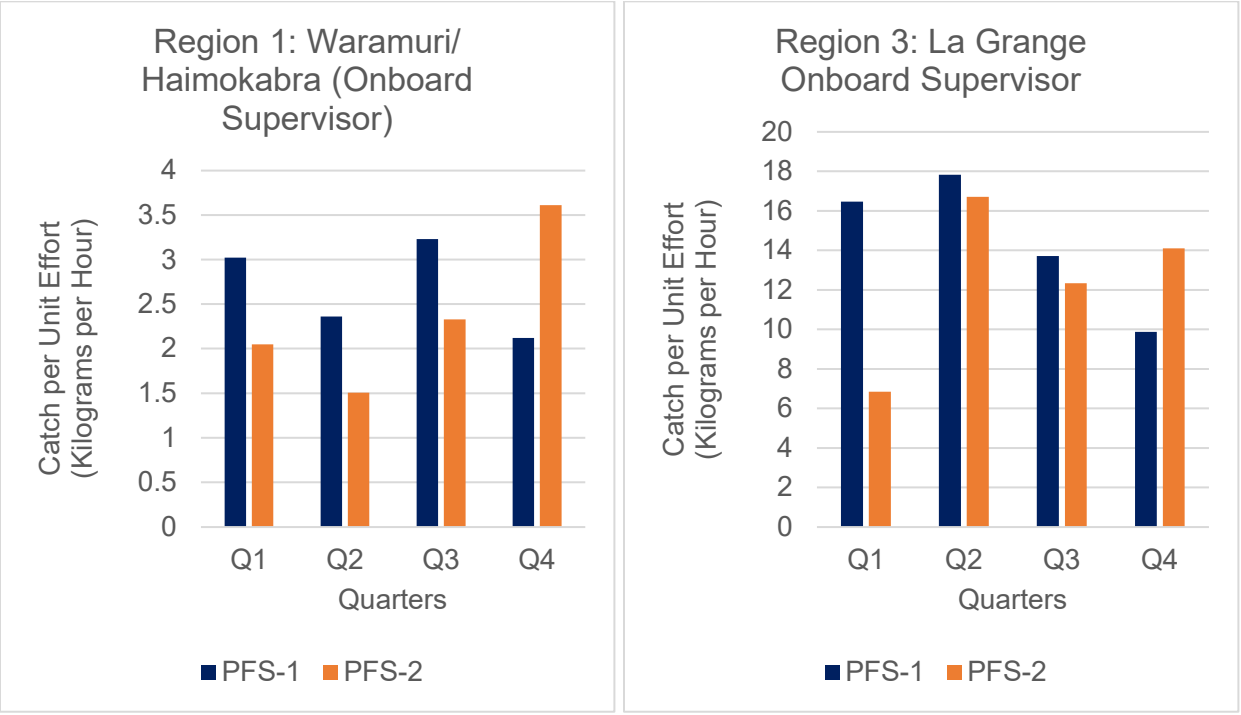
Figure 4-5: Comparison of Catch per Unit Effort during PFS-1 and PFS-2 for Landing Sites Using Pin Seines

4.4 Productivity of Cadell Lines

There were two landing sites where Cadell lines were the primary gear type used to target sea catfish. These were the landing sites in Waramuri/Haimokabra (Region 1) and La Grange (Region 3). Generally, CPUE was higher at La Grange than in Waramuri and this was directly associated with the differences in effort and the types of products that are landed. At Waramuri, fishing trips last for approximately 14 days whereas at La Grange, a fishing trip lasted for fewer than 24 hours. Moreover, landed hauls by the Waramuri onboard supervisor are largely dried or smoked fishes that result in lower total haul volumes per fishing trip. The trends in productivity at these landing sites were unclear and did not align with the trends observed in PFS-1. A comparison of quarterly productivity at landing sites using Cadell lines to fish can be seen in Figure 4-6.

At the Waramuri landing site, decreased productivity was recorded in the first three quarters of PFS-2 relative to the PFS-1 reference periods (Figure 4-6 [A]). Specifically, CPUE declined by 32 percent in Q1, 36 percent in Q2, and 28 percent in Q3. The most productive period in PFS-2 was Q4 when the highest CPUE for all periods assessed by PFS-1 and PFS-2 was achieved. It was also the only period in which CPUE was greater in PFS-2 than PFS-1 with an increase of 70.28 percent. This is unusual for this landing site since in PFS-1, Q4 had the lowest productivity.

Similarly, at the La Grange landing site, productivity significantly declined in the first three quarters of PFS-2 in comparison to the PFS-1 reference periods by 58 percent in Q1, 6.28 percent in Q2, and 10 percent in Q3 (Figure 4-6 [B]). CPUE increased in Q4 and this was the only period in which CPUE was greater in PFS-2 than PFS-1 with an increase of 43 percent. Unlike Waramuri, Q2 was the most productive quarter at this landing site and this coincides with the good season for fishing. This trend is also unusual for this landing site because in PFS-1, Q4 had the lowest productivity.



(A) (B)

Figure 4-6 (A-B): Comparison of Catch per Unit Effort during PFS-1 and PFS-2 for Landing Sites Using Cadell Lines Waramuri (A) and La Grange (B)

4.5 Productivity of a Generalist Approach

Data was collected by regional and onboard supervisors at two landing sites where activities were classified as generalist with no defined target species. These were Smith's Creek (Region 1) where data was collected by a regional supervisor and an onboard supervisor, and Bushlot (Region 5) where data was collected by an onboard supervisor. Due to the varied fishing methods and other challenges encountered by fisherfolk, there was no illustrative trends in seasonal productivity at these landing sites. A comparison of quarterly productivity at landing sites with a generalist approach to fishing can be seen in Figure 4-7.

At the Smith's Creek landing site, data collected by the regional supervisor showed decreases in Q1 to Q3 of PFS-2 relative to PFS-1 (Figure 4-7 [A]). Specifically, CPUE declined by 71.05 percent in Q1, 67 percent in Q2, and 12 percent in Q3. The declines in Q1 and Q2 may be partially attributed to the increased use of snapper seines which, on account of their large mesh sizes and high selectively, typically have lower productivity than seines with smaller mesh sizes. However, other socio-economic factors may have influenced the downturn such as the steep rise in fuel in Smith's Creek, prior to Q1, which curtailed fishing activities at this landing site. The most productive period was Q3 and this was noteworthy since this period intersects with the beginning of the hard season. Although it was the most productive, as discussed above, the CPUE was still lower than the PFS-1 reference period. In PFS-1, Q2 and Q1 were the most productive quarters but conversely, Q3 and Q4 were most productive in PFS-2. The only period in which CPUE was greater in PFS-2 than PFS-1 was in Q4 which also had the lowest productivity in PFS-1.

The onboard supervisor at Smith's Creek did not collect data in Q1 and Q2 of PFS-1 because high fuel costs meant that fishing trips were not profitable. In the data collected by the onboard supervisor,

Q4 was the most productive quarter in both PFS-1 and PFS-2 (Figure 4-7 [B]). Due to the wide variety of gear type used and generalist nature of the fishing practice, it is difficult to pinpoint a reason for the increases in Q4.

At the Bush Lot landing site, onboard supervisor experiences increased productivity in the first three quarters of PFS-2 in comparison to PFS-1 (Figure 4-7 C). In particular, CPUE increased in PFS-1 by 23 percent in Q1, 42 percent in Q2 and 8 percent in Q3. These increases may be attributed to the change in gear type from snapper seines to more generalist fishing gear (drift seines with mesh sizes of 12.7 centimetres [5 inches]). The only period in which productivity declined relatively to PFS-1 was in Q4. Drift seines with mesh sizes of 12.7 centimetres (5 inches) were most commonly used in Q4 during both PFS-1 and PFS-2 and therefore, the reason for the decline cannot be attributed to different fishing gear. Moreover, the highest productivity of fishing trips in all PFS-2 quarters was in Q4 and this is similar to the trend which was observed in PFS-1.

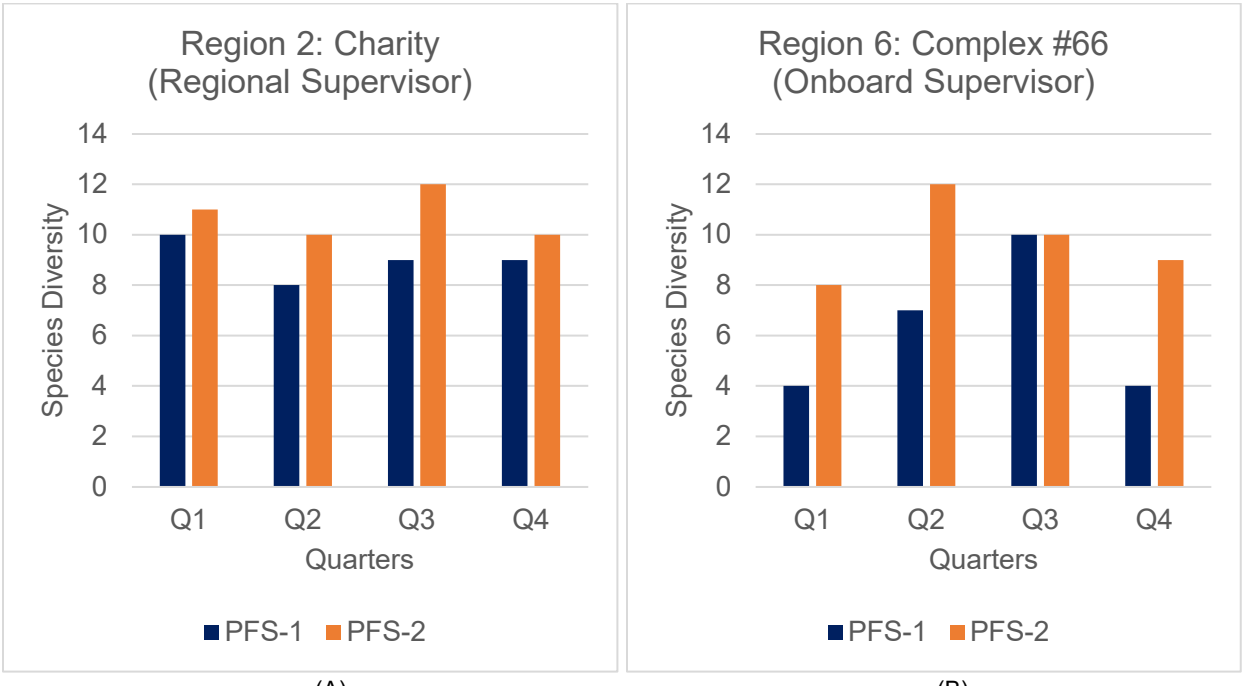
Figure 4-7 (A-C): Comparison of Catch per Unit Effort during PFS-1 and PFS-2 for Landing Sites Using Generalist Fishing Gear Smith's Creek Regional Supervisor (A), Smith's Creek Onboard Supervisor (B) and Bush Lot (C)

5.0 SPECIES DIVERSITY

The species diversity of hauls is determined principally by two factors, both of which were observed in PFS-1 and PFS-2. The first is the mesh size of the seines used and generally, seines with larger mesh sizes are more selective and capture only larger species and larger fishes. Cadell lines also tend to capture larger species, depending on the hook size used. On the other hand, seines with small mesh sizes have low selectively and capture a large number of species, including small fishes and juvenile fishes of larger species. The second factor that determines the species diversity of the landed hauls is fisherfolks' perception about what species are likely to be considered commercially viable at their landing sites. For example, species diversity is relatively high at the Smith's Creek landing site because more species were considered to be commercially viable, including sea bats and stingrays which are either released or discarded as bycatch at most other landing sites surveyed. Moreover, Chinese seines typically capture large volumes of juvenile fishes like sea catfish, pacu (*Batrachoides surinamensis)*, cuirass and lau lau (*Brachyplatystoma vaillantii)*, among others, which are not commercially viable due to their small size. As a consequence, most of these species are discarded as bycatch. This section presents the species diversity of hauls from different gear types for the PFS-1 and PFS-2 reference periods.

5.1 Snapper Seines

Snapper seines have the largest mesh sizes of all seine types used by artisanal fisheries in Guyana and species diversity of the hauls are relatively low. Snapper seines were used exclusively throughout PFS-2 at two landing sites: Charity (Region 2) and Complex #66 (Region 6). As seen in Figure 5-1, species diversity was similar with a maximum of 12 at both sites during PFS-1. This represents an increase from PFS-1 when the maximum species diversity at both sites was 10. Species diversity consistently increased for all quarters in PFS-2 relative to PFS-1.



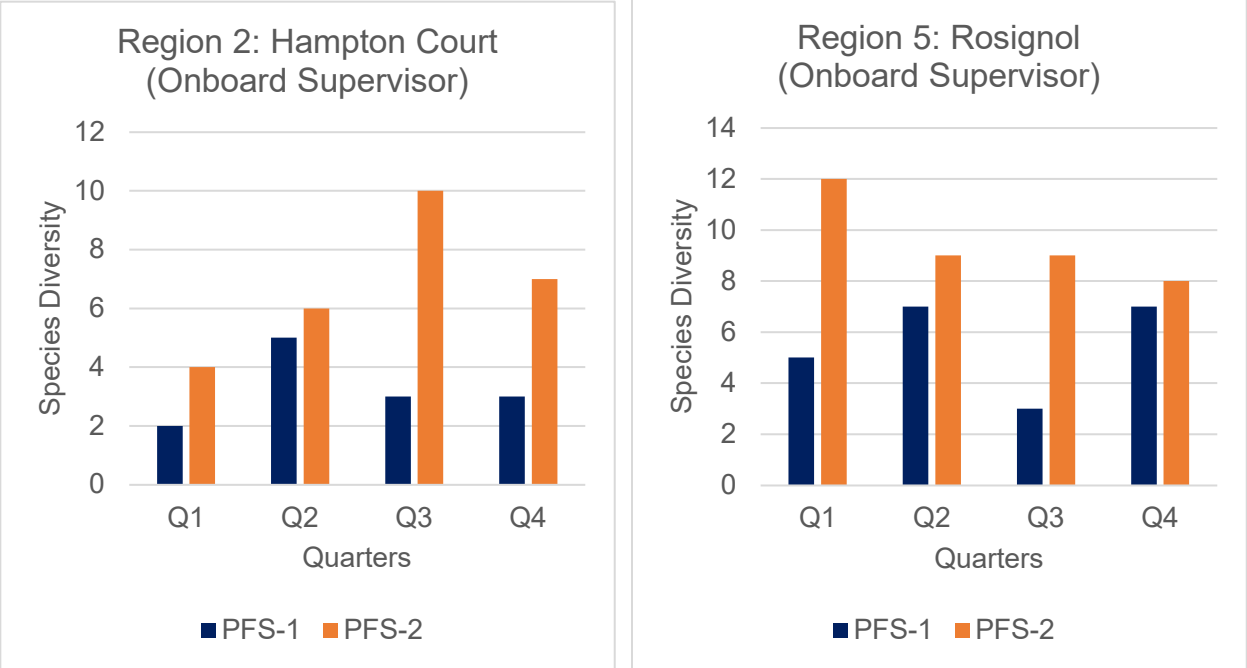
(A) (B)

Figure 5-1 [A-B]: Species Diversity at Charity (Region 2) [A] and Complex #66 (Region 6) [B]

Snapper seines are also the primary gear type used by onboard supervisors at landing sites in Hampton Court (Region 2) and Rosignol (Region 6). However, these supervisors reported significant

declines in the productivity of snapper seines in Q1 and Q2 and therefore, in Q3 and Q4 both supervisors introduced bangamary seines into their fishing practices. At Hampton Court, the effect of this change in gear type on species diversity was evident (Figure 5-2). The highest species diversity was reported was in Q3 and species diversity remained relatively high in Q4. Conversely, species diversity did not increase at Rosignol as a result of incorporating bangamary seines into the fishing practices in Q3. Species diversity was highest in Q1 and progressively declined until Q4. Although seines with smaller mesh sizes were also used at these landing sites during PFS-2, species diversity remained relatively low. At the Rosignol landing site, there were increases in diversity during PFS-2 when compared to PFS-1. The onboard supervisor during PFS-1 was replaced and the new supervisor had variations in the overall fishing practices utilized. The Onboard supervisor during Q1 of PFS-1 utilized mesh sizes of 11.43, 12.7, and 19.05 centimetres (4.5, 5 and7.5) however, this did not translate to higher diversity during Q1 when compared to the same [eriod for PFS-2. Lower diversity seen during Q2 to Q4 when PFS-1 is compared to PFS-2 maybe as a result of the PFS-1 supervisor utilizing snapper seine while the supervisor for PFS-1 was utilizing bangamary seine that capture a high diversity of fishes.

Generally, species diversity at Charity, Hampton Court and Complex #66 increased in all reporting quarters in PFS-2 in comparison to PFS-1. With respect to the former two of these landing sites, the species diversity increased even though productivity declined and the captured volumes of high-value target species (snapper, trout and gillbacker) also declined. This implies lower abundance of key target species for capture.



(A) (B)

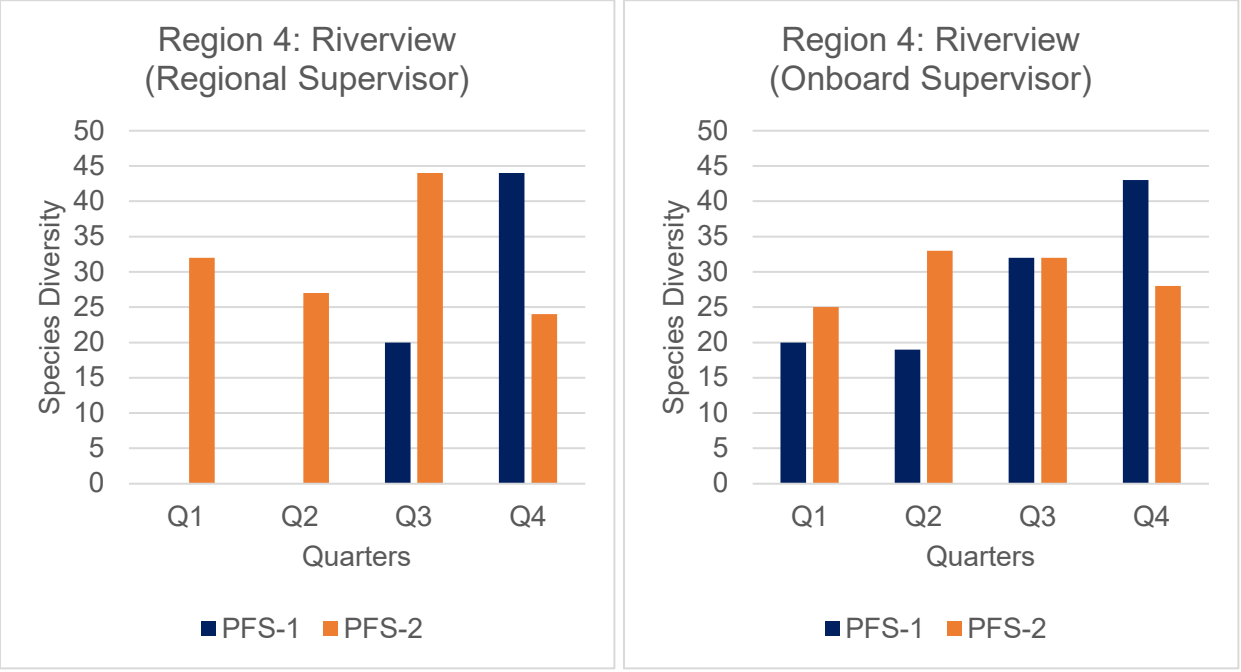
Figure 5-2 (A-B): Species Diversity at Hampton Court (A) and Rosignol (B)

5.2 Bangamary Seines

Species diversity from bangamary seines at the Riverview landing site (Region 4) is significantly higher than the other landing sites which exclusively used bangamary seines for fishing. Indeed, the maximum species diversity reported in PFS-2 was 44 by the regional supervisor and 35 by the onboard supervisor (Figure 5-3). This is comparable to the maximum number of species reported per quarter in PFS-1. The minimum species diversity reported in PFS-2 was 24 by the regional supervisor and 25

by the onboard supervisor. There is no clear direction of either an upward or downward trend in species diversity in PFS-2 as compared with PFS-1. Due to concerns about the credibility of data collected by the regional supervisor, Figure 5-3 (A) does not include data for the Riverview landing site in Q1 and Q2 of PFS-1.

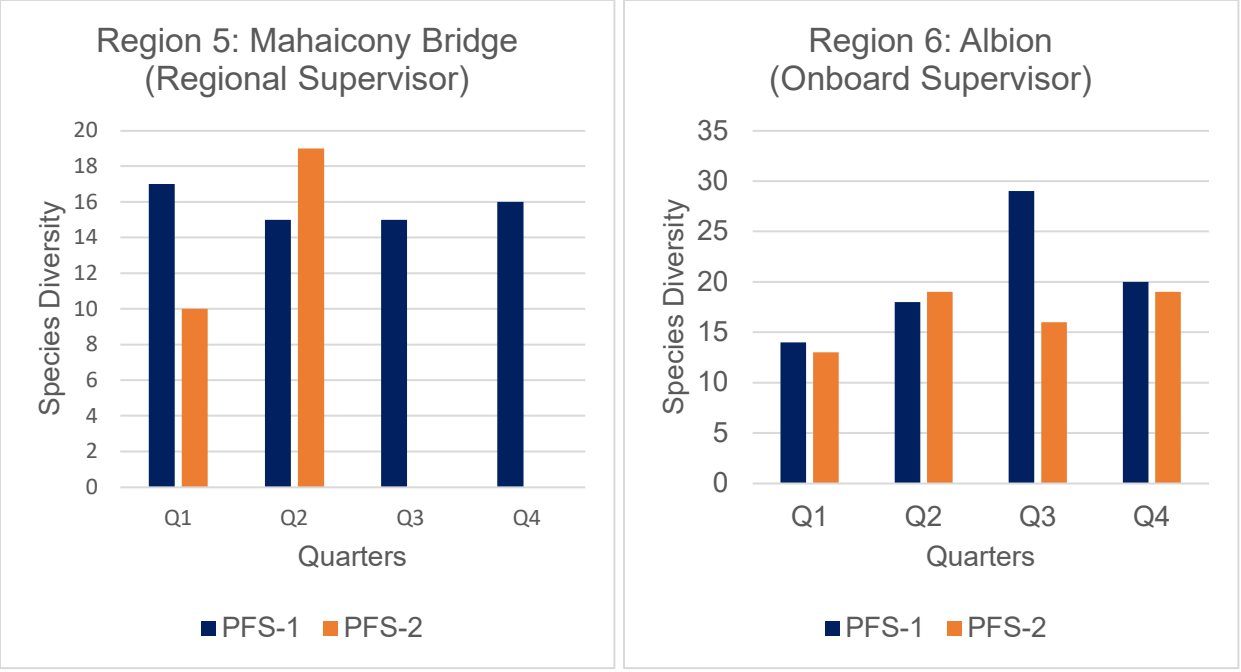
Bangamary seines capture a wide range of species and is expected to have a high species diversities. The species diversity reported by the supervisors at Riverview may be considered a true reflection of the number of species captured by this gear type. There are two reasons for the high species diversity reported at Riverview. Firstly, a larger number of species are considered to be commercially viable at Riverview and these are not discarded as bycatch at sea. Thus, the majority of species captured are landed and if they cannot be sold, they are used by fisherfolk for sustenance or are donated to persons in need in the community. Secondly, species were reported in a disaggregated fashion and this was not observed at any of the other landing sites. For example, several species of shark and snapper were reported at Riverview whereas at most other landing sites these would have been reported as one species each.



(A) (B)

Figure 5-3 (A-B): Species Diversity at Riverview by the Regional Supervisor (A) and Onboard Supervisor (B)

In contrast to the Riverview landing site, the maximum species diversity in PFS-2 was 19 at the landing sites in Mahaicony Bridge and Albion. The minimum species diversity reported in PFS-2 was 10 at Mahaicony Bridge and 13 at Albion. At the Albion landing site, species diversity was consistently lower for all quarters in PFS-2 relative to PFS-1. Species diversity for hauls at the landing sites in Mahaicony Bridge and Albion can be seen in Figure 5-4. Due to concerns about the credibility of data collected by the regional supervisor, Figure 5-4 (A) does not include data collected for the Mahaicony Bridge landing site in Q3 and Q4 of PFS-2.



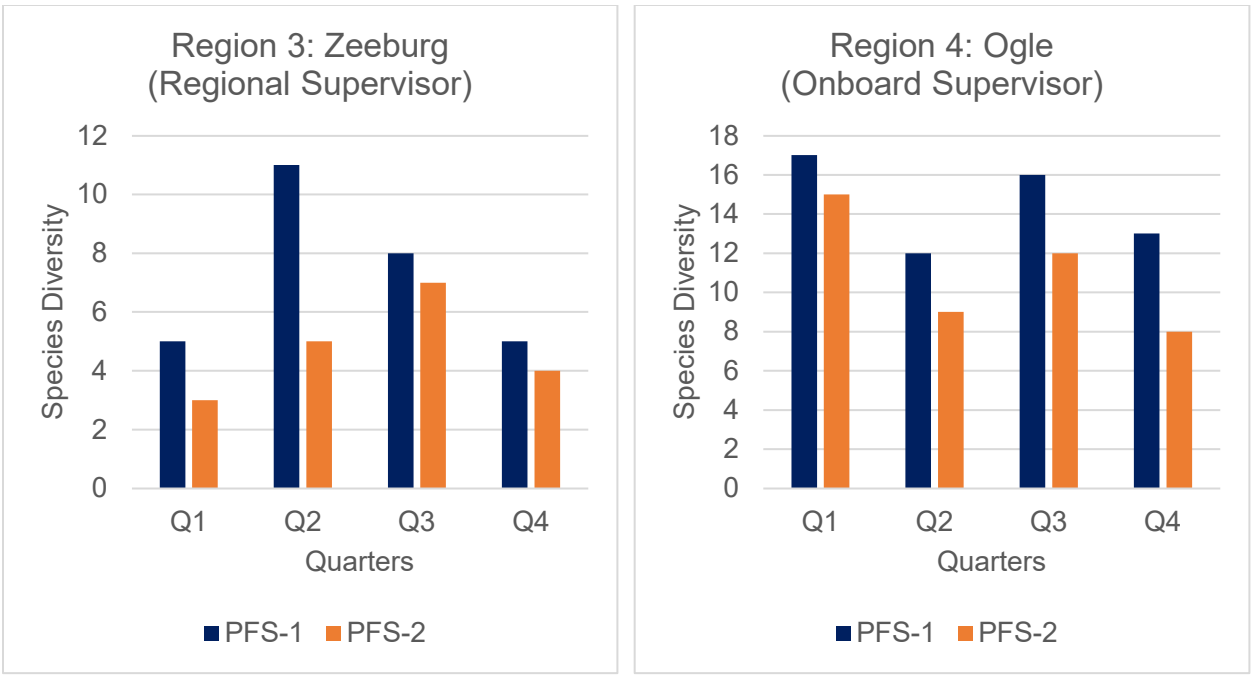
(A) (B)

Figure 5-4 (A-B): Species Diversity in Mahaicony Bridge (A) and Albion (B)

5.3 Shrimping

Chinese seines were used exclusively at two landing sites throughout PFS-1 and PFS-2 namely, Zeeburg (Region 3) and Ogle (Region 4). At both of these landing sites, species diversity decreased in all quarters in PFS-2 relative to PFS-1. Two reasons may be associated with the decline in species diversity. In the first instance, fewer fishing trips were conducted in most quarters in PFS-2 relative to PFS-1 and therefore, the opportunities for capturing a higher diversity of species over the quarter. In addition, high fresh water loads in the Chinese seine fishing grounds may have resulted in movement of several species farther offshore with the consequence that only species tolerant of freshwater conditions would have been caught.

At Zeeburg, the maximum species diversity was 7 while the minimum was 3. At Ogle, the maximum species diversity was 15 while the minimum was 8. Low species diversity from Chinese seines, particularly in Zeeburg, is largely due to bycatch discards of fishes not deemed commercially viable, either due to the species or the size. During the PFS-2 periods of particularly low productivity, species diversity may have also been influenced by low or no catches on fishing trips. For example, during the QA/QC exercise in Q3, the study team assessed a vessel where the entire haul for a fishing trip comprised two sea catfish individuals. Species diversity for hauls at the landing sites in Zeeburg and Ogle can be seen in Figure 5-5.



(A) (B)

Figure 5-5 (A-B): Species Diversity in Zeeburg (A) and Ogle (B)

Although Chinese seines were the primary gear types at landing sites in Lima (Region 2) and Windsor Forest (Region 3) in PFS-1, declining productivity at both sites as well as issues pertaining to landing site accessibility at Lima resulted in shift of gear types used. At Lima, drift seines and pin seines were used more commonly than Chinese seines and at Windsor Forest, Cadell lines were more commonly used particularly in Q2 and Q3.

At Lima, the maximum species diversity was 22. The relatively high species diversity is due to the range of species captured by the different gear types as well as the commercial viability of these species in local markets. Indeed, the Lima onboard supervisor typically sells hauls directly to consumers in nearby villages so that a larger number of species (including juveniles of large species) are commercially viable. A minimum species diversity of 11 was recorded in Q4 and this was directly due to fewer fishing trips being conducted because of challenges with landing site accessibility. With the exception of the dip in Q4, species diversity increased in all other quarters of PFS-2 relative to PFS-1.

The highest species diversity at Windsor Forest were 15 and 14 recorded in Q1 and Q4. Higher species diversity occurred during the periods when Chinese seines were used on a higher number of fishing trips than Cadell lines. Species diversity in all quarters of PFS-2 equaled or exceeded the PFS-1 reference period. Species diversity for hauls at the landing sites in Lima and Windsor Forest can be seen in Figure 5-6.

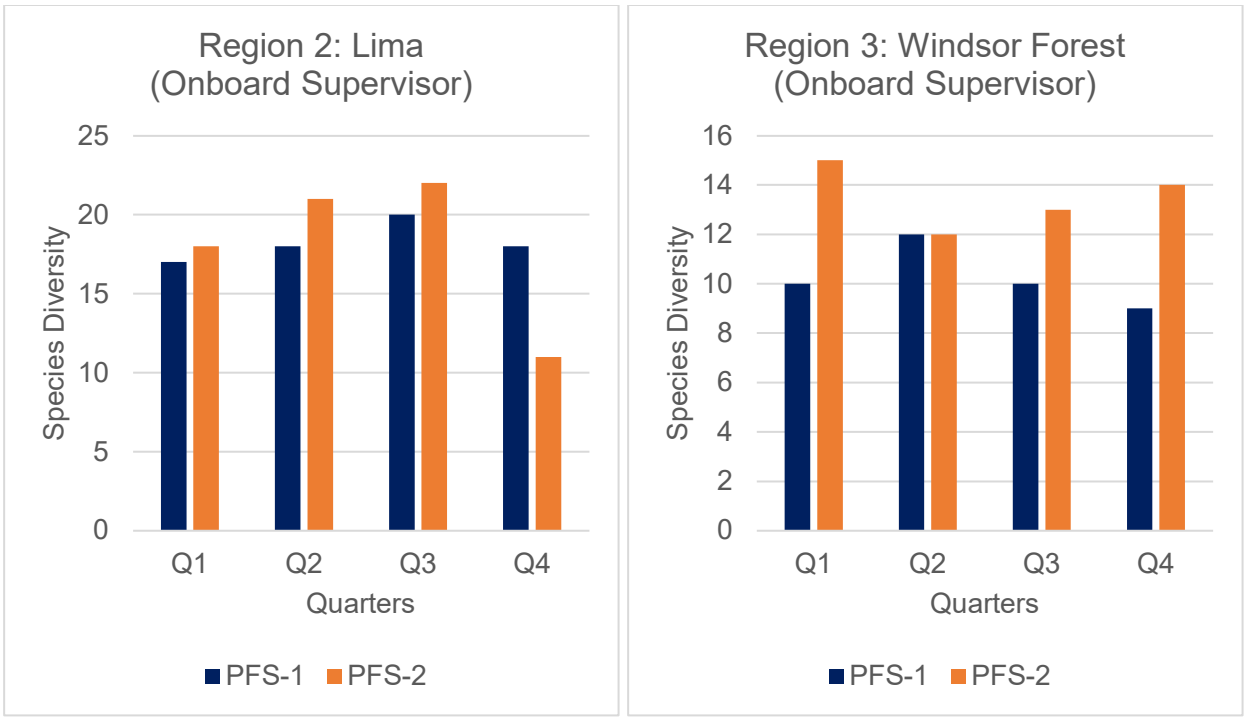
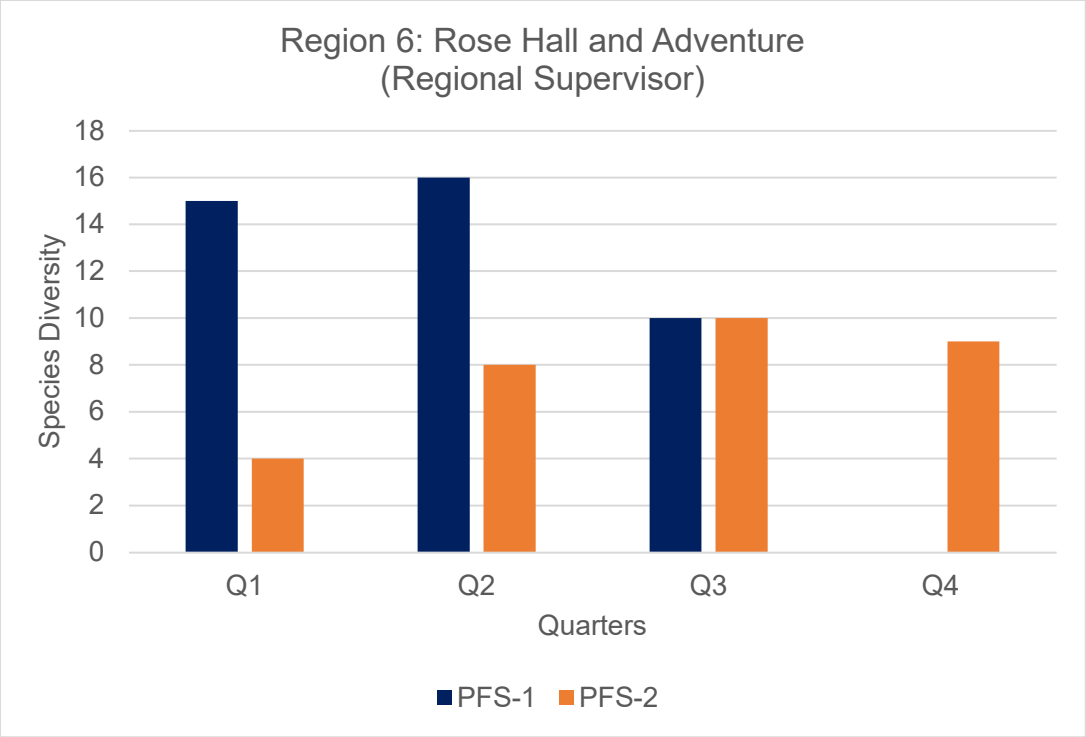


Figure 5-6 (A-B): Species Diversity in Lima (A) and Windsor Forest (B)

Pin seines were used at the Rose Hall landing site and the Adventure landing site. In both PFS-1 and PFS-2, data was collected at the Rose Hall landing site and there was a wide variance in species diversity. This is due to only one fishing trip being conducted in Q1 of PFS-1 which limited the number of species which were landed at that site. In Q3, where data was collected from Rose Hall in PFS-1 and Adventure in PFS-2, species diversity remained constant over the quarters. Species diversity from pin seine fishing at Rose Hall and Adventure is presented in Figure 5-7.



Notes:

i. Data collected from the Rose Hall landing site is presented for all quarter in PFS-1 and for Q2 in PFS-2.

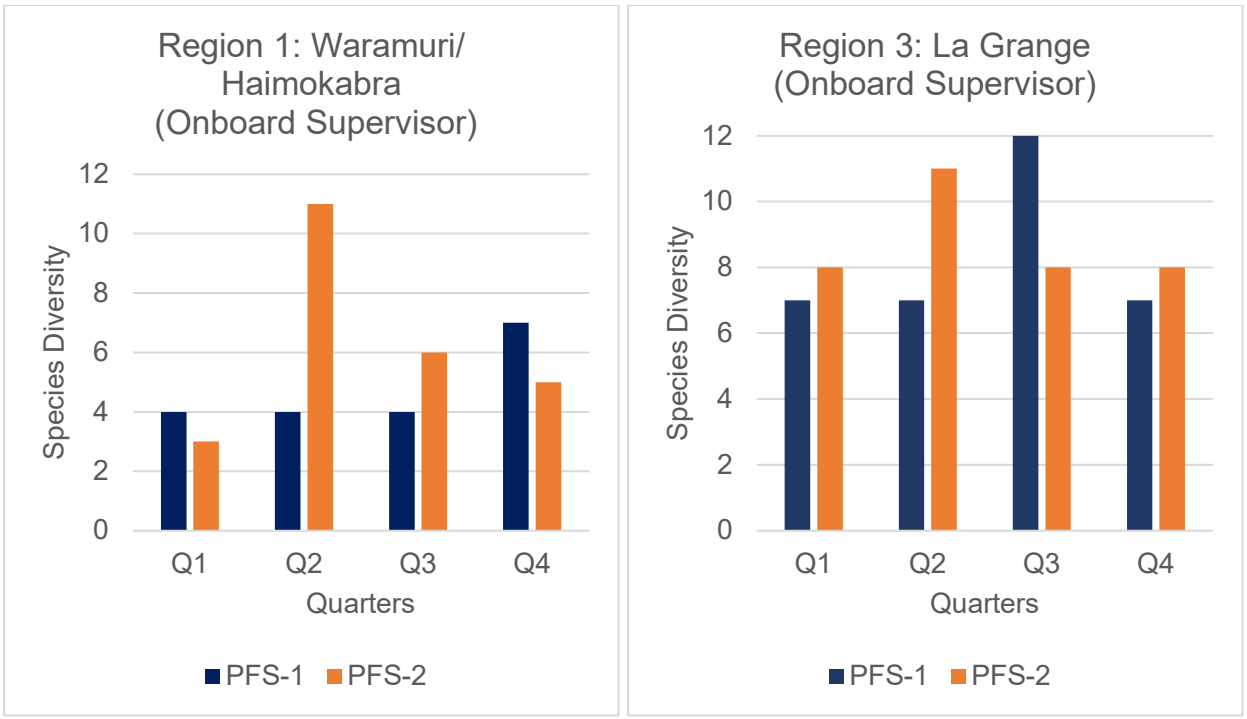
ii. Data collected from the Adventure landing site is presented for Q3 and Q4 of PFS-2.

iii. There are no available or suitable datasets for the Rose Hall landing site to be used for Q4 of PFS-1 (when there were no fishing trips) or Q1 of PFS-2 (when there was one fishing trip).

Figure 5-7: Species Diversity at Rose Hall and Adventure (Region 6)

5.4 Cadell Lines

Cadell lines were used by onboard supervisors at Waramuri/Haimokabra (Region 1) and La Grange (Region 3). At both landing sites the maximum species diversity in PFS-2 was 11. This is a significant increase in the maximum species diversity from 7 in PFS-1 at Waramuri/Haimokabra but a minor decrease from 12 at La Grange. This maximum species diversity was reported in Q2 at both landing sites. The minimum species diversity was 3 at Waramuri/Haimokabra and 8 at La Grange. Relatively low species diversity is common from Cadell lines particularly when larger hook sizes are used. Species diversity at Waramuri/Haimokabra and La Grange is presented in Figure 5-8.



(A) (B)

Figure 5-8 (A-B): Species Diversity at Rose Hall and Adventure (Region 6)

5.5 Generalist Fishing Gear

Species diversity at Smith's Creek (Region 1) was relatively high when compared with other landing sites surveyed (except Riverview). During PFS-2, the maximum species diversity recorded was 29 by the regional supervisor and 35 by the onboard supervisor. No fewer than 26 species were recorded per quarter in PFS-2 by the regional supervisor. The minimum species diversity reported by the onboard supervisor was greater, being 30. Species diversity recorded by the regional and onboard supervisors at Smith's Creek can be seen in Figure 5-9. The Smith's Creek onboard supervisor did not conduct any fishing trips in Q1 and Q2 of PFS-1 due to the high cost of fuel. As such, there are no comparative datasets for the graph presented in Figure 5-9 (A).

The high species diversity is due to two factors. There is a wide range of gear types, particularly gillnets with small mesh sizes, used at this landing site and this allows a wider range of species to be captured. Moreover, a wider range of fish and non-fish species were deemed commercially viable at this landing sites. For example, well developed local and export markets for sea bats and string rays were observed at Smith's Creek (particularly for export to Venezuela), but markets for these species typically do not exist elsewhere in the country.

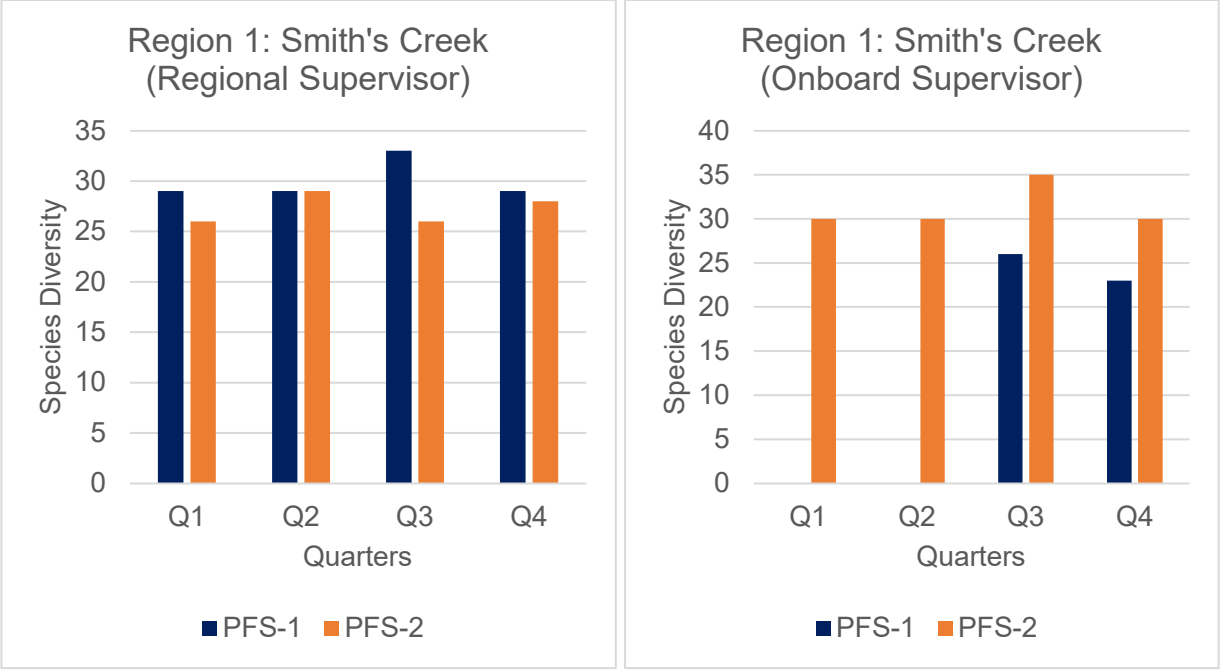


Figure 5-9 (A-B): Species Diversity at Smith's Creek Regional Supervisor (A) and Onboard Supervisor (B)

Although fishing practices by the onboard supervisor at Bushlot (Region 5) were also generalised, a significantly lower species diversity was recorded. This may have been influenced by the predominant use of drift seines with larger mesh sizes of 12.7 centimetres (5 inches) on fishing trips and also by the lower commercial viability of several species for which there are markets at Smith's Creek. The maximum species diversity at this landing site was 14 and the minimum was 11. There is no clear direction of trends in species diversity in comparison to PFS-1 and this is associated with the use of different types of fishing gear in the reference periods.

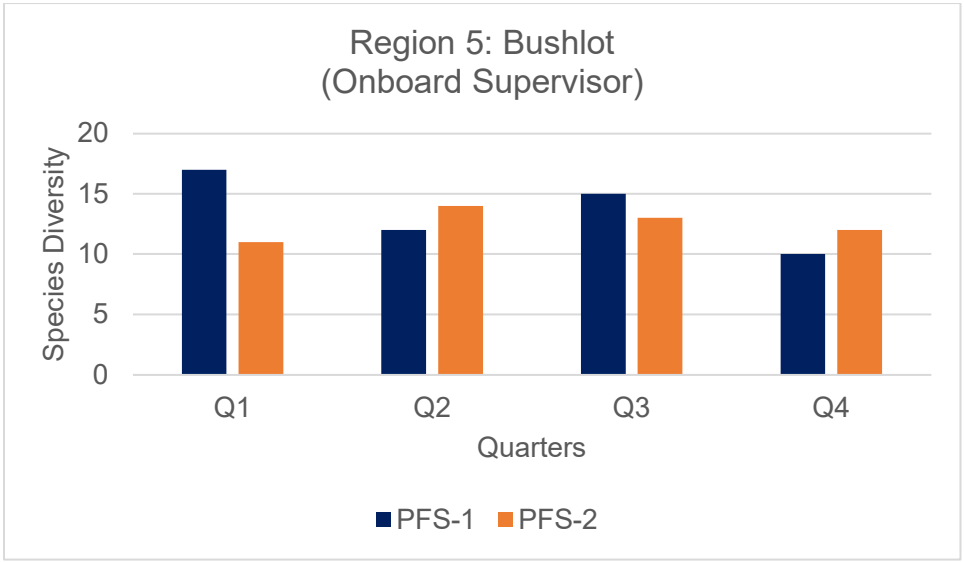


Figure 5-10: Species Diversity at Bushlot

6.0 BIOMETRIC MEASUREMENTS

Biometric measurements are important to determine the maturity of fishes caught by different types of fishing gear. The mesh sizes of the fishing gear used is the key determining factor of fish sizes. Fishing gear with small mesh sizes, like Chinese seines that target shrimp, catch small species or juveniles of large fish species. Consequently, the majority of fishes caught by Chinese seines were juveniles. Large fish are not caught by seines with small mesh sizes as they are likely to be prevented entry to the seines. Conversely, seines with large mesh sizes, such as snapper seines, will entangle large fishes while allowing smaller fishes to escape. Thus, seine selectivity influences the maturity of fishes. Although seines with large mesh sizes typically capture mature species there are a few exceptions. Generally, shark species captured are juveniles. In addition, most captures of jewfish were also juveniles.

This section presents a summary of the maturity of the key target species of different types of fishing gear. For landing sites with regional supervisors, biometric measurements for four species are compared, namely, snapper, trout, bangamary and cuirass. For landing sites with onboard supervisors, biometric measurements are compared for six species including the four previously mentioned as well as sea catfish and cuirass. Biometric measurements for shrimp species are not presented in this section because these had all reached maturity whenever caught.

6.1 Snapper Seines

During PFS-2, no individual fish that was smaller than 45 centimeters in length was captured at Charity (Figure 5-1). Snapper, the target species, had reached maturity in all quarters. Other large high-value species like gillbacker and trout had reached maturity (Figure 6-1). As seen in Figure 6-1, cuirass which was relatively abundant in the haul was also mature. Generally, the lengths of abundant species were larger in PFS-2 compared to PFS-1. Since only large species were caught at Charity landing, no bangamary was caught as they typically do not meet the minimum lengths of other species caught at this landing site. Although most species caught were mature, there were three exceptions. Cuffum (*Megalops atlanticus)* and shark species were caught in all four quarters but none had reached maturity. In addition, jewfish (*Epinephelus itajara)* was captured in Q1 and was immature.

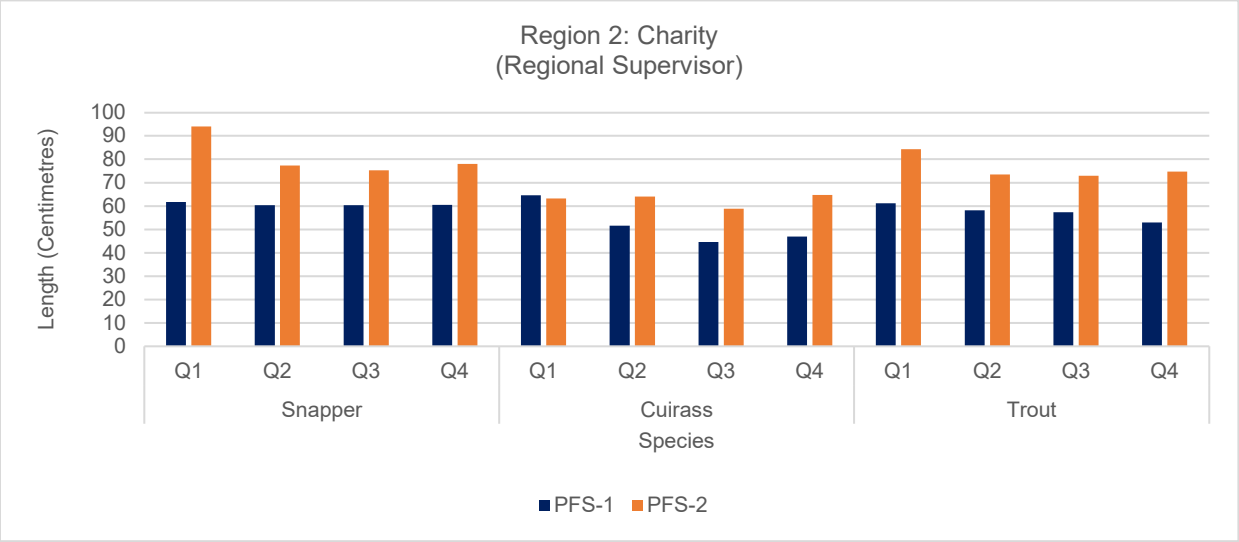


Figure 6-1: Average Lengths of Key Species Caught at Charity

Onboard supervisors at Hampton Court (Region 2), Rosignol (Region 5) and Complex #66 also used snapper seines as their primary gear type. Biometric measurements showing the average lengths of key species caught at the Hampton Court landing site are presented in Figure 6-2. All species measured by the Hampton Court onboard supervisor, from both types of fishing gear used in PFS-2, had reached maturity including a jewfish individual which was captured in Q1. Cuirass, which was reported at all other landing sites where snapper seines were the primary gear type, was only caught in small quantities in Q2 and biometric measurements were not taken. Unlike hauls at Charity and Rosignol, no shark species or cuffum were caught by the onboard supervisor. In Q1 and Q2, when snapper seines were used, the average lengths of snapper were larger in PFS-2 and compared with PFS-1. However, there was a steep decline in the average size of snapper caught in Q4 but this still surpassed the length maturity threshold for this species.

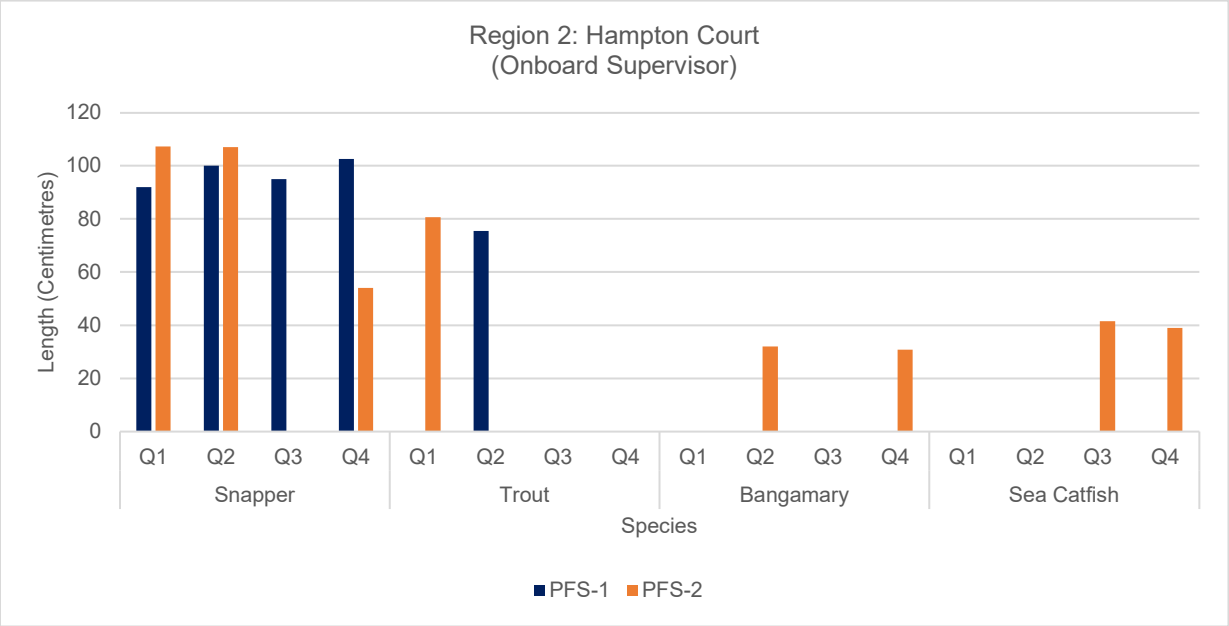


Figure 6-2: Average Lengths of Key Species Caught at Hampton Court

At the Rosignol landing site, most species caught in Q1 to Q3 were mature including target species such as snapper and bangamary as well as other high-value species like gillbacker. An individual jewfish was also caught in Q1 and this had reached maturity. However, there were three exceptions namely, paggie, cuffum and all shark species. In Q4, several of the species caught were immature including trout, paggie sea catfish, bangamary and butterfish. Biometric measurements showing the average lengths of key species caught at the Rosignol landing site are presented in Figure 6-3. All fishes caught during PFS-1 were mature and, in all instances, when comparable to PFS-2 they were larger in size.

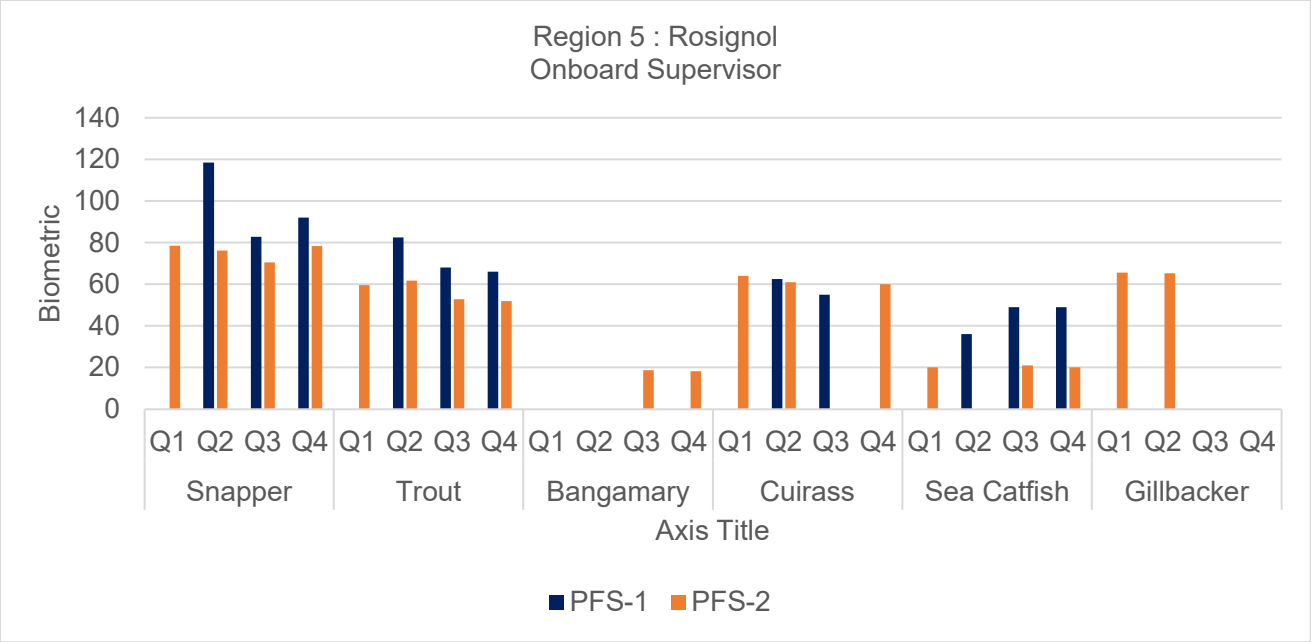


Figure 6-3: Average Lengths of Key Species Caught at Rosignol

At Complex #66 Region 6, most of the species caught by the onboard supervisor had reached maturity with two exceptions. None of the cuffum or shark species captured in Q2 to Q4 were mature. By comparison to the average lengths obtained in PFS-1, almost all species were larger than those caught in PFS-1. This is similar to the trend observed at the Charity landing site where snapper seines were used throughout the PFS-2 period. Bangamary was a noteworthy species in the haul in Q1 and Q2, when low quantities were also captured by the snapper seines. Biometric measurement showing the average lengths of key species caught at the Complex #66 landing site are presented in Figure 6-4.

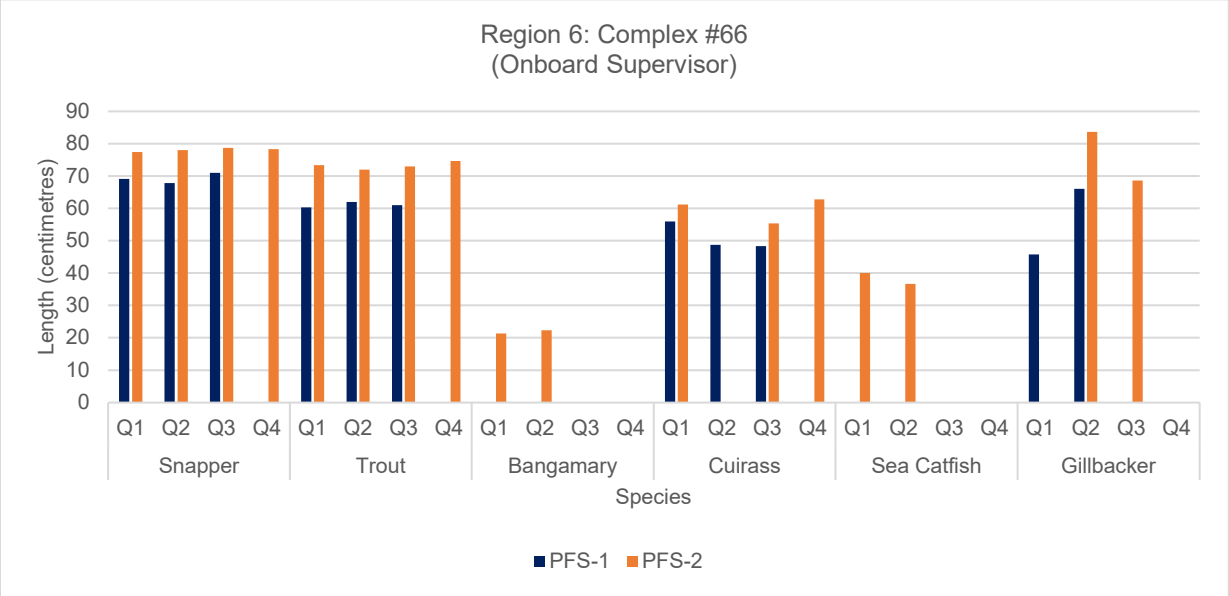


Figure 6-4: Average Lengths of Key Species Caught at Complex #66

6.2 Bangamary Seines

Bangamary seines typically capture species that have lengths of about 50 centimetres. At the Riverview landing site. there were few instances of immature species in Q1 and Q2 but this significantly increased in Q3 and Q4. Immature species included high-value species like snapper and gillbacker. Trout, a secondary target species was caught at immature lengths from Q2 to Q4. Shark species and cuffum (*Megalops atlanticus*) were also frequently captured at this landing site and were always immature. The immature species recorded by the regional supervisor and the onboard supervisor included:

- Regional Supervisor:
  - Q1: Cuffum, gillbacker, snapper and shark species
  - Q2: Gillbacker, trout, snapper and shark species
  - Q3: Cuffum, snapper, trout, paggie, shark species, pompano (*Trachinotus sp)* and crevalle (*Caranax hippos*)
  - Q4: Cuffum, mullet, snook, bright eye (*Cynoscion sp.)*, paggie, blinka, crevalle and trout

- Onboard supervisor:
  - Q1: Cuffum and shark species
  - Q2: Gillbacker, trout and shark species
  - Q3: Gillbacker, trout, snapper, shark species, snook and pompano
  - Q4: Cuffum, trout, snapper, cuirass, paggie, pompano, crevalle and herring (*Anchoa spinifer)*

Bangamary, the primary target species, was captured at mature lengths throughout the PFS-2 period. The sizes of this species remained relatively consistent with the PFS-1 reference periods although marginal decreases in size were observed in the average lengths recorded by the onboard supervisor. Generally, the average lengths of the species measured by the onboard supervisor were smaller in PFS-2 in comparison to the PFS-1 reference periods.

Biometric measurement showing the average lengths of key species recorded at the Riverview landing site are presented in Figure 6-5 (data collected by the regional supervisor) and Figure 6-6 (data collected by the onboard supervisor). Due to concerns about the credibility of data collected by the regional supervisor, Figure 6-5 does not include data for the Riverview landing site in Q1 and Q2 of PFS-1.

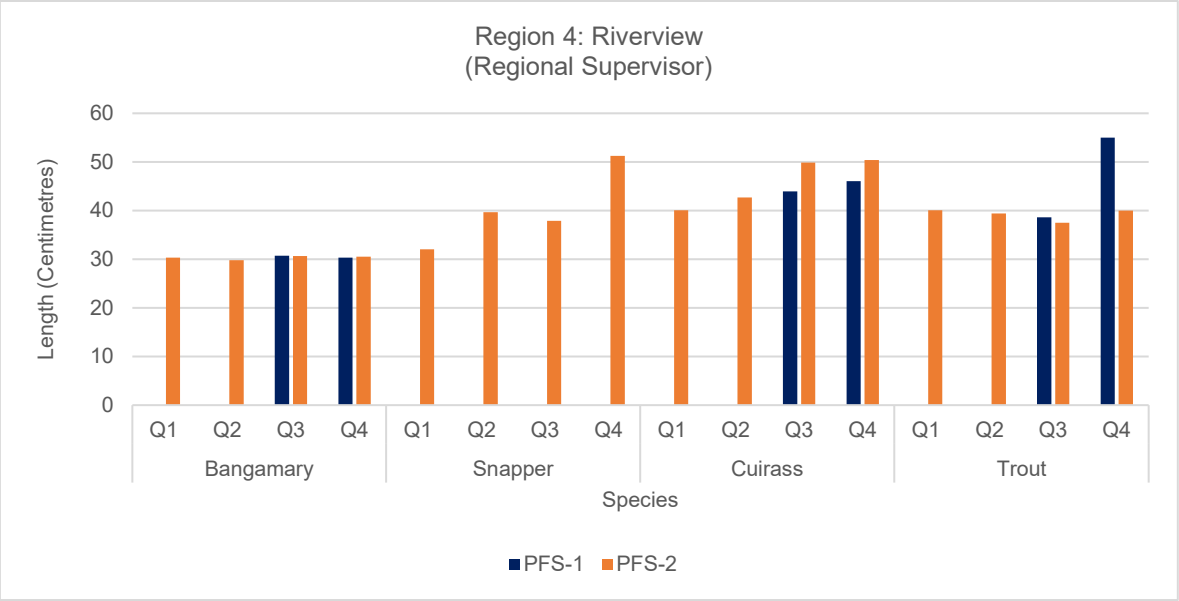


Figure 6-5: Average Lengths of Key Species Recorded by the Riverview Regional Supervisor

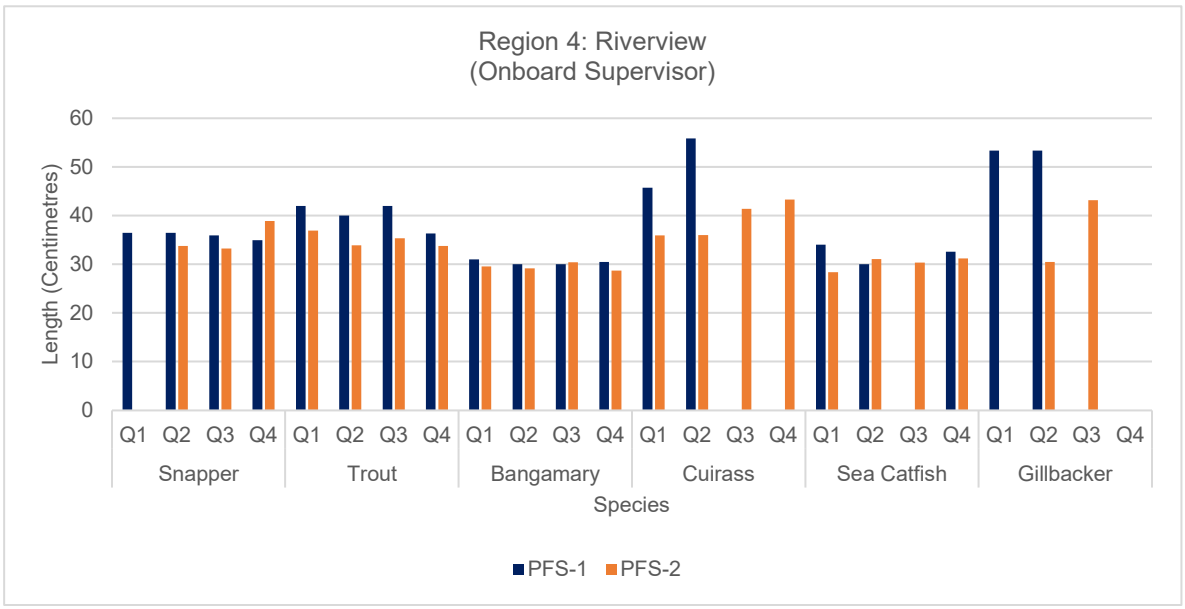


Figure 6-6: Average Lengths of Key Species Recorded by the Riverview Onboard Supervisor

Biometric measurement showing the average lengths of key species caught at the Mahaicony Bridge landing site are presented in Figure 6-7. Although bangamary seines are also used at the Mahaicony Bridge landing site, hauls are not as species diverse as at Riverview and thus, biometric measurements were taken for fewer speies. Due to concerns about the credibility of data collected in Q3 and Q4 of PFS-2, the data collected by the regional supervisor for these periods is not considered in this discussion. Generally, most species caught at this landing site were mature with a few

exceptions. In Q1, three species were immature including snapper, trout and the shark species. In Q2, cuffum and the shark species had not reached maturity.

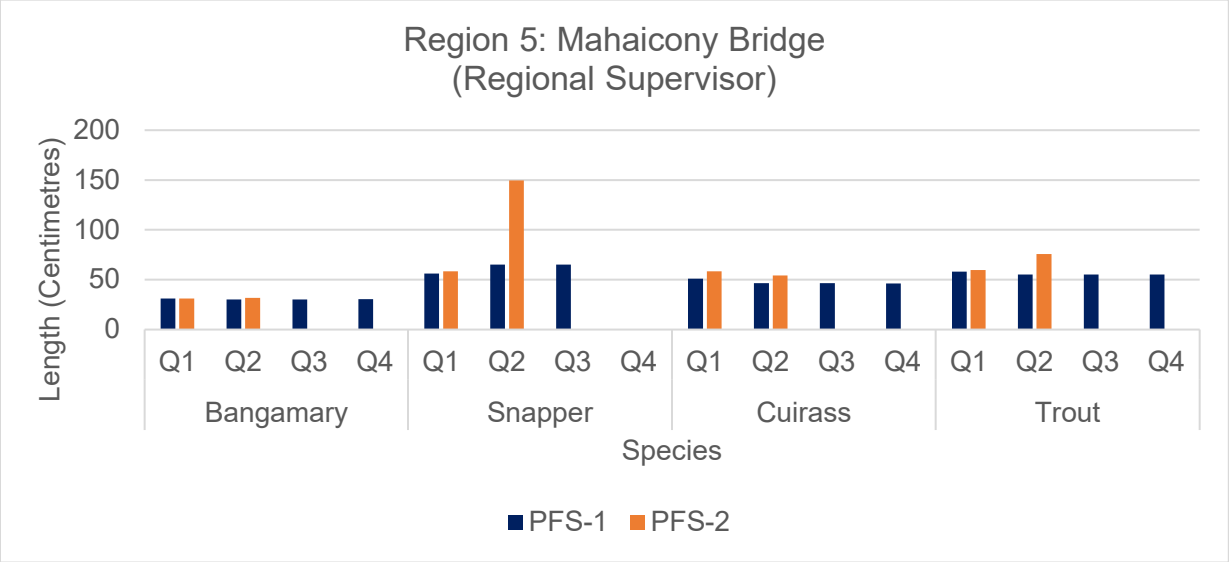


Figure 6-7: Average Lengths of Key Species Caught at Mahaicony Bridge

At the Albion landing site, most species captured in Q1 and Q2 reached maturity with a few exceptions. In Q1, shark species were not mature and in Q2, cuffum, shark species and a single jewfish individual were also immature. Unlike the other landing sites where bangamary is the target species, snapper caught in Q1 and Q2 had reached maturity. By contrast, in Q3, a large number of species were immature including long john, shark, cuirass, paggie, kokwari (*Sciades sp*)., snook *(Centropomus undecimalis*) , and annafoke (*Genyatremus luteus*). The immature species captured by the onboard supervisor again reduced in Q4 when shark, cuirass, kokwari and snook were the only immature species recorded.

Biometric measurement showing the average lengths of key species caught at the Albion landing site are presented in Figure 6-8. The primary and secondary target species, bangamary, trout and butterfish, had reached maturity in all PFS-2 quarters. Moreover, species captured throughout PFS-2 were larger than those captured in the PFS-1 reference periods. The reason for the increases recorded is not known.

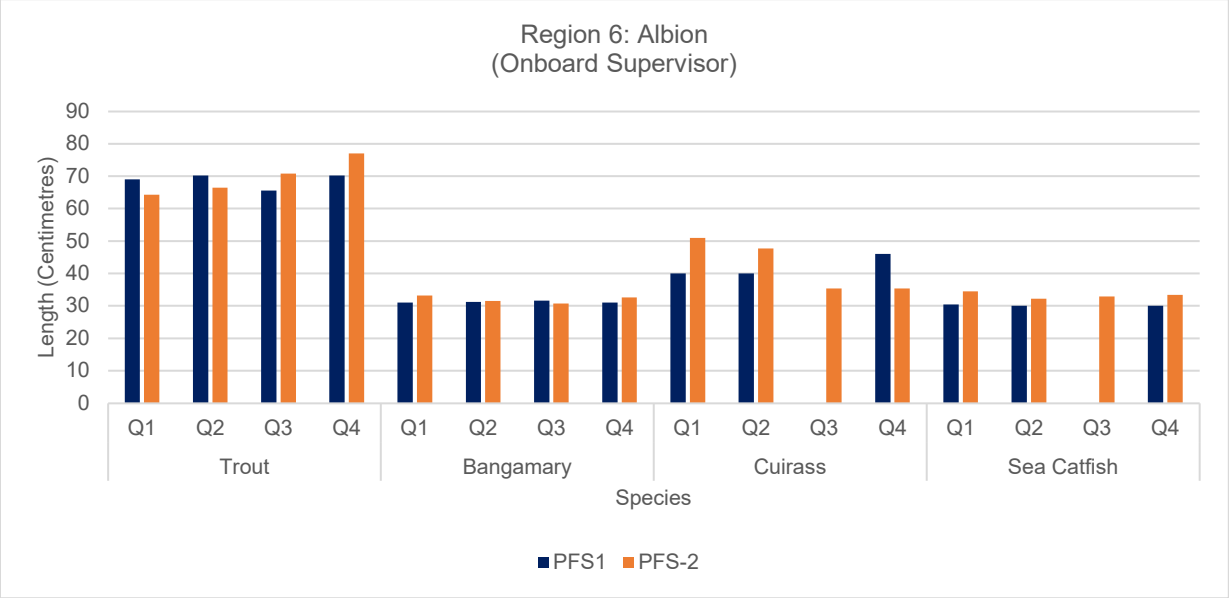


Figure 6-8: Average Lengths of Key Species Caught at Albion

6.3 Shrimping

Biometric measurement showing the average lengths of bangamary caught by Chinese seines at the Zeeburg landing site are presented in Figure 6-9. Generally, all white belly shrimp caught at the Zeeburg landing site had reached maturity. Bangamary was the only species of finfish for which biometric measurements were taken by the regional supervisor in PFS-2. The average lengths of bangamary from the Chinese seines indicated that all fish caught were well below the threshold for maturity and fish as small as 5 centimetres were recorded during Q2. No data was collected for the lengths of bangamary during PFS-1 hence, no comparison can be made.

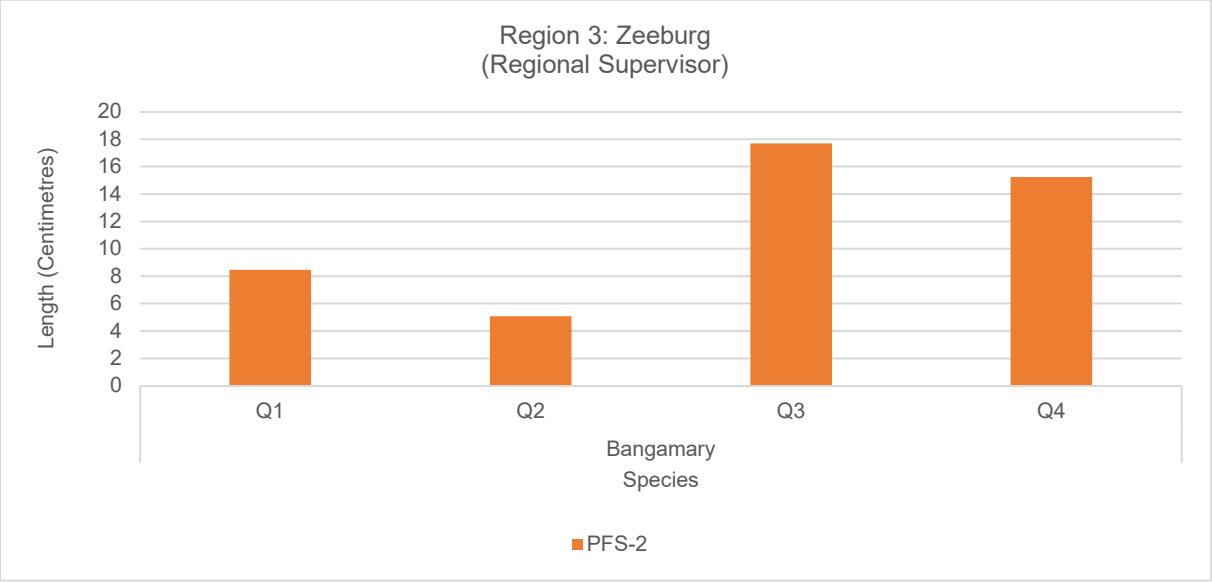
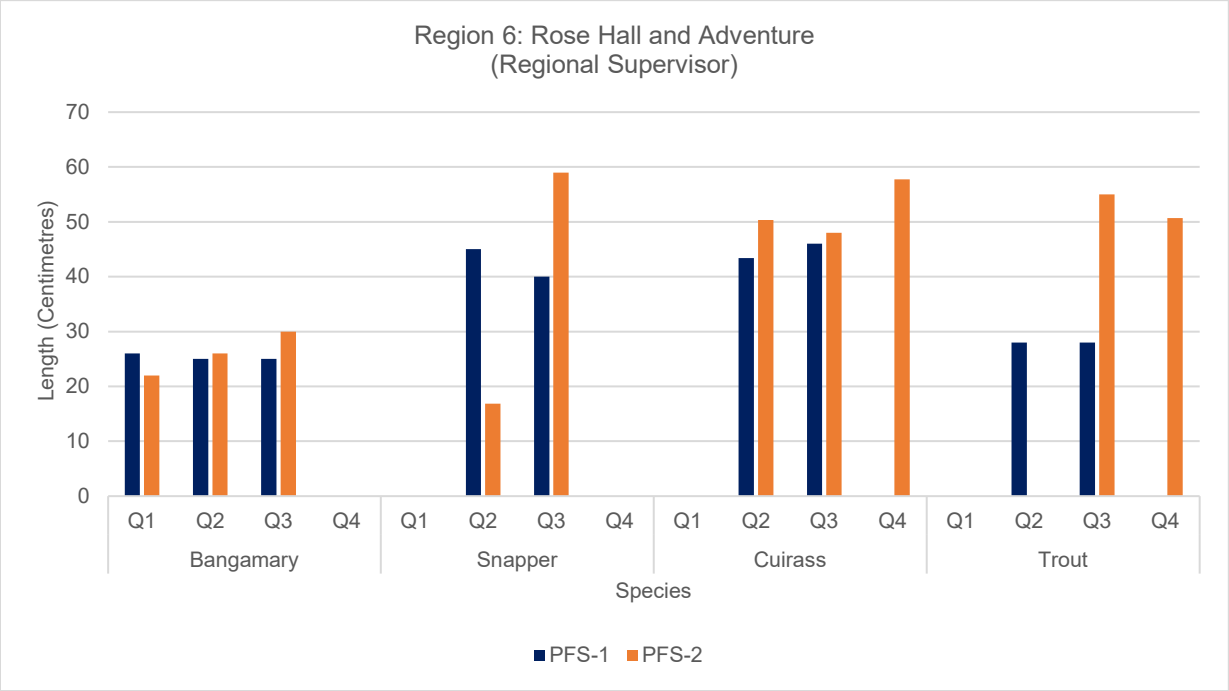


Figure 6-9: Average Lengths of Key Species Caught at Zeeburg

Pin seines were used to target shrimp at the Rose Hall (in Q1 and Q2) and Adventure (in Q3 and Q4) landing sites. The mesh sizes of the pin seines used at these landing sites were smaller than the mesh sizes of Chinese seines. However, the species diversity of the landed catch was diverse and relatively large fishes were prevalent in the haul. The presence of large species in hauls from pin seines is due to the unique method of catch retrieval. Pin seines are set on mud flats just before high tide and are left to soak. On the subsequent low tide, fisherfolk use catamarangs to travel to the seines and retrieve catch. The limited haul capacity of the catamarang results in fisherfolk being highly selective about which species to collect for landing. As such, shrimp species for which there is greater market demand and large fishes (one or a few which become entangled in the seine as the tide receded) are landed. All catch not retrieved is discarded as bycatch and are consumed by other species including marine birds.

All shrimp species caught by the pin seines at these landing sites had reached maturity. However, as seen in Figure 6-10, there was no consistency in the maturity of landed species based in average lengths. For example, all cuirass had reached maturity while all trout were immature. Bangamary was mature in two quarters (Q2 and Q3) but was below the maturity threshold in one. Moreover, snapper was significantly below the maturity threshold in Q2 but had significantly exceeded this threshold in Q3. Generally, the measurements indicated that the species captured in PFS-2 were larger than those captured in PFS-1.



Notes:

i. Data collected from the Rose Hall landing site is presented for all quarter in PFS-1 and for Q2 in PFS-2.
ii. Data collected from the Adventure landing site is presented for Q3 and Q4 of PFS-2.
iii. There are no available or suitable datasets for the Rose Hall landing site to be used for Q4 of PFS-1 (when there were no fishing trips) or Q1 of PFS-2 (when there was one fishing trip).

Figure 6-10: Average Lengths of Key Species Caught at Rose Hall and Adventure

In PFS-1, onboard supervisors utilized Chinese seines to target shrimp at three landing sites namely, Lima (Region 2), Windsor Forest (Region 3) and Ogle (Region 4). However, persistent low hauls of shrimp led to drastic changes in fishing practices at the former two of these landing sites which led to changes in the haul including, inter alia, the sizes of fishes captured.

Based on the variety of gear type used at Lima, there was diversity in the sizes of fishes in the landed hauls (Figure 6-11). Although shrimp hauls were low, all shrimp species caught in PFS-2 were mature. All snapper caught in PFS-2 was mature and were significantly larger than the sizes of the fish caught in PFS-1. On the other hand, all bangamary, cuirass and sea catfish that were caught were immature. Bangamary was of similar size in PFS-1 but cuirass and sea catfish were smaller. Generally, in PFS-1, cuirass and sea catfish had reached maturity. The variation in sizes was also observed in trout which were, on average, well above the maturity threshold in Q2 while being well below this level in Q3 of PFS-2.

Generally, the majority of species captured at the Lima landing site during PFS-2 were immature including:

- **Q1:** butterfish, cuffum and kokwari.
- **Q2:** cuffum, sea catfish, butterfish, bangamary, paggie and kokwari.
- **Q3:** cuirass, cuffum, lau lau, blinka, basha, kokwari, paggie, annafoke, longnose stingray *(Hypanus guttatus)*, mullet, bangamary, and sea catfish.
- **Q4:** paggie, basha (*Micropogonias furnieri)*, mullet, annafoke, highwater and snook.

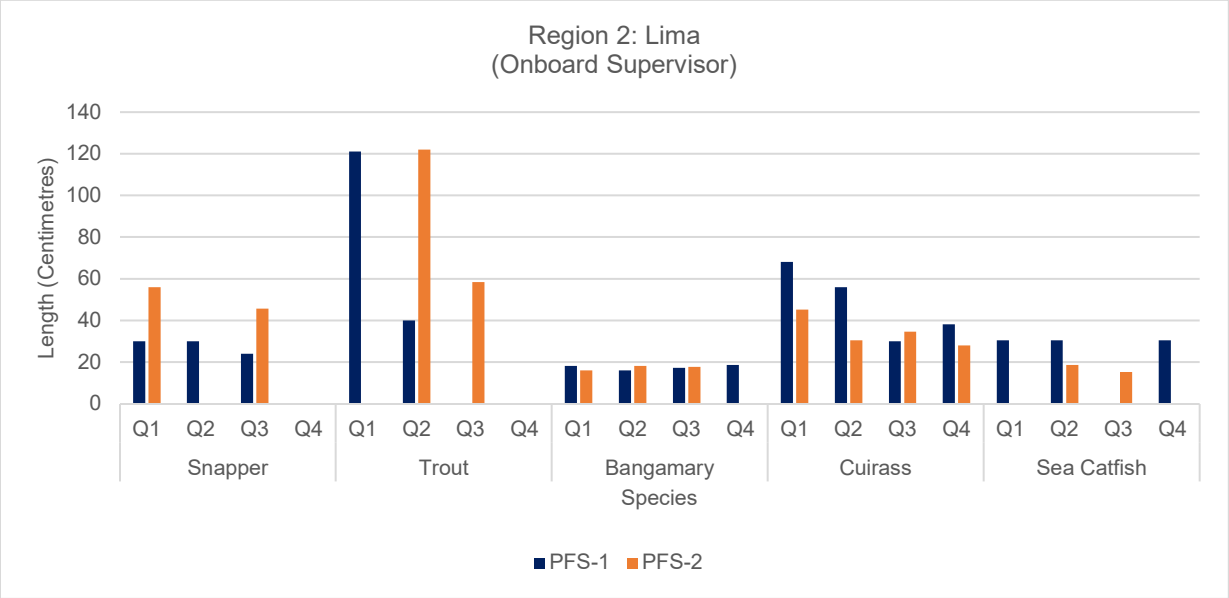


Figure 6-11: Average Lengths of Key Species Caught at Lima

At Windsor Forest, during PFS-1, Cadell lines were used to augment Chinese seines but in PFS-2, Cadell lines were used exclusively on the majority of fishing trips in Q2 and Q3. Chinese seines are used to target white belly shrimp and bangamary is a secondary target species. All white belly shrimp had reached maturity. However, bangamary were all immature (Figure 6-12). Both trends are consistent with the findings of PFS-1 and are typically of hauls from Chinese seines. Several other species which were immature were captured at this landing site including cuffum, highwater, mullet, paggie and netly (*Odontognathus mucronatus)*.

On the other hand, several species of fishes, most of which have large lengths of maturity compared with bangamary, were all mature namely, trout, cuirass, gillbacker and sea catfish. The capture of large, mature fish is a result of the utilization of Cadell lines.

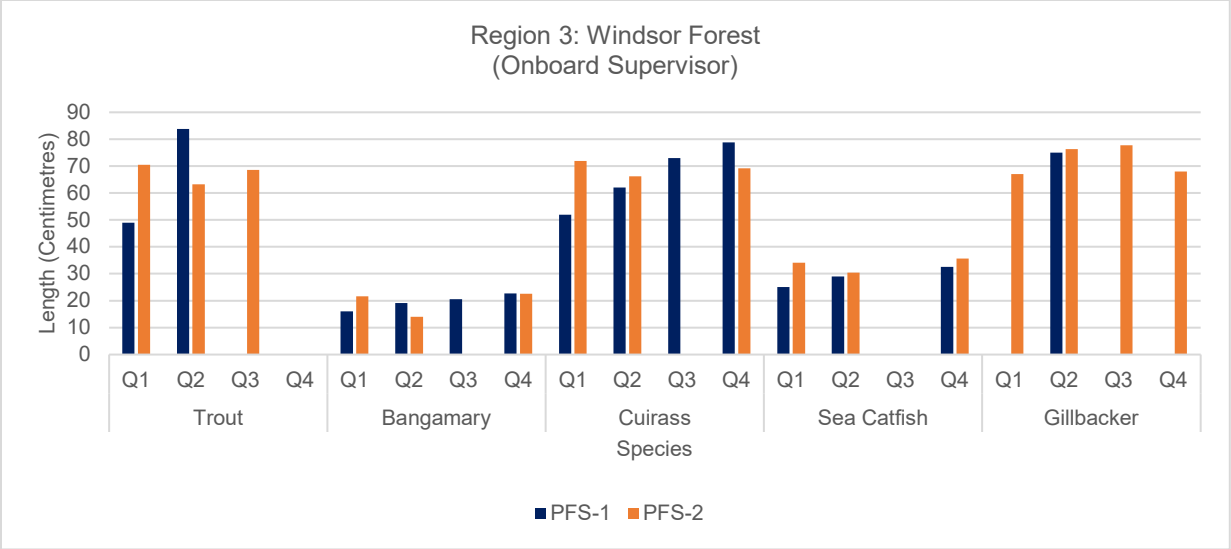


Figure 6-12: Average Lengths of Key Species Caught at Windsor Forest

The onboard supervisor at Ogle did not change gear types and captured only three of the fish species in Q1 to Q3. Bangamary and cuirass were both immature. However, sea catfish was also captured and this species had reached maturity (Figure 6-13). All shrimp species caught at the Ogle landing site were mature. Large quantities of juveniles are expected to have been captured in Q1 to Q3 but these were typically discarded as bycatch either due to the small size of the fish or commercial viability of the species.

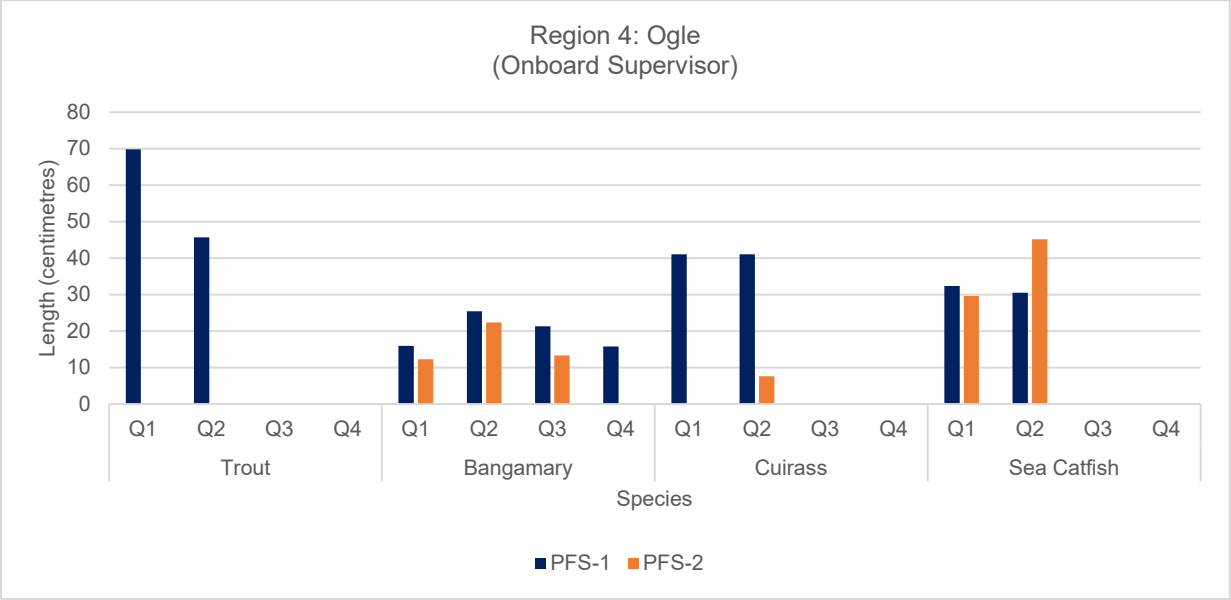


Figure 6-13: Average Lengths of Key Species Caught at Ogle

6.4 Cadell Lines

The size selectivity of fishes captured by Cadell lines is dependent on the sizes of hooks which are affixed to the lines. The size of hooks used may also help to avoid capture of smaller fish and juvenile

fish. During PFS-2, the majority of the fish species captured by the onboard supervisor from the Waramuri/Haimakobra landing site were mature including sea catfish (the target species), cuirass and gillbacker (Figure 6-14). Trout was only captured in Q2, and it was immature. The smallest species caught in PFS-2 was sea catfish, in Q1, with an average length of 36.06 centimetres. In PFS-2, the fishes recorded by the onboard supervisor were smaller on average than what was recorded in PFS-1. Generally, all species captured were sexually mature with the exception of sharks that were caught between Q2 to Q4.

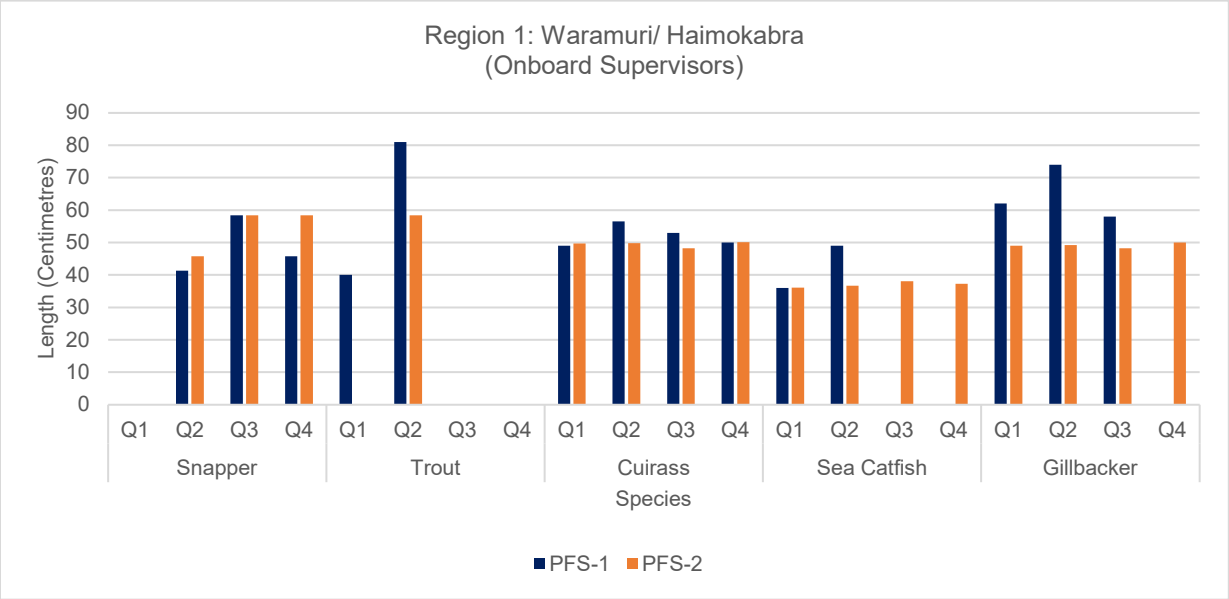


Figure 6-14: Average Lengths of Key Species Caught at Waramuri/Haimokabra

Although the onboard supervisor at the La Grange landing site also used only Cadell lines for fishing, the sizes of the species captured were smaller as compared with the onboard supervisor from Waramuri/Haimokabra. The smallest species captured at this landing site was cuirass which had an average length of 30.48 centimetres. Sea catfish (the target species), gillbacker and bangamary were the only species captured which had reached maturity in all PFS-2 quarters in which they was captured (Figure 6-15). Snapper was well below required lengths for maturity in Q4 and cuirass was immature in Q3 and Q4. In addition, trout was captured in Q1 to Q3 and was immature in all quarters.

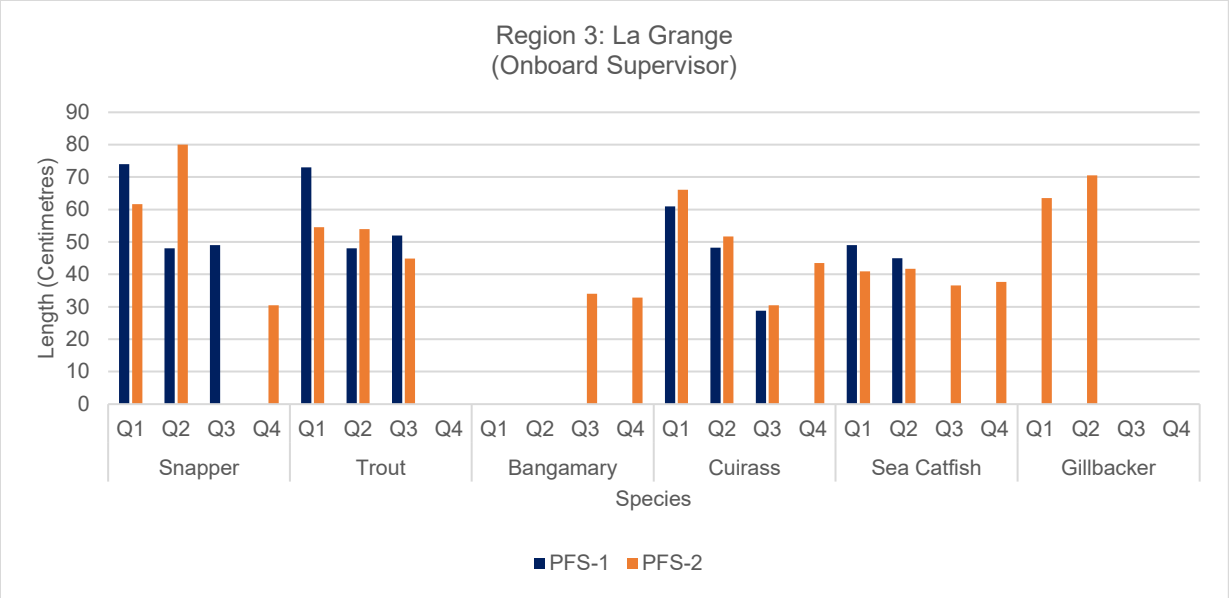


Figure 6-15: Average Lengths of Key Species Caught at La Grange

6.5 Generalist Gear

The generalized approach to fishing at the Smith's Creek landing site resulted in a variety of sizes of fishes captured. Based on data collected by the regional supervisor, bangamary was the only species which was mature in all quarters in which it was captured (Figure 6-16). Snapper and cuirass were both immature in Q3. Trout were juveniles in Q2 and Q3.

By contrast, most of the species captured by the onboard supervisor were mature including snapper, cuirass, sea catfish and gillbacker (Figure 6-17). However, bangamary and trout were juveniles in Q1 and Q3. The onboard supervisor also captured jewfish in Q1 to Q3, and this fish was juvenile in all three quarters.

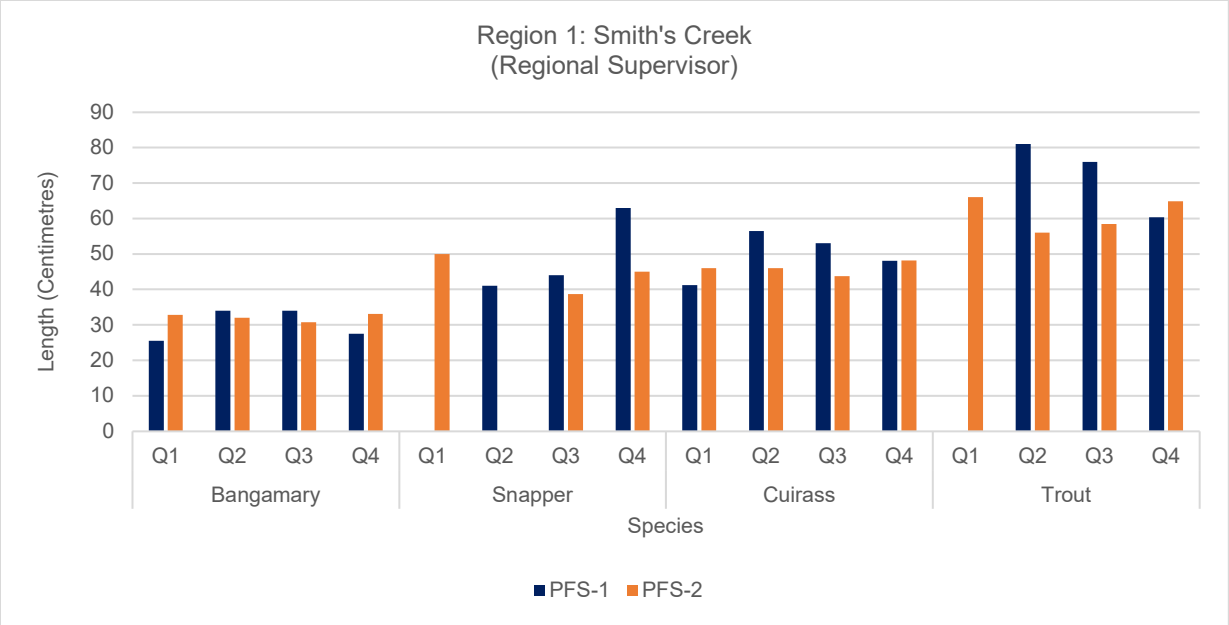
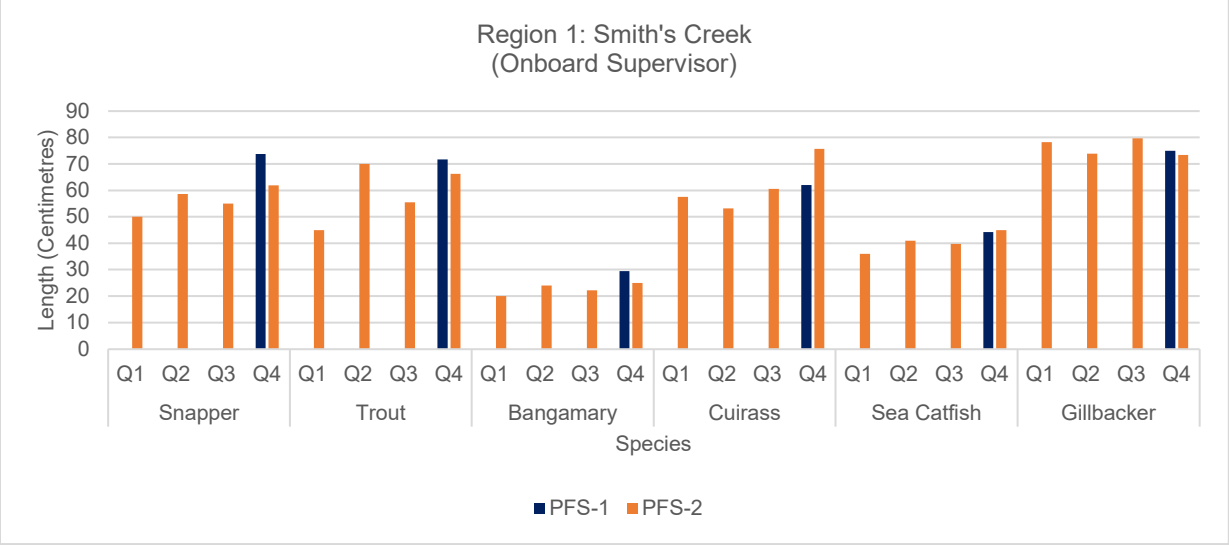


Figure 6-16: Average Lengths of Key Species Recorded by the Smith's Creek Regional Supervisor



Note: The Smith's Creek onboard supervisor did not conduct any fishing trips in Q1 and Q2 of PFS-1 due to the high cost of fuel. As such, there are no comparative datasets.

Figure 6-17: Average Lengths of Key Species Recorded by the Smith's Creek Onboard Supervisor

The Bushlot onboard supervisor also used a variety of fishing gear throughout PFS-2. Only sea catfish and gillbacker were mature in all quarters. Snapper and bangamary were both juveniles in Q4, and cuirass was juvenile in Q1 and Q4. Trout was captured in all four quarters and had never reached maturity. Generally, fishes were smaller in all periods in PFS-2 in comparison to PFS-1 (Figure 6-18). The trend in decreases can be attributed to the use of drift seines with mesh sizes of 12.7 centimetres (5 inches) more frequently than the snapper seines which were utilized as the main gear type during PFS-1.

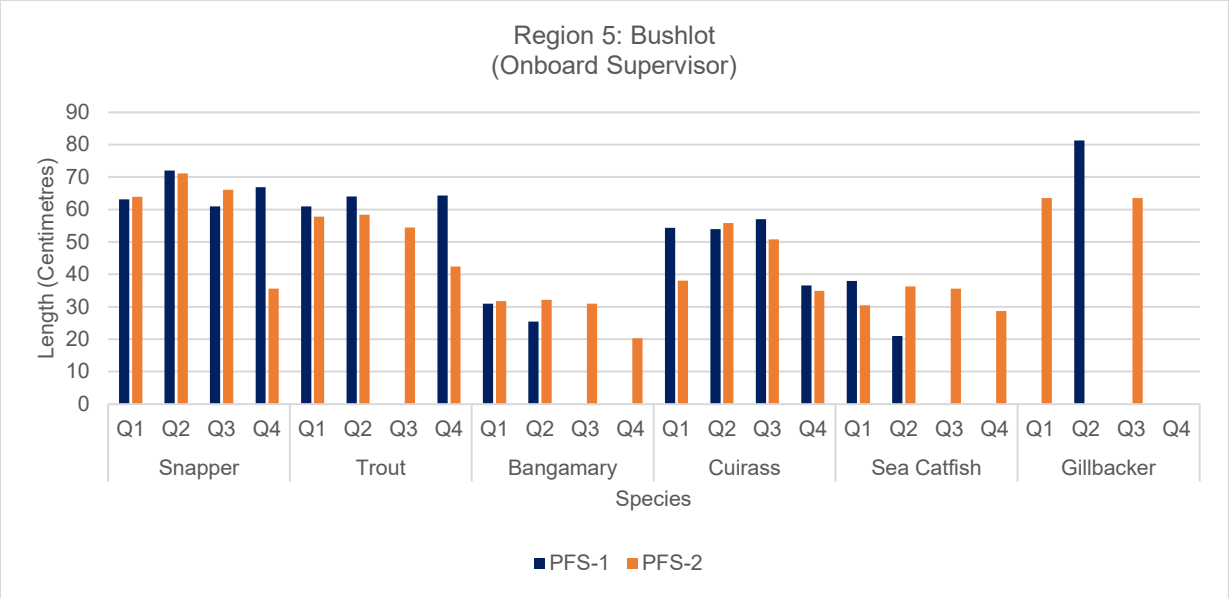


Figure 6-18: Average Lengths of Key Species Caught at Bushlot

7.0 PRICE AND MARKETS

A key finding of PFS-1 was that the total value of a haul was determined by several factors including the species composition, the total weight, the size of the fishes that were caught, and bargaining with vendors or other customers. These factors remained relevant during PFS-2. Fisherfolk who sold their hauls directly to consumers had the opportunity to negotiate for higher prices per kilogram, particularly for medium-value species. For example, in Q3, the price per kilogram for white belly shrimp at Lima, where the catch was sold directly to consumers, was GYD $1,763.70 (USD $8.44), significantly exceeding the prices obtained at other landing sites where the average price was lower than GYD $500 (USD $2.39). At some landing sites, vendors, some of whom had refrigerated trucks, purchased hauls directly from fisherfolk. These vendors have significant purchasing power and can influence decisions made by fisherfolk on the products which are sold at the landing site as well as the prices which are obtained. Vendors who visit landing sites in Riverview (Region 4) and Mahaicony Bridge (Region 5) only purchase whole fishes with all organs intact. This restricts fisherfolks from harvesting high-value trout glue for separate sale which may increase the value of their fishing trips. The vendors likely harvest these by-products to further increase their profit margins.

Similarly, during the intervening period between PFS-1 and PFS-2, a group of vendors affiliated with an expatriate owned processing facility, started to visit the landing sites at Zeeburg (Region 3) and Ogle (Region 4) to purchase shrimp. According to fisherfolk, these vendors typically negotiate for lower the prices per kilogram than prices which would be obtained if sold to local vendors and communities. Fisherfolk opt to sell hauls to these vendors because they purchase the entire haul. At the Zeeburg landing site, these vendors also made investments to improve infrastructure by installing a concrete driveway to allow for easier access. However, in Q2, due to significant reductions of productivity of shrimping, these vendors ceased to visit the landing sites. This activity did not resume until Q4 at the Zeeburg landing site and did not resume at all at the Ogle landing site.

During PFS-2, dynamic socio-economic conditions associated the impacts of the COVID-19 pandemic, rising fuel prices and declining productivity of fishing trips also influenced the prices for which hauls were sold. Upon the commencement of data collection for PFS-2, the impacts of the COVID-19 pandemic was still being experienced by artisanal fisherfolk. In particular, the general economic downturn caused by the pandemic lowered demand for most species in local and export markets resulting in price reductions. This effect was temporary and by Q2, prices were rebounding to pre-pandemic levels at all landing sites surveyed.

In the latter quarters of PFS-2, particularly Q4, the interplay of increased cost for conducting fishing trips and reducing productivity of high-value species and target species also influenced the prices across the board. At most of the landing sites surveyed, fisherfolk reported that the costs of conducting fishing trips significantly increased due, in large part, to the increased prices of fuel and, for fishing trips conducted by large vessels, increased costs of rations. High expenses to conduct fishing trips and increased scarcity of key species resulted in price increases for most species. Moreover, in the final two quarters, price changes were also influenced by rough seas which created challenging conditions offshore and by fisherfolks taking breaks from fishing during the Christmas holidays. Scarcity of fishes influenced price increases, particularly in Q3. Reductions in fish supplies during Q3 are a yearly occurrence however, PFS-2 saw a major increase in prices due to the combination of factors highlighted.

Finally, the location of the landing site plays an important role in determining prices. This is evident in two trends which were observed since PFS-1. The average prices obtained for high-value species like snapper and gillbacker (and their by-products like glue) in Region 1 are considerably lower than prices obtained at landing sites in other coastal regions (Regions 2 to 6). By contrast, the average price obtained for bangamary at Smith's Creek is comparable or higher than the prices obtained at landing sites like Riverview, Mahaicony Bridge and Albion where it is the target species. Moreover, the renown

of a landing site for a particular species may significantly influence the price for which species are sold. For example, the highest prices for gillbacker are usually recorded at the Windsor Forest landing site where popular vendors who specialize in gillbacker retail are based. Similarly, the highest price for snapper and snapper glue are frequently recorded at the Charity landing site where there are well established markets, including export markets, for these products. This section examines the prices for which key target species and by-products were sold at the landing sites surveyed.

7.1 High Value Species: Gillbacker and Snapper

Generally, gillbacker and snapper were the top two most expensive species at all landing sites surveyed. When PFS-1 was executed, the artisanal fishing sector was adjusting to a ban effected by the United States Department of Agriculture (USDA) on the export of catfishes and catfish products from Guyana to the U.S because food safety inspection systems were not equivalent to U.S inspection systems. Prior to the ban, gillbacker was the most valuable species at most landing sites across Guyana's coast but prices dipped significantly. As a consequence, during PFS-1 snapper was the most expensive species at most landing sites.

However, this effect was temporary even though the ban remains effective. During PFS-2, gillbacker was the most expensive species at all landing sites where it was caught. The average prices at which gillbacker was sold was highest at Windsor Forest where gillbacker was sold for GYD $2,200 (USD $10.53) per kilogram in Q1. At this landing site, the price rose steadily throughout the PFS-2 study period and, in Q4, the average price of gillbacker was GYD $3,036.36 (USD $14.52) per kilogram. A progressive upward price trend for gillbacker throughout the PFS-2 study period was observed at most of the landing sites where it was captured.

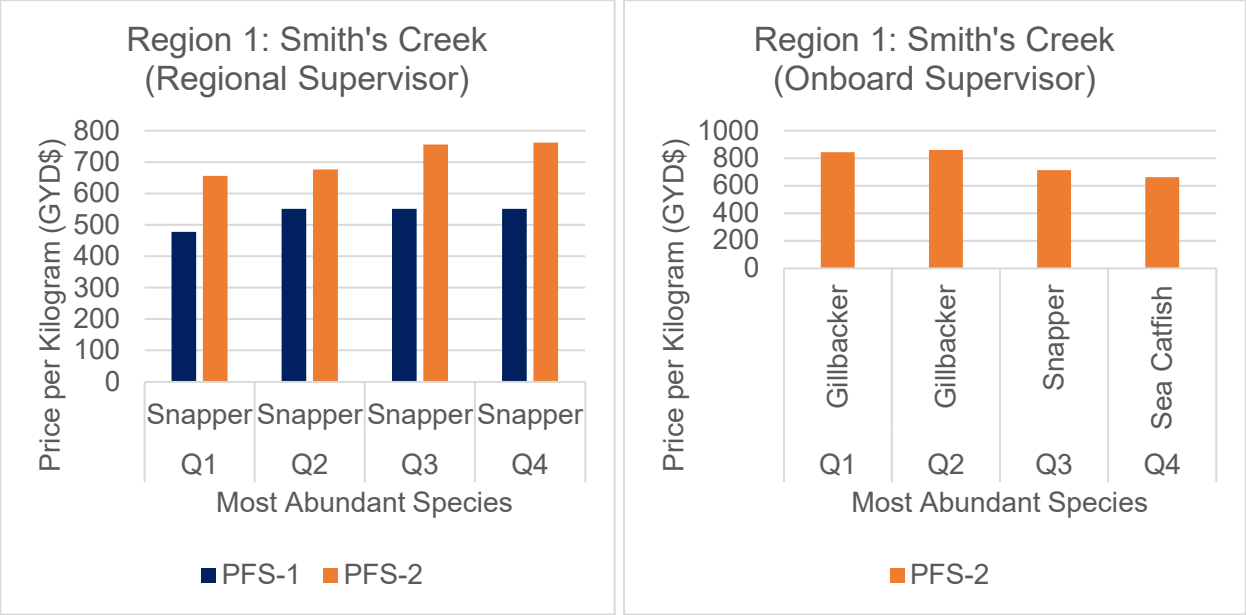
Generally, at landing sites where snapper and gillbacker were captured, snapper was the second most highly valued species. However, whenever gillbacker was not part of the haul, snapper frequently most valuable. The exception was at landing sites where juvenile snapper were caught (such as at Riverview where bangamary seines are used) and smaller fish are sold for lower prices. Notwithstanding such exceptions, the Q1 price for snapper was higher than the prices obtained in PFS-1 and prices also continued to trended upward throughout the PFS-2 study period.

As previously discussed, Smith's Creek is a generalist landing site and in PFS-1, cuirass was the most abundant species captured but cuirass is a lower-valued species at this landing site. However, during PFS-2, snapper was most abundantly captured in all quarters based on data collected by the regional supervisor and other high-value species like gillbacker were abundantly caught by the onboard supervisor. Moreover, during PFS-1, no by-products (glue or eggs) were harvested for separate sale. Fisherfolks transitioning to using larger mesh sizes to capture large species like snapper and gillbacker may have been influenced both by the high-value of these species and the new practice of harvesting by-products (particularly snapper glue) for separate sale.

The price of snapper steadily increased throughout PFS-2 with minor increases being reported by the regional supervisor in each quarter. Moreover, in all quarters, the average price per kilogram of snapper was higher in PFS-2 in comparison to PFS-1 (Figure 7-1). This is largely due to steadily increasing fuel prices. In Region 1, fuel is imported from Venezuela where fuel shortages and the concomitant price increases were being experienced since PFS-1. Fuel prices had risen further when data collection for PFS-2 commenced and continued to rise throughout the study period. Increased expenses per fishing trip was passed onto consumers via higher prices. In addition, increased demand also influenced the price increased. During Q2, amid declining productivity of fishing trips in other coastal regions, vendors from Georgetown started to visit Smith's Creek to purchase fish for export to Georgetown. Fisherfolk also reported that entire hauls were sold to Venezuelan trawlers who occasionally purchase the entire catch. New consumers are expected to have greater purchasing

power and be willing to pay higher prices per kilogram, particularly for species like snapper and gillbacker.

In Q1 and Q2, gillbacker was abundant as well as the most expensive species recorded by the Smith's Creek onboard supervisor (Figure 7-1 [B]). Unlike most of the landing sites surveyed, snapper was not highly valued at this landing site as it was the sixth most expensive in Q1 and the eighth most expensive in Q2. Moreover, although it was the most abundant species captured in Q3, it was the fifth most highly valued. This is illustrative of the unique circumstances in Region 1 because species that were of medium- to lower-value in other coastal regions were consistently more expensive including bangamary, sea catfish and trout. However, by Q4, the onboard supervisor's pricing structure had evolved with gillbacker and snapper being the most expensive species respectively. This change in species valuation by the onboard supervisor may have been influenced by external forces including demand from vendors who originate outside of Region 1. Onboard supervisors did not collect data on the prices for which fishes were sold in PFS-1 and therefore, comparative prices between the study periods are not presented in Figure 7-1 (B).



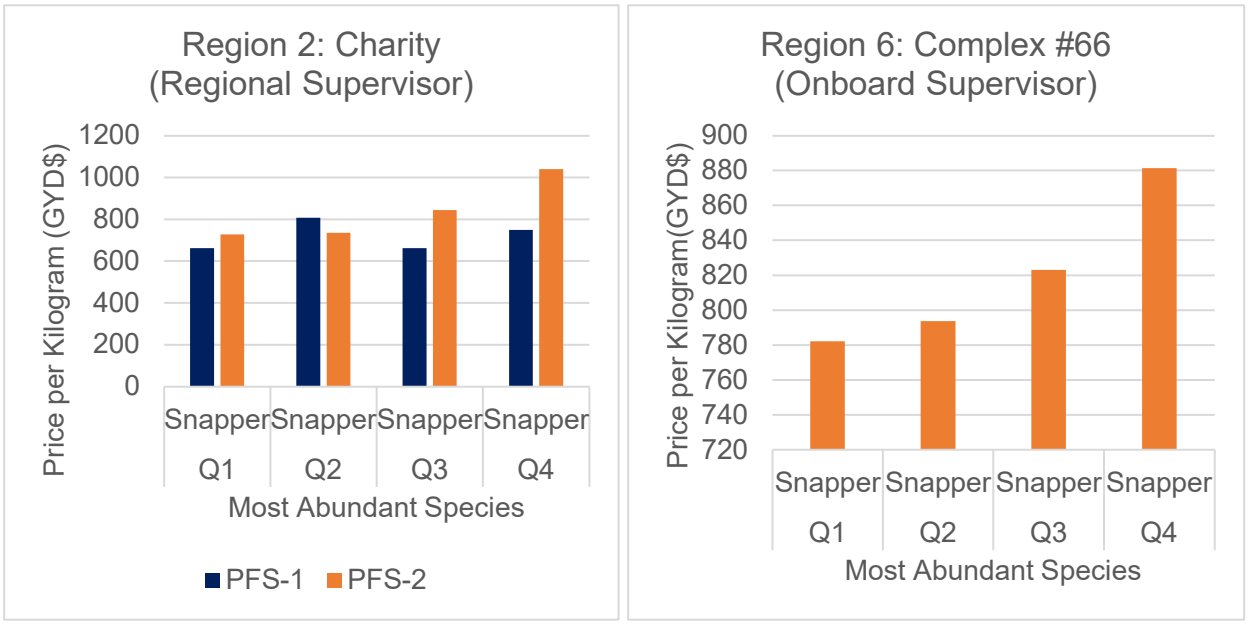
(A) (B)

Figure 7-1 (A-B): Average Prices per Kilogram for the Most Abundant Species by the Smith's Creek Regional Supervisor (A) and Onboard Supervisor (B)

Snapper seines were used exclusively at the landing sites in Charity (Region 2) and Complex #66 (Region 6) throughout PFS-2. As a consequence, snapper was the most abundant species caught at both landing sites in all quarters. As seen in Figure 7-2, the average prices for which snapper was sold increased significantly in the latter two quarters of PFS-2, with the most significant increase occurring in Q4. At Charity, these price increases were due to higher expenses for conducting fishing trips as well as lower productivity of target species. However, the productivity of fishing trips conducted by the onboard supervisor at Complex #66 was equal to or slightly greater than in PFS-1 and thus, the increasing price obtained may have been influenced by increased fuel cost and by prevailing market conditions at the landing site. Based on this trend, it is likely that productivity declines were also experienced by other fisherfolk who use snapper seines at the Complex #66 landing site.

Gillbacker was the most expensive species in all quarters at the Charity landing site. Gillbacker was only captured in Q2 and Q3 by the onboard supervisor from Complex #66 and in both periods, it was

also the most expensive species in the haul. The price of gillbacker progressively increased at both of these landing sites throughout the PFS-2 period. Onboard supervisors did not collect data on the prices for which fishes were sold in PFS-1 and therefore, comparative prices between the study periods are not presented in Figure 7-2 (B).



(A) (B)

Figure 7-2 (A-B): Average Prices per Kilogram for the Most Abundant Species Caught at Charity (A) and Complex #66 (B)

Snapper seines are also the primary gear type used by onboard supervisors at landing sites in Hampton Court (Region 2) and Rosignol (Region 5). However, these supervisors reported significant declines in the productivity of snapper seines in Q1 and Q2 and therefore, in Q3 and Q4 both supervisors introduced bangamary seines into their fishing practices. In PFS-1, gillbacker and snapper were the most abundant species caught alternatingly at Hampton Court. This was observed in Q1 to Q3 but when the bangamary seines were frequently used in Q4, the most abundant species captured was mullet which was of considerably lower value (Figure 7-3 [A]). The price obtained for gillbacker in Q2 and Q3 was significantly higher than the prices obtained for snapper in Q1.

At Rosignol, snapper remained the most abundant species caught even when new fishing gear was used. Similar to price trends observed at Charity and Complex #66, the price for snapper increased significantly in Q4 from the previous three quarters (Figure 7-3 [B]). The price increase at Rosignol was the highest with a 46 percent rise in Q4 relative to Q3. As a result of this increase, the price pe kilogram for snapper at Rosignol in Q4 was the highest for the entire PFS-2 study period among the landing sites surveyed. Gillbacker was not caught in all quarters by the Rosignol onboard supervisor, but when it was part of the haul it was the most expensive species. Onboard supervisors did not collect data on the prices for which fishes were sold in PFS-1 and therefore, comparative prices between the study periods are not presented in Figure 7-3.

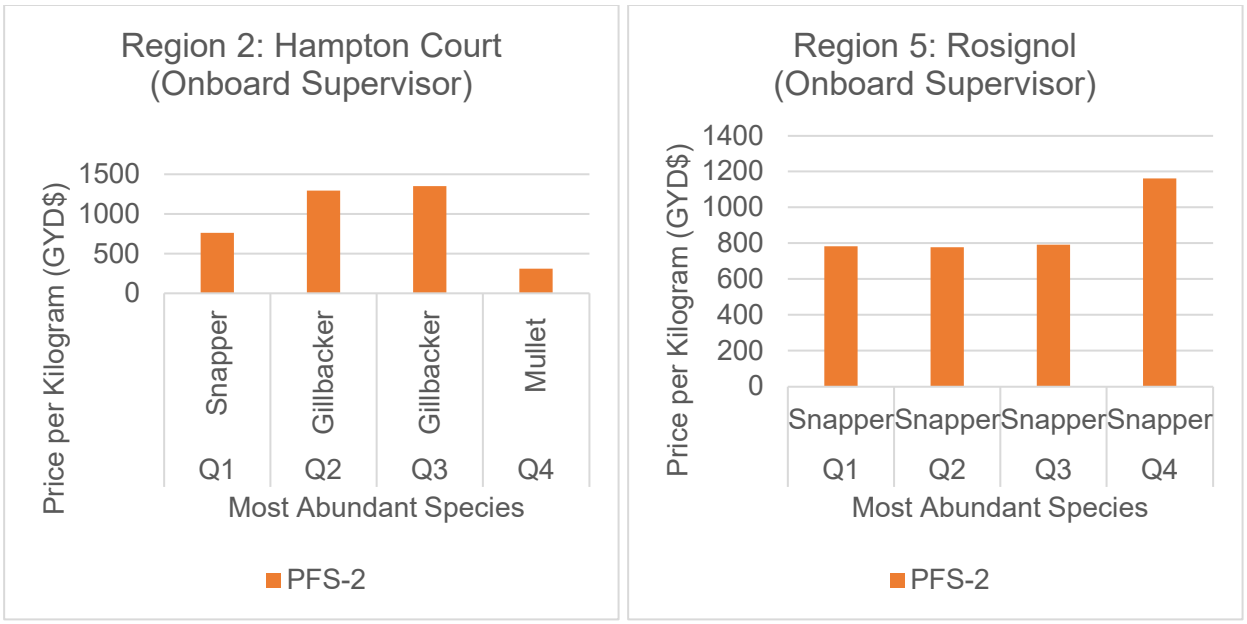


Figure 7-3 (A-B): Average Prices for the Most Abundant Species Caught at Hampton Court (A) and Rosignol (B)

7.2 Bangamary

Data was collected by supervisors at four landing sites where the primary gear type utilized was snapper seines namely, Riverview (Region 4) where data was collected by a regional supervisor and an onboard supervisor, Mahaicony Bridge (Region 5), Albion (Region 6). Bangamary was the most abundant species caught in all PFS-2 quarters at these landing sites. In PFS-1, the price for which bangamary was sold was approximately GYD $220 (USD $1.05) at Riverview and Albion. Although prices varied moderately at the Mahaicony Bridge landing site throughout PFS-1, it remained within range the prices recorded at the other landing sites surveyed where bangamary was the target species. Indeed, the highest price for bangamary at the Mahaicony Bridge landing site in PFS-1 was GYD $231(USD $1.11).

However, price stability for bangamary drastically changed in the latter quarters of PFS-2. The prices reported in PFS-1 remained relatively constant in Q1 and Q2. However, in Q3, the price gradually rose at all landing sites and this was followed by the sharp increase in Q4 (Figure 7-4 [A-D]). The increased price of bangamary may have been influenced by several factors including the relative scarcity of this species in Q3 and fisherfolk recovering expenses by increasing the price. Overall, prices in Q4 were approximately 40 percent higher at the Albion landing site, 50 percent higher in the prices reported by the Riverview onboard supervisor and 55 percent higher in the prices reported by the Riverview regional supervisor.

There is no comparable data for the PFS-2 quarters in Q3 and Q4 at the Mahaicony Bridge landing site because the data collected by the regional supervisor was not found to be credible during the QA/QC exercise. The regional supervisor at this landing site has since been replaced. In addition, onboard supervisors did not collect data on the prices for which fishes were sold in PFS-1 and therefore, comparative prices between the study periods are not presented in Figure 7-2 (B) and (D).

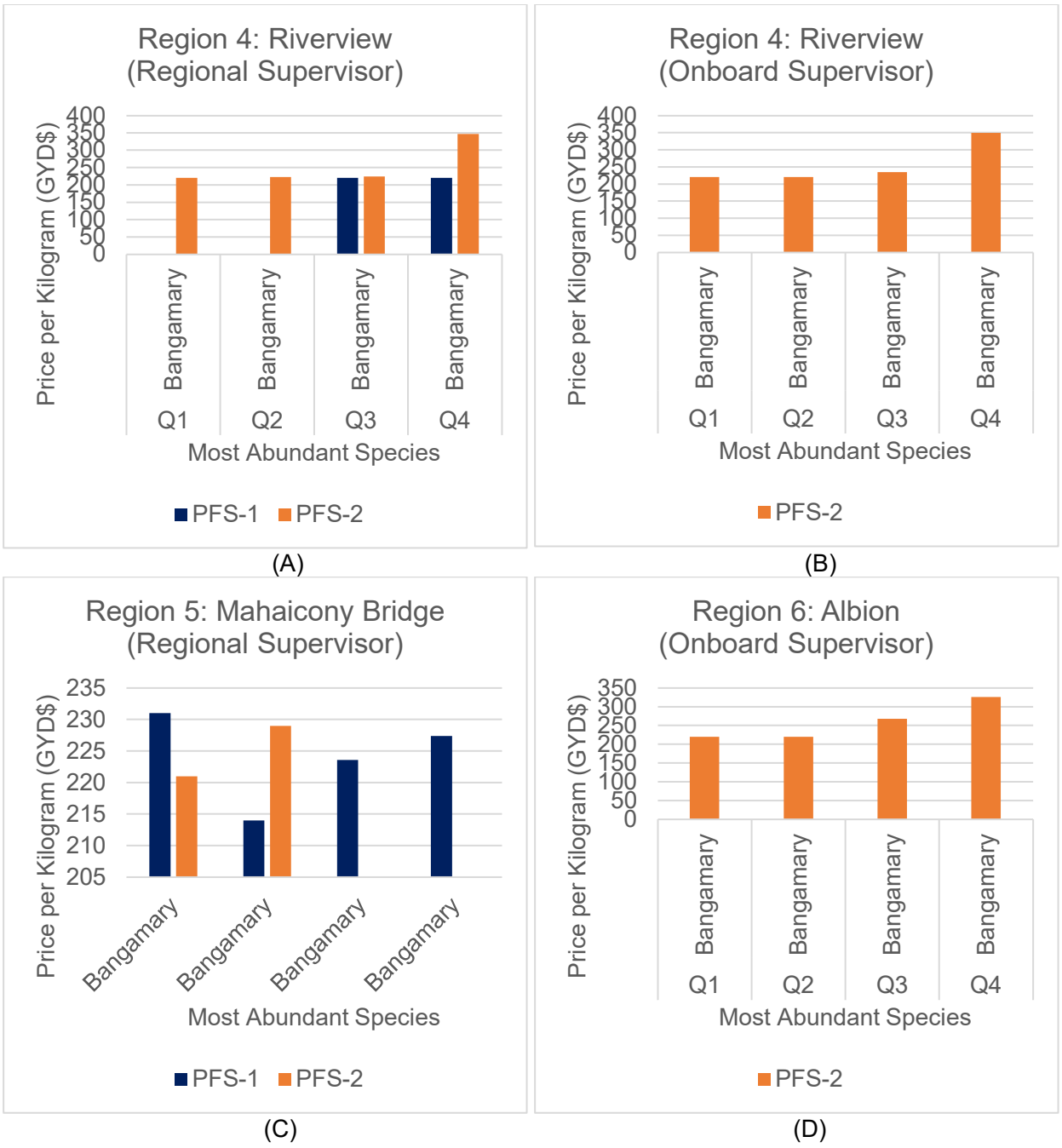


Figure 7-4 (A-B): Average Prices per Kilogram for Bangamary at Riverview Regional Supervisor (A), Riverview (B),Mahaicony Bridge (C) and Albion (D)

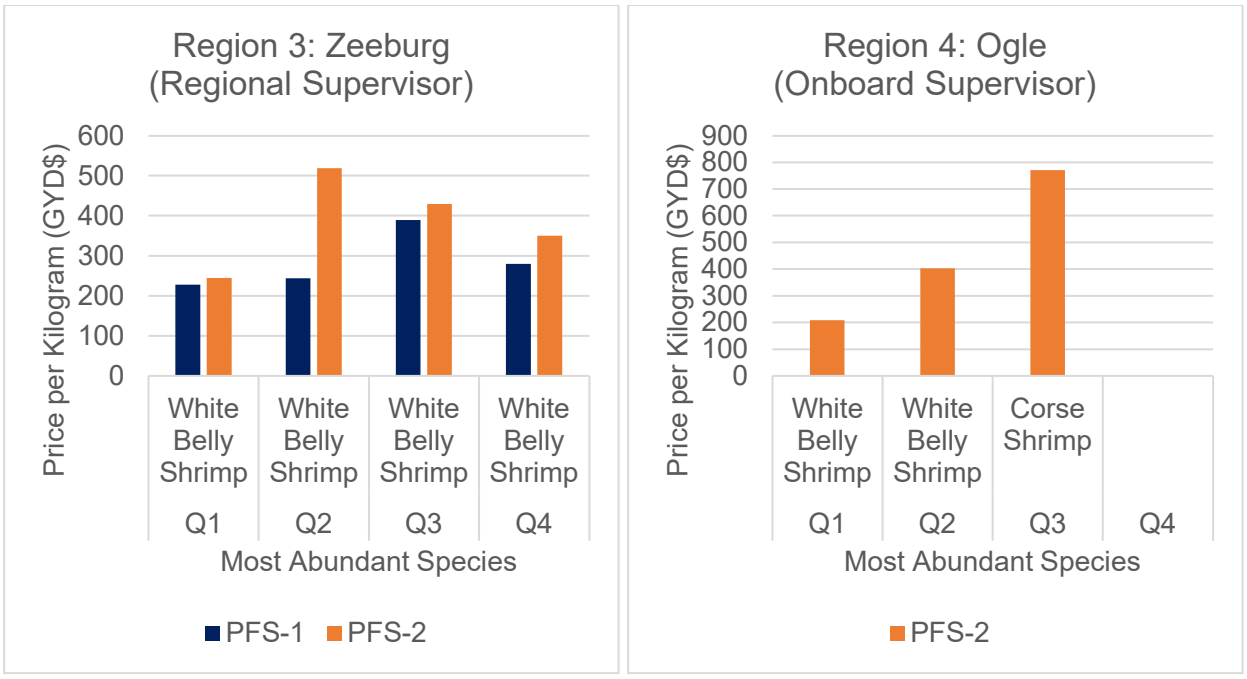
7.3 Shrimp

Regional and onboard supervisors collected data from five landing sites where shrimp (white belly shrimp or coarse shrimp) were the target species. Specifically, Chinese seines were used to target shrimp at Lima (Region 2), Zeeburg (Region 3), Windsor Forest (Region 3) and Ogle (Region 4). In addition, data was collected from pin seine fishing from the Adventure landing site (Region 6). During PFS-2, there were significant downturns in the productivity of shrimping and productivity is generally lower in comparison to the PFS-1 reference periods. At the landing sites in Lima (Region 2) and

Windsor Forest (Region 3), the onboard supervisors altered fishing practices by using alternative fishing gear in an effort to improve productivity. As a consequence, shrimp were not the most abundant species captured at these landing sites and the prices for which these species were sold are discussed in Section 7.5.

Chinese seines were used exclusively at two landing sites throughout PFS-2 namely, Zeeburg (Region 3) and Ogle (Region 4). At the Zeeburg landing site, major declines in productivity in Q2 resulted in a drastic increase (by more than 100 percent) in the price for white belly shrimp relative to Q1 and the PFS-1 reference quarter. Lower hauls reduced supply causing an increase in demand and in price. Reduced supply of white belly shrimp contributing to a considerable price increase which was also observed at the Lima landing site (Region 2). However, the prices for white belly shrimp at Windsor Forest landing site (Region 3) and Ogle (Region 4) were lower and consistent with the prices obtained in Q1. Following the spike in Q2, prices progressively declined. A noteworthy trend was that productivity in Q3 was even lower than in Q2, but the price declined nonetheless. Moreover, the prices obtained by the Lima onboard supervisor is unique because the price recorded are retail price from sale directly to consumers whereas at the other three landing sites entire hauls are typically sold wholesale to vendors.

At the Ogle landing site, the target species is coarse shrimp but in Q1 and Q2, the most abundant species captured was white belly shrimp. In Q1, the average price per kilogram for white belly shrimp was lower than any of the other three landing sites where Chinese seines were used for shrimping. but by 94 percent in Q2 when productivity of shrimp declined. In Q3, coarse shrimp (the target species) was the most abundant species caught and the price per kilogram was 91 percent greater than the price for which white belly shrimp was sold in Q2. Moreover, in Q1 and Q2, due to scarcity, coarse shrimp was among the top three most valuable species and the price obtained in Q3 was the highest for all quarters in which data was collected. However, neither species were the most valuable. In Q1 to Q3, prawns were the most valuable species sold by the onboard supervisor. In Q4, the new onboard supervisor conducted only one fishing trip and data on the prices obtained were not reported.

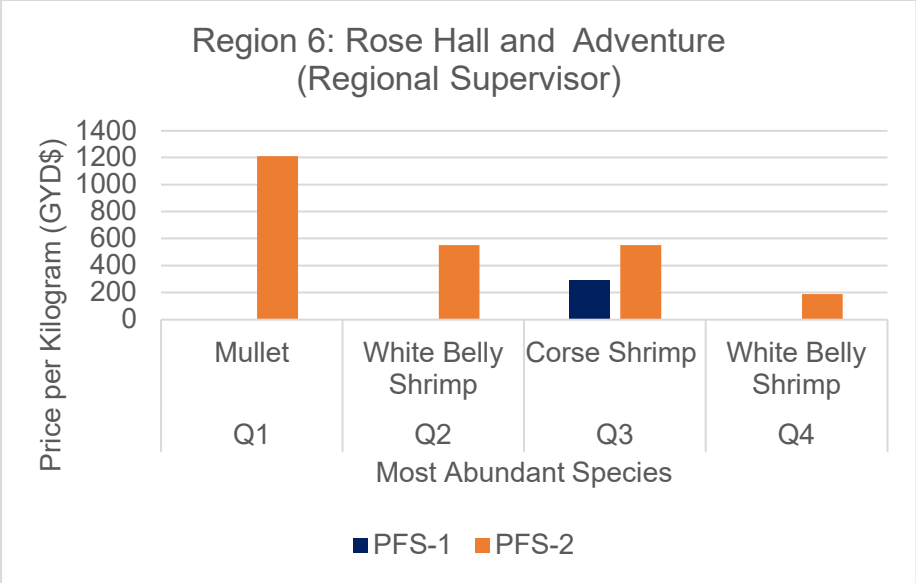


(A) (B)

Figure 7-5 (A-B): Average Prices per Kilogram for White Belly Shrimp and Coarse Shrimp at Zeeburg (A) and Ogle (B)

Fisherfolk from the landing sites in Rose Hall and Adventure sold hauls directly to the consumers and there were no defined trends in prices. Additionally, there was no common species that was abundant in the PFS-2 quarters and the PFS-1 reference periods. Mullet was the most abundant species caught in Q1 but was not caught during the comparable period in PFS-1. Similarly, white belly shrimp was most abundant in Q2 and Q4 but this did not occur during the comparable period of PFS-1. Coarse shrimp represented the only species where there was a comparative basis to the PFS-1 reference period and there was a major price difference with an increase of 90 percent in PFS-2 versus PFS-1.

However, the average price points obtained for mullet in Q1 and white belly shrimp in Q2 clearly illustrate the bargaining power fisherfolk have when directly interfacing with consumers. Specifically, mullet was also the most abundant species captured by the Hampton Court onboard supervisor (in Q4) but the price obtained by fisherfolk from the Rose Hall landing site was almost three times greater. Similarly, the price for which white belly was sold was greater than the three landing sites where hauls were typically sold to vendors (Zeeburg, Windsor Forest and Ogle) and was only lower than the price obtained by the Lima onboard supervisor who also sold hauls directly to consumers. During PFS-2, white belly shrimp was the only species caught most abundantly caught in more than one quarters, that is, in Q2 and Q4. In Q4 the price had decreased by 65 percent which could be attributed to the increased supply of shrimp, similar to the price decrease which accompanied increased productivity of shrimping at Zeeburg.



Notes:

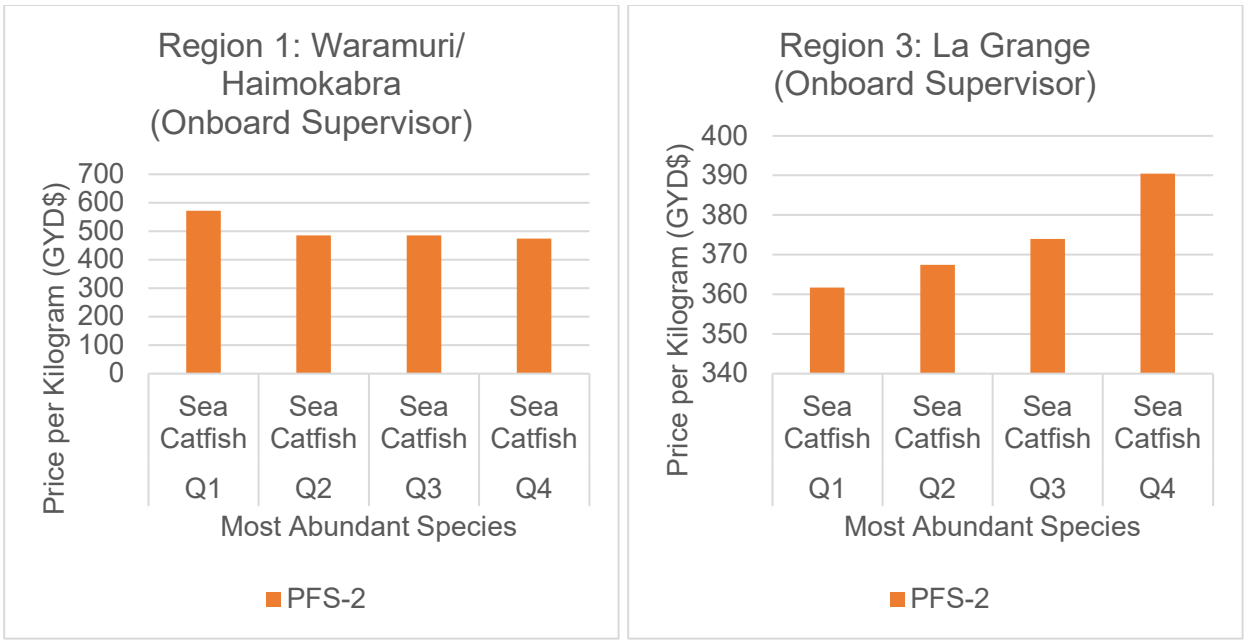
i. Data collected from the Rose Hall landing site is presented for all quarter in PFS-1 and for Q2 in PFS-2.
ii. Data collected from the Adventure landing site is presented for Q3 and Q4 of PFS-2.
iii. There are no available or suitable datasets for the Rose Hall landing site to be used for Q4 of PFS-1 (when there were no fishing trips) or Q1 of PFS-2 (when there was one fishing trip).

Figure 7-6: Average Prices per Kilogram for the Most Abundant Species Caught at Rose Hall and Adventure (Regional Supervisor)

7.3 Sea Catfish

At the landing sites in Waramuri/ Haimokabra (Region 1) and La Grange (Region 3) where Cadell lines were used, sea catfish was the most abundant species caught. However, there was a major deviation in prices obtained and pricing trends between these landing sites. Indeed, prices were significantly higher at Waramuri/ Haimokabra than at La Grange and the lowest price at the former exceeded the highest price obtained at the latter (Figure 7-7). The primary reason for the price difference is the type of product sold by these supervisors. Ice is not readily available in Waramuri/ Haimokabra. Fishing trips conducted by the onboard supervisor lasted for up to 14 days at sea and thus, alternative fishing methods such as salting, smoking or drying fish (locally referred to as ‘corn fish’)are utilized. Preserved fish are typically sold for higher prices due to its being the dehydrated weight of the catch.

During PFS-2, prices trended downward at Waramuri/ Haimokabra but steadily increased at La Grange. At the former landing site, this may have been directly influenced by the productivity of fishing trips which were greatest in Q4 when the lowest price was recorded. Market prices are expected to decline as supply rises. At La Grange, the onboard supervisor attributed to the price increase to rising demand for sea catfish in local markets and from the vendor to whom most hauls are sold. Moreover, it is likely that the increased price of fuel was transferred to consumers in higher prices so that anticipated profit margins could be achieved. Onboard supervisors did not collect data on the prices for which fishes were sold in PFS-1 and therefore, comparative prices between the study periods are not presented in Figure 7-7.



(A) (B)

Figure 7-7 (A-B): Average Price for Sea Catfish at Waramuri/Haimokabra (A) and La Grange (B)

7.4 Other Species

In PFS-1, Chinese seines were the primary gear type utilized by the onboard supervisors from Lima (Region 2) and Windsor Forest (Region 3). However, in PFS-2, alternative gear types were utilized in pursuit of greater productivity and during the latter quarters at Lima, due to challenges with accessing the landing site during low tide.

At the Lima change site, a generalist approach to fishing was adopted and three different species were the most abundant species caught in the PFS-2 quarters. The only species which was most abundant for two periods was blinka; caught in Q1 and Q2. Blinka is a low-value species notwithstanding the doubled price in Q2 (Figure 7-8 [A]). Highwater and mullet, the most abundant species caught in Q3 and Q4, were also of low value. Indeed, the average price obtained for mullet was almost 30 percent lower than in Hampton Court, a landing site in Region 2 where mullet was also the most abundant species caught in Q4. In all quarters, white belly shrimp was the most expensive species at this landing site.

At the Windsor Forest Region 3 landing site, the onboard supervisor recorded cuirass as the most abundantly caught species in Q1 and Q2 and sea catfish as the most abundantly caught species in Q3 and Q4. The prices obtained for both species remained stable across the quarters (Figure 7-8 [B]). Cuirass is a low-value species and the price of GYD $154 (USD $0.75) was higher than obtained at Bushlot, the only other landing site where cuirass was the most abundant species captured. Similarly, the price obtained for sea catfish was higher in Windsor Forest than at La Grange, a landing site in Region 3 where sea catfish was most abundant, by 18 percent in Q3 and 13 percent in Q4. In all quarters, gillbacker was the most expensive species at this landing site. As observed at other landing sites, the price of gillbacker progressively increased throughout the PFS-2 study. At Windsor Forest, the price per kilogram increased by almost 40 percent from GYD $2,200 (USD $10.53) in Q1 to GYD $3,036.36 (USD $14.52) in Q4. Generally, this landing site had the highest prices for gillbacker and this is largely associated with the renowned gillbacker vendor stands which are located adjacent to the landing site.

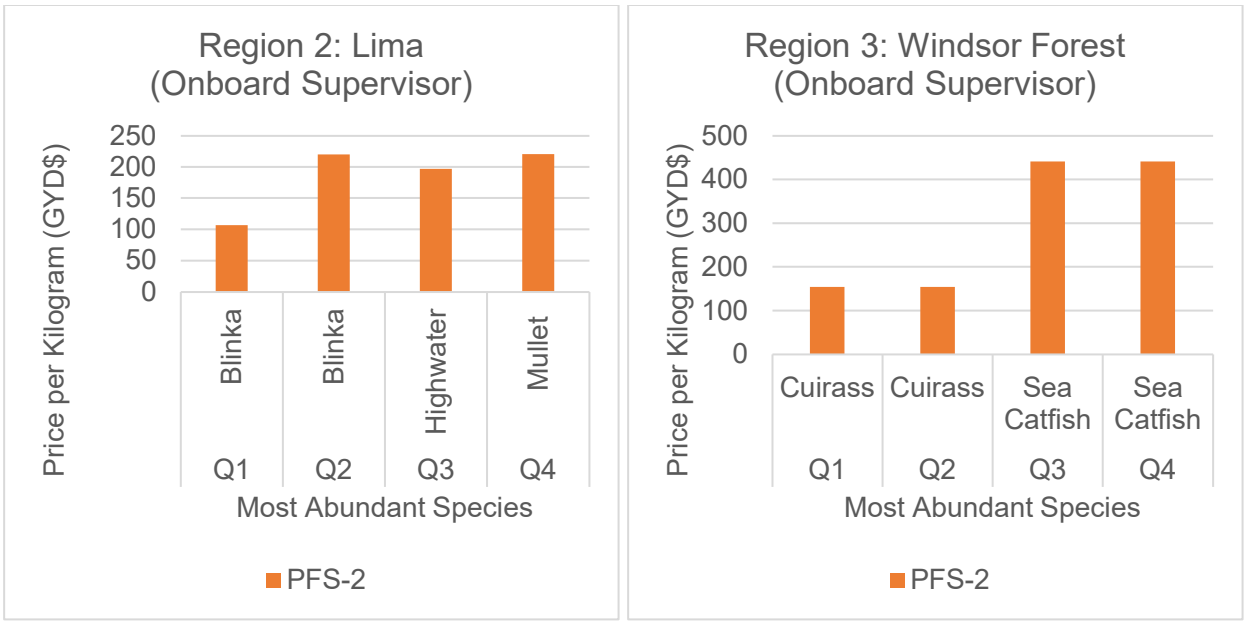


Figure 7-8 (A-B): Average Prices per Kilogram for the Most Abundant Species Caught at Lima (A) and Windsor Forest (B)

The onboard supervisor at the Bushlot landing site had no target species. Cuirass was the most abundant species caught during Q1 and Q2. Cuirass was a low value species although the price increased marginally in Q2 (Figure 7-9). In Q3 and Q4, paggie was the most abundant species. In Q3, a relatively high price per kilogram was achieved but this was followed by a major decrease, of 75 percent, in Q4.

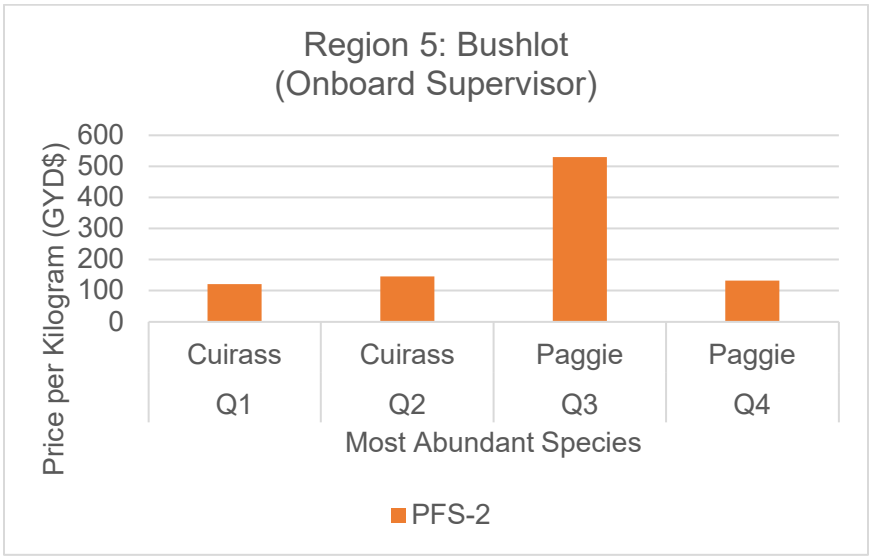


Figure 7-9: Average Prices per Kilogram for the Most Abundant Species Caught at Bushlot

7.5 By-Products

During PFS-2, regional and onboard supervisors also collected data on the prices for which by-products (swim bladders [commonly known as glue] and eggs were sold). Harvesting by-products to be sold separately is becoming more widespread among artisanal fisherfolks and is most prevalent at landing sites where snapper is the target species. By-products were always the most valuable components of the haul at the landing sites where they were sold separately.

The most expensive by-product was snapper glue (Figures 7-10 and 7-11). In some cases, snapper glue was worth about 50 times more than the value than the flesh of the fish. This exorbitant price may have incentivized fisherfolk to target snapper. Glue harvested from trout and eggs from several species are also typically more expensive than the most highly value species in the haul but are still less expensive, by a wide margin than snapper glue. The only exception to snapper glue being most valuable by-product was observed in the data collected by the Smith's Creek onboard supervisor in Q2 and Q3, when trout glue was most valuable. According to the onboard supervisor, this low price for snapper glue was due to the small size of the fish from which they were harvested.

The prices for snapper and trout glue reported by the regional and onboard supervisors from Smith's Creek were significantly lower than those obtained at the other landing sites at which glue was harvested. This is similar to the pricing trends for the flesh of fish the landing sites in Region 1 compared with landing sites in Regions 2 to 6. At Smith's Creek, glue was not harvested for separate sale in PFS-1 and thus, the market is nascent. However, prices may rise as the market develops particularly if local fisherfolk become aware of the prices obtained for these by-products at other landing sites and if most of the buyers are external to the local community.

The prices for which glue was sold varied throughout the year. In Regions 2 to 6, The highest price per kilogram for snapper glue was GYD $42,438.94 (USD $ 203.06) which was obtained at the Charity landing site while the minimum price was almost 30 percent lower at Hampton Court. Similarly, the highest price for trout glue was GYD $11,023.10 (USD $52.74) at Rosignol while the minimum price was 43 percent lower at Charity. The lowest prices for both snapper and trout glue were obtained at the Hampton Court landing site. The price variability is largely due to an informal system for grading glue which was developed by vendors. Under this system, larger swim bladder, which would have been harvested from larger fishes, are most expensive. Moreover, swim bladders that may have been cut or punctured during the de-gutting process have a lower value.

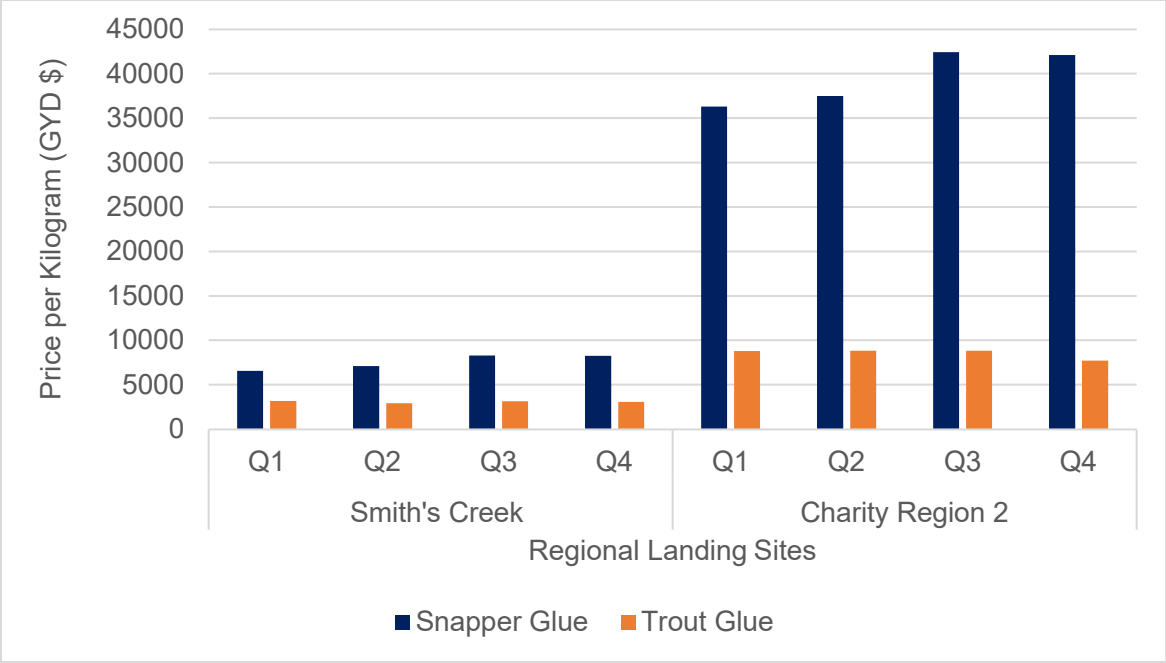


Figure 7-10: Comparison of Prices for Snapper Glue and Trout Glue at Landing Sites with Regional Supervisors

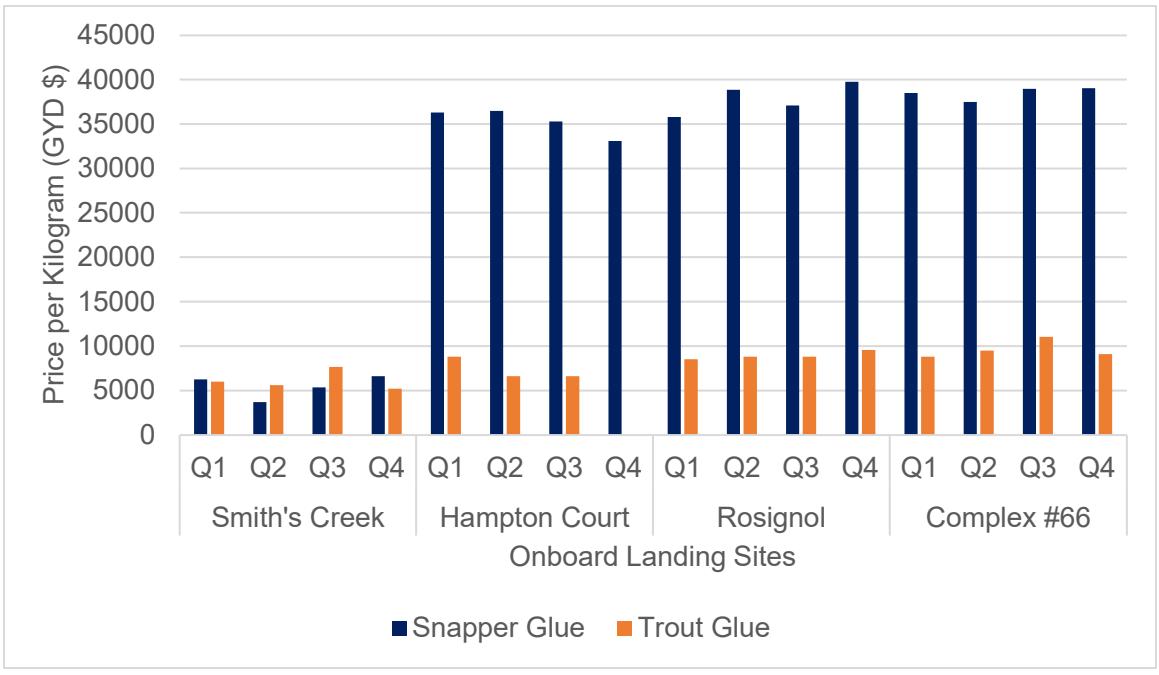


Figure 7-11: Comparison of Prices for Snapper Glue and Trout Glue at Landing Sites with Onboard Supervisors

In addition, several other by-products, eggs and glue were harvested from other species. These by-products were also reported from the five landing sites at which glue was collected from snapper and trout. By-products are not harvested at the other landing sites surveyed because the vendors to whom hauls are sold only purchase fishes that are intact. For example, at the landing sites where bangamary

seines are used, trout is among the top three most abundant species caught but glue was not harvested for separate sale. Harvesting high-value trout glue for separate sale may increase the value of hauls for these fisherfolk, particularly during periods of low productivity. However, vendors do not purchase gutted fishes and this is likely an attempt by vendors likely harvest these by-products to further increase their profit margins.

All of the other by-products harvested also exceeded the price of the most expensive species at the landing sites where they were harvested. These include:

- In Q1:
  - **Smith's Creek (Regional Supervisor):** Glue was also harvested from gillbacker and bangamary. Eggs were harvested from gillbacker, cuirass and sea catfish.
  - **Smith's Creek (Onboard Supervisor):** Glue was also harvested from gillbacker and bangamary. Eggs were harvested from gillbacker, cuirass, sea catfish and quirman.
  - **Waramuri/Haimokabra:** Glue was harvested from cuirass and gillbacker. Like the other products sold by this onboard supervisor, the glue was dried and salted for preservation. Eggs cannot be preserved by salting and therefore, were not harvested for sale.
  - **Charity:** Glue was also harvested from gillbacker and cuirass.
  - **Hampton Court:** Glue was also harvested from gillbacker.

- In Q2:
  - **Smith's Creek (Regional Supervisor):** Glue was also harvested from gillbacker and bangamary. Eggs were harvested from gillbacker and cuirass.
  - **Smith's Creek (Onboard Supervisor):** Glue was also harvested from gillbacker, sea catfish and bangamary. Eggs were harvested from sea catfish, cuirass, gillbacker, quirman and Thomas.
  - **Waramuri/Haimokabra:** Glue was harvested from cuirass and gillbacker.
  - **Hampton Court:** Glue was also harvested from gillbacker.

- In Q3:
  - **Smith's Creek (Regional Supervisor):** Glue was also harvested from gillbacker and eggs cuirass.
  - **Smith's Creek (Onboard Supervisor):** Glue was also harvested from gillbacker, bangamary, and cuirass. Eggs were harvested from cuirass and sea catfish.
  - **Waramuri/Haimokabra:** Glue was harvested from cuirass, gillbacker and sea catfish. Sea catfish was the target most abundant species caught at this landing site and this was the only quarter in which glue was harvested from this fish.
  - **Charity:** Glue was also harvested from gillbacker and cuirass.
  - **Hampton Court:** Glue was also harvested from gillbacker.

- In Q4:
  - **Smith's Creek (Regional Supervisor):** Glue was also harvested from gillbacker and cuirass. Eggs were harvested from cuirass.
  - **Smith's Creek (Onboard Supervisor):** Glue was also harvested from gillbacker, bangamary and bright eye. Eggs were harvested from sea catfish, cuirass and quirman
  - **Waramuri/Haimokabra:** Glue was harvested from cuirass, gillbacker and sea catfish.
  - **Charity:** Glue was also harvested from gillbacker and cuirass.
  - **Hampton Court:** Glue was also harvested from bangamary.

8.0 FISHING GROUNDS

Onboard supervisors took GPS waypoints of their fishing points and routes traveling to these fishing points during PFS-1 and PFS-2. In PFS-1, these GPS waypoints were used to create maps that established fishing ranges and fishing points (where seines were soaked) for each onboard supervisor. These maps were used as a baseline against which any changes in fishing grounds used by the onboard supervisors would have been assessed in PFS-2.

Generally, the total distance traveled and the distance offshore at which activities occurred were linked to the supervisor's fishing practices, including the gear type and vessel type used. This trend was established in PFS-1 and remained relevant throughout the PFS-2 study period. However, the majority of onboard supervisors (83 percent) explored new fishing grounds during the study period. Seeking out alternative fishing grounds was directly in response to lower haul volumes than targeted, altered environmental conditions of preferred fishing areas and regulatory factors. The onboard supervisors whose fishing ranges were expanded during PFS-2 included:

- **Smith's Creek:** New fishing grounds were explored in Q2 and the range was even farther extended in Q3. In Q3, the farthest fishing point was located approximately 50.52 kilometres from the landing site (Figure 8-1). The expanded range may have been in search of more productive fishing grounds as Q3 was the least productive quarter.

- **Waramuri/Haimokabra:** New fishing grounds were explored in Q2 (the least productive period) when a single fishing point was located outside the range mapped in PFS-1. The maximum distance travelled from the landing site was 73.88 kilometres (Figure 8-2). Although the onboard supervisor had travelled far away from the landing site, the fishing areas were relatively close to shore. Some fishing points appear to be onshore but this was attributed to the rapid massive erosion occurring along Region 1.

- **Hampton Court:** Fishing grounds mapped in PFS-1 were exceeded, frequently in a significant manner, in all quarters in PFS-2 (Region 8-3). In Q1, Q2 and Q4, the onboard supervisor travelled more than 100 kilometers to the northwest to fish in areas reported to be productive such as Iron Punt (located along the Region 1 coastline). In Q3, when the supervisor changed the type of fishing gear and vessel used, new fishing grounds south of the landing site were explored.

- **Lima:** New fishing grounds along the coastline of the Essequibo Coast were explored in Q1 when the supervisor increased the use of drift seines on fishing trips (Figure 8-4). All fishing points located in proximity to the landing site were associated with the use of Chinese seines and pin seines. The contracted fishing range was most common in Q3 and Q4 because of challenges with accessibility to the landing site during low-tides.

- **La Grange:** New fishing grounds were explored in Q2 and Q4 (Figure 8-6). Unlike other fishing practices, these were the most productive quarters for this supervisor and these trips may have been successful attempts at exploratory fishing in new grounds. During Q2, the supervisor travelled the farthest away from the landing site at a distance of 57 kilometres.

- **Riverview**: New fishing grounds were explored in Q3 and Q4 (Figure 8-7). In Q3, the onboard supervisor fished closer to shore than any previous periods (including PFS-1) and this was due to rough seas making trips farther offshore challenging. In Q4, the least productive period, the supervisor travelled the farthest away from the landing site with a distance of 20.22 kilometres.

- **Ogle:** Fishing occurred within the fishing range established in PFS-1 but new fishing grounds within this range were explored in an attempt to identify areas that may be more productive for shrimping (Figure 8-8). In these instances, the onboard supervisor set Chinese seines in "pens" that were either abandoned or created by fisherfolk with whom they have agreements for shared use.

- **Bushlot:** New fishing grounds were explored during Q2 (Figure 8-9). Although productivity was higher in Q2 than in PFS-1 reference period, the most abundant species caught was cuirass. The exploration of new fishing grounds may have been an attempt to capture higher-value species. The farthest the onboard supervisor travelled away was 8 kilometres.

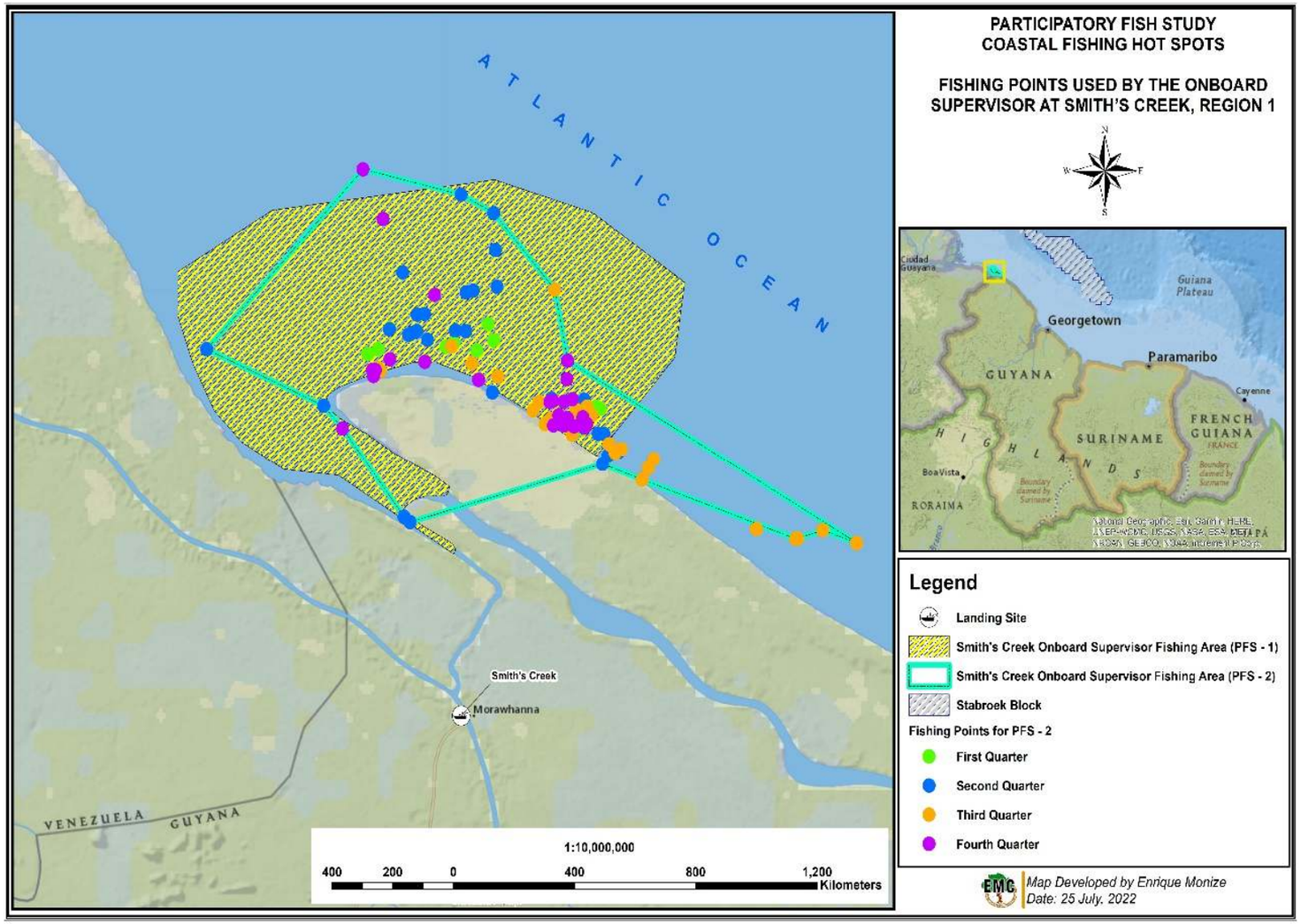
- **Albion:** New fishing grounds were sought in Q2 and Q4 (Figure 8-11). As observed in the fishing practices of the La Grange onboard supervisor, Q4 was the period with the second highest productivity and was also when the onboard supervisor ventured the farthest from the landing site with a distance of 33.63 kilometres.

- **Complex #66**: New fishing grounds were explored in Q4 when the onboard supervisor ventured almost 175 kilometres away from the landing site (Figure 8-12). This was in relatively deep waters and may have been exploratory fishing because of the low productivity which was experienced during this quarter.

The following two onboard supervisors (17 percent) remained within or contracted the fishing ranges used in PFS-1:

- **Windsor Forest:** Although the onboard supervisor utilized two different types of fishing gear, only one fishing point was used. When Chinese seines were used, the supervisor travelled to either of two "pens" located approximately 10 kilometres offshore (Figure 8-5). When the use of Chinese seines was discontinued because of low hauls, the supervisor used the same fishing point for soaking the Cadell lines. This fishing point was also used by the onboard supervisor throughout the PFS-1 study, in Q1 and Q2 of 2021. The supervisor explained that this point was used for fishing trips for more than 20 years and will not be changed in the future.

- **Rosignol:** Public health restrictions associated with the COVID-19 pandemic prevented the onboard supervisor from Rosignol (Region 5) and Complex #66 (Region 6) from fishing along the Surinamese coastline in Q1. However, these restrictions were lifted and the onboard supervisor from Complex #66 resumed fishing in these areas. Notwithstanding, the onboard supervisor from Rosignol did not conduct any fishing trips along the Surinamese coast resulting in a significant contraction of the fishing grounds used in PFS-1 (Figure 8-10).



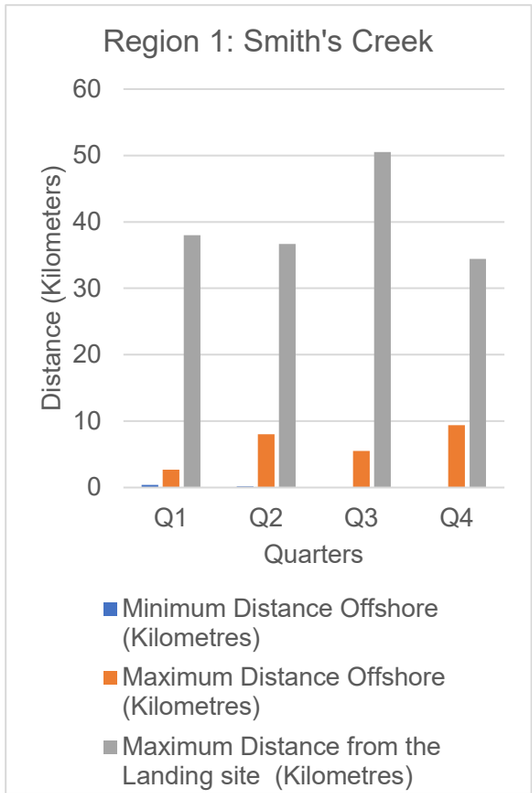
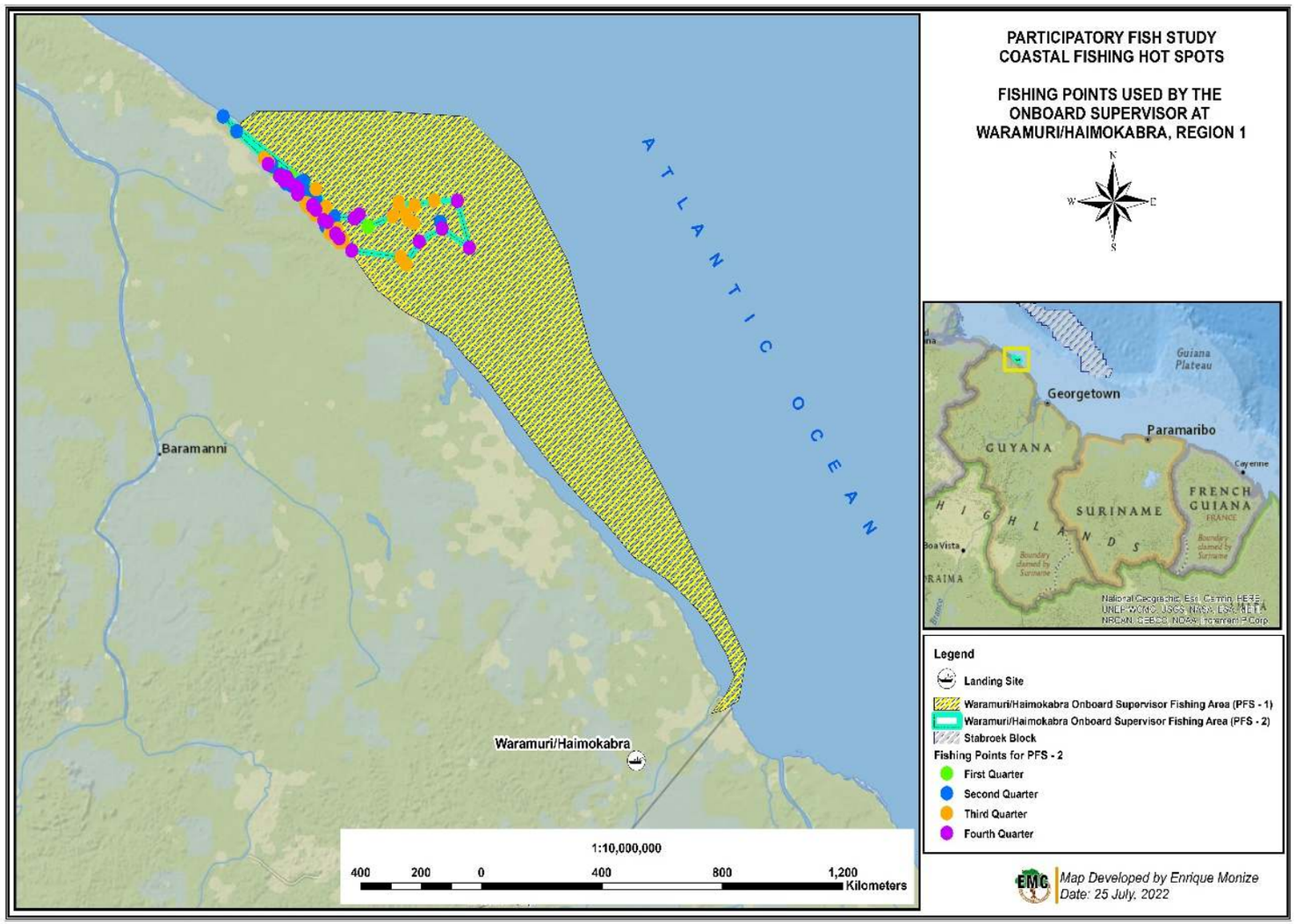


Figure 8-1: Fishing Grounds Used by the Smith's Creek Onboard Supervisor and Distances Travelled Each Quarter in PFS-2 (in Bar Graph)



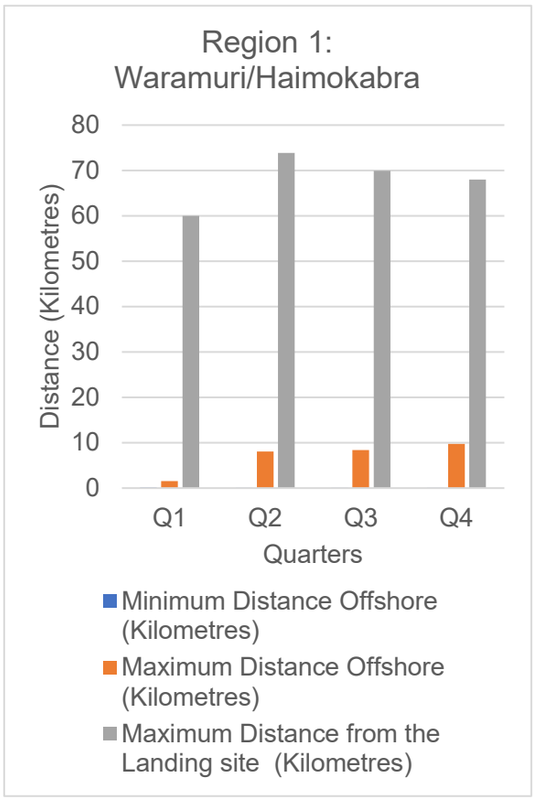
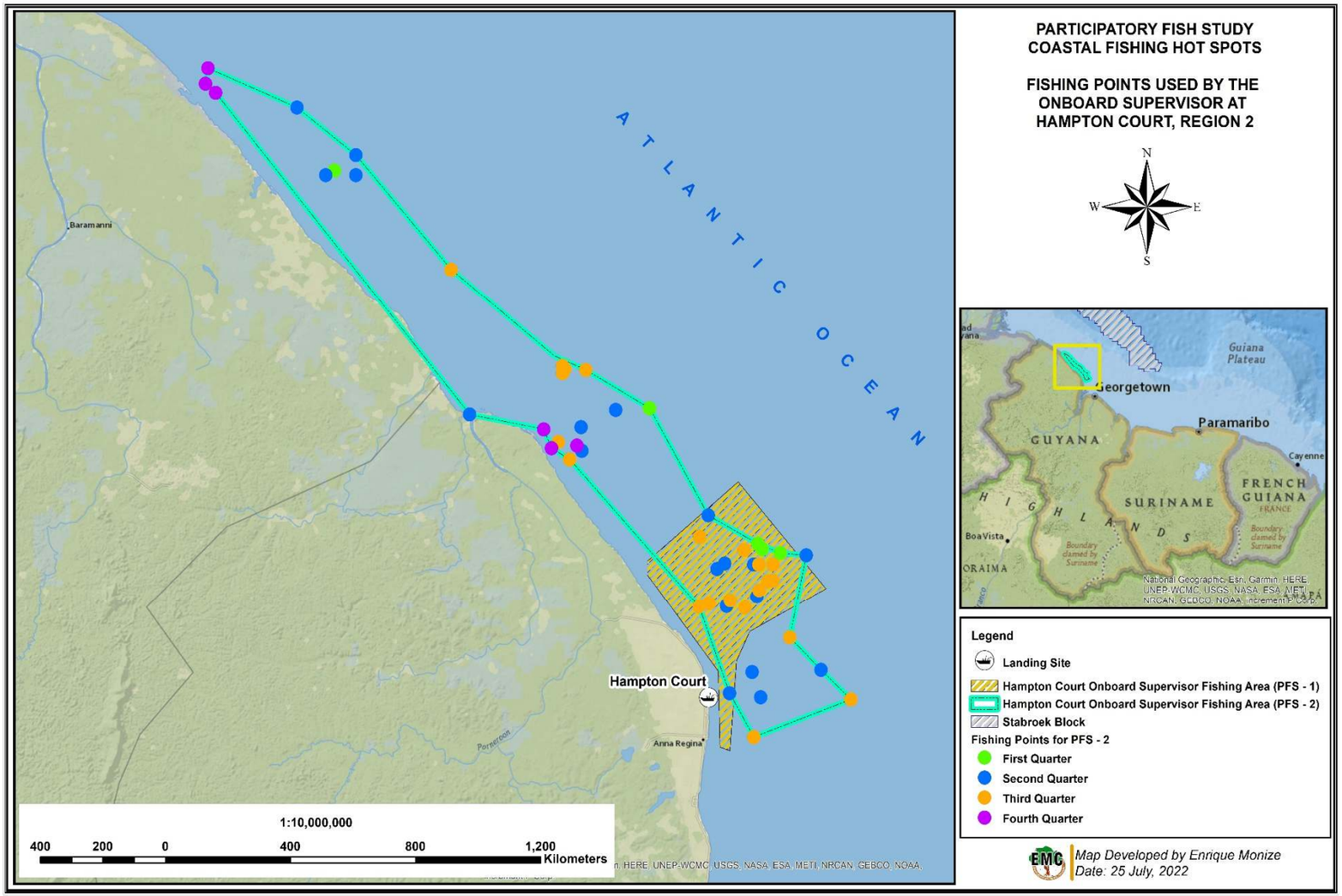


Figure 8-2: Fishing Grounds Used by the Waramuri/Haimokabra Onboard Supervisor and Distances Travelled Each Quarter in PFS-2 (in Bar Graph)



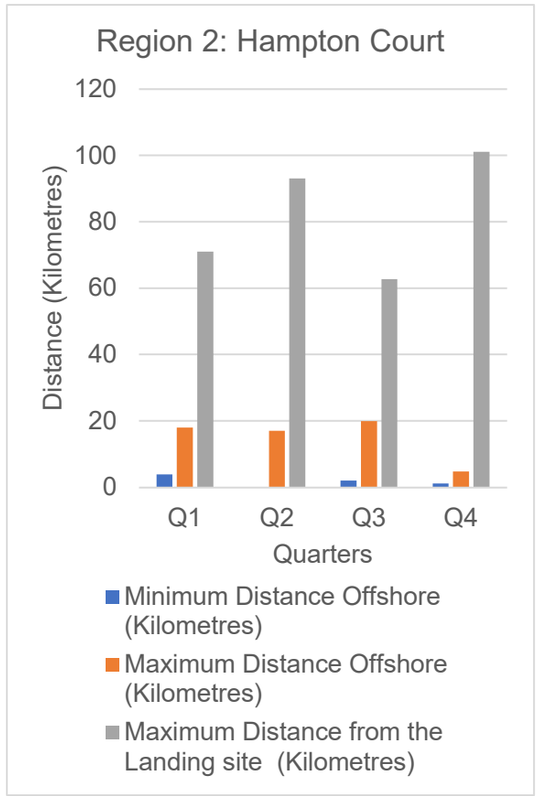
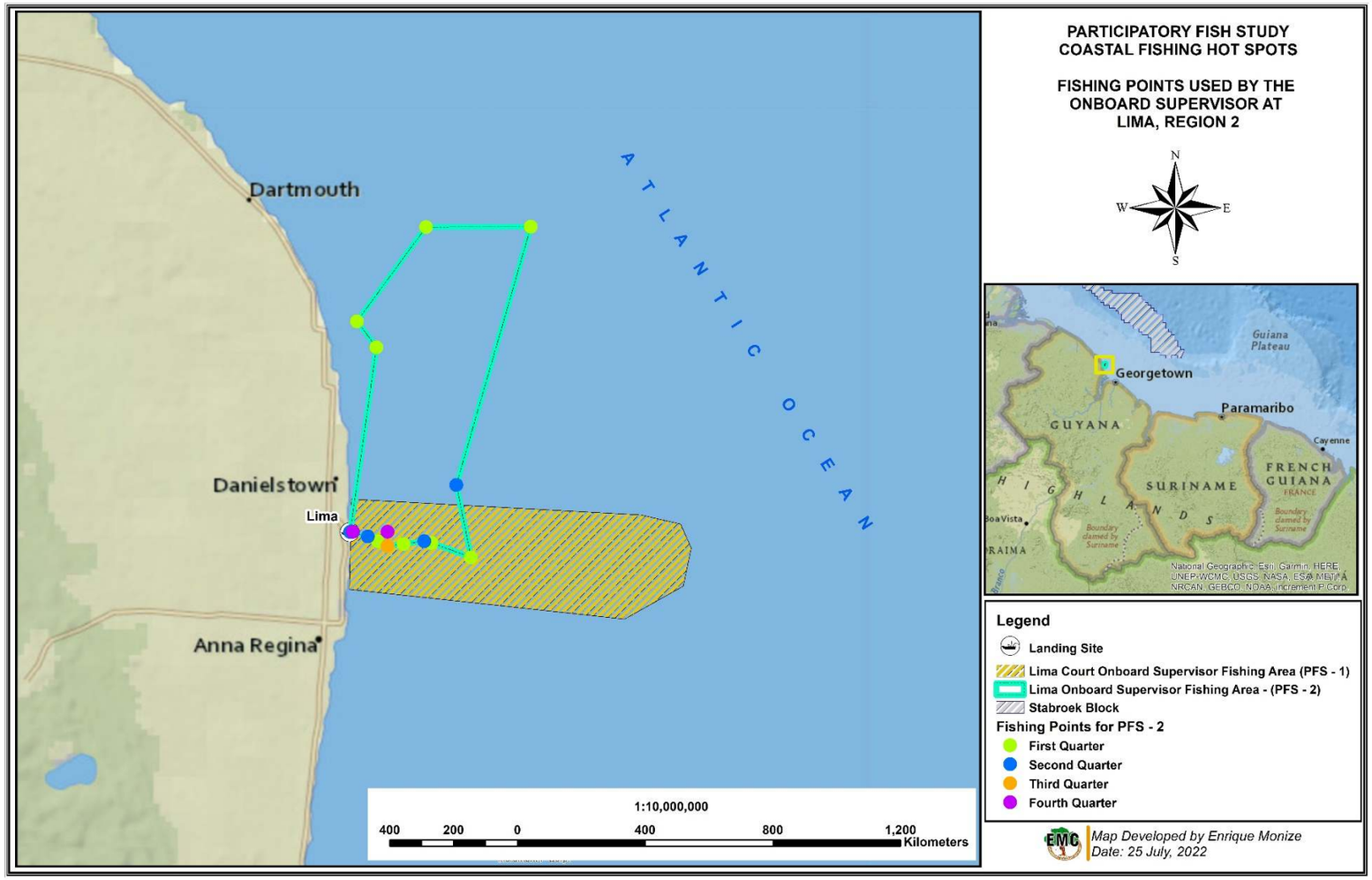


Figure 8-3: Fishing Grounds Used by the Hampton Court Onboard Supervisor and Distances Travelled Each Quarter in PFS-2 (in Bar Graph)



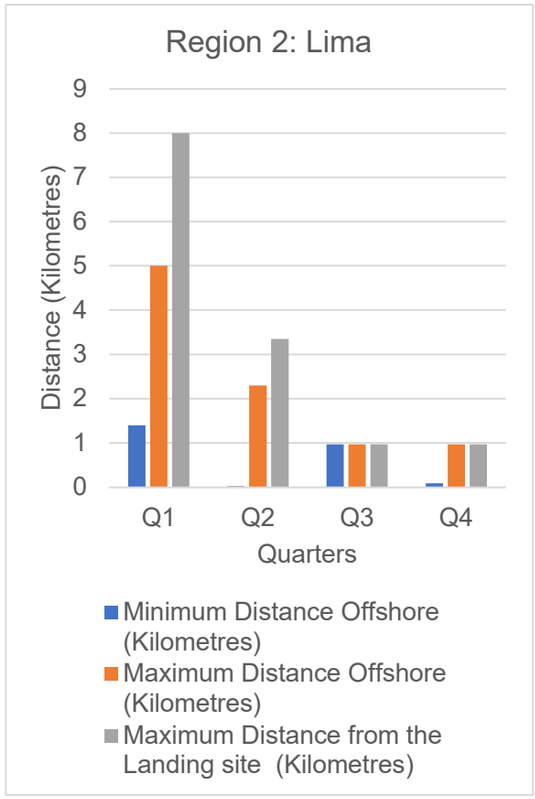
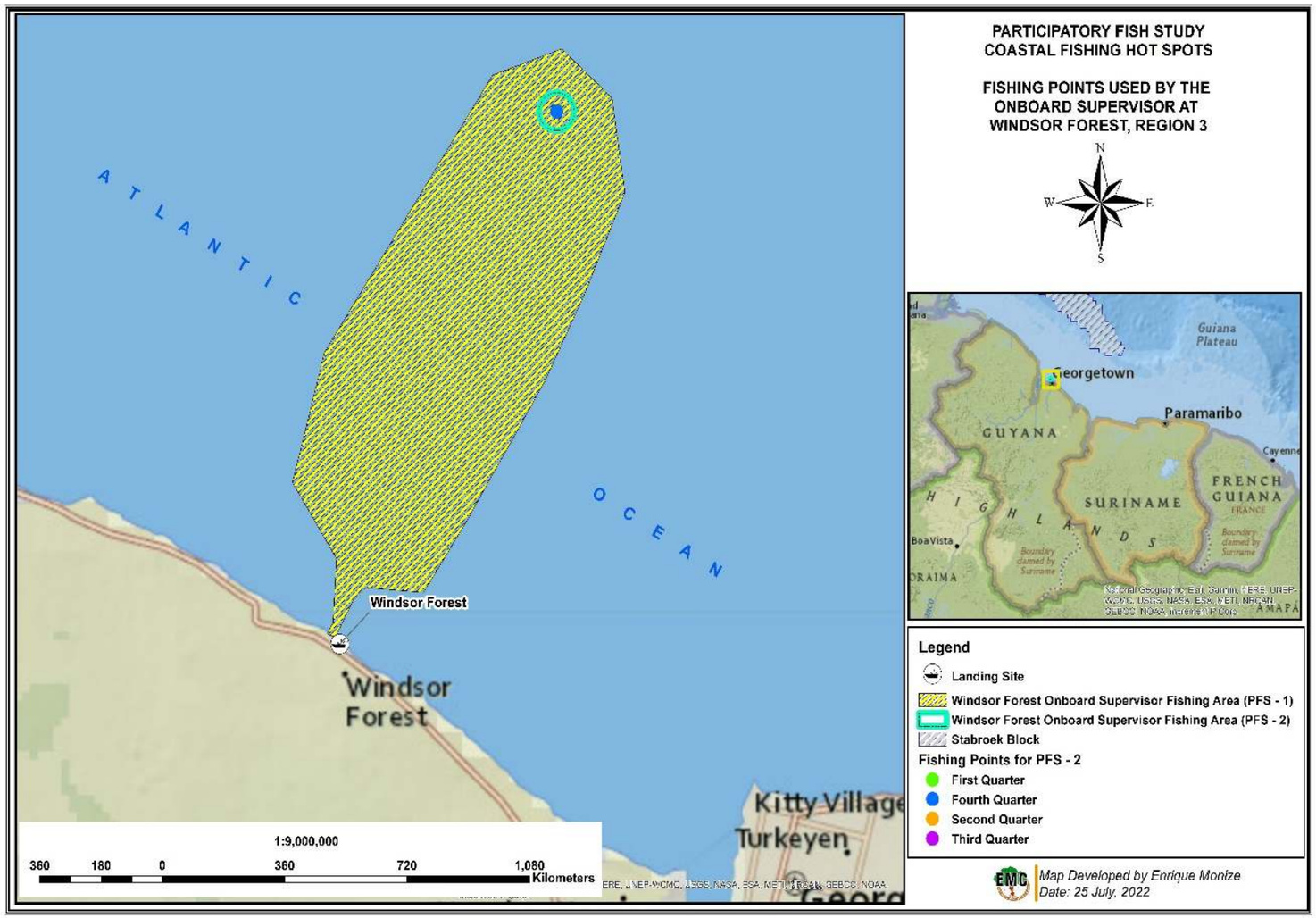


Figure54-4: Fishing Grounds Used by the Lima Onboard Supervisor and Distances Travelled Each Quarter in PFS-2 (in Bar Graph)



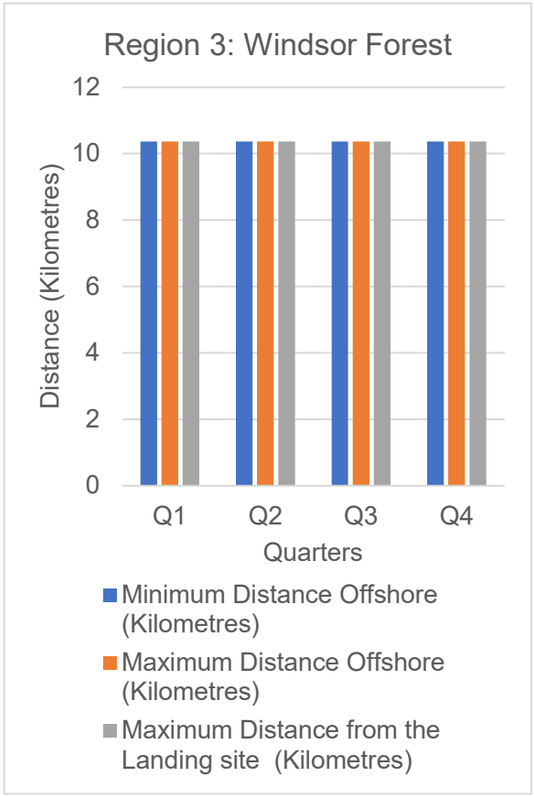
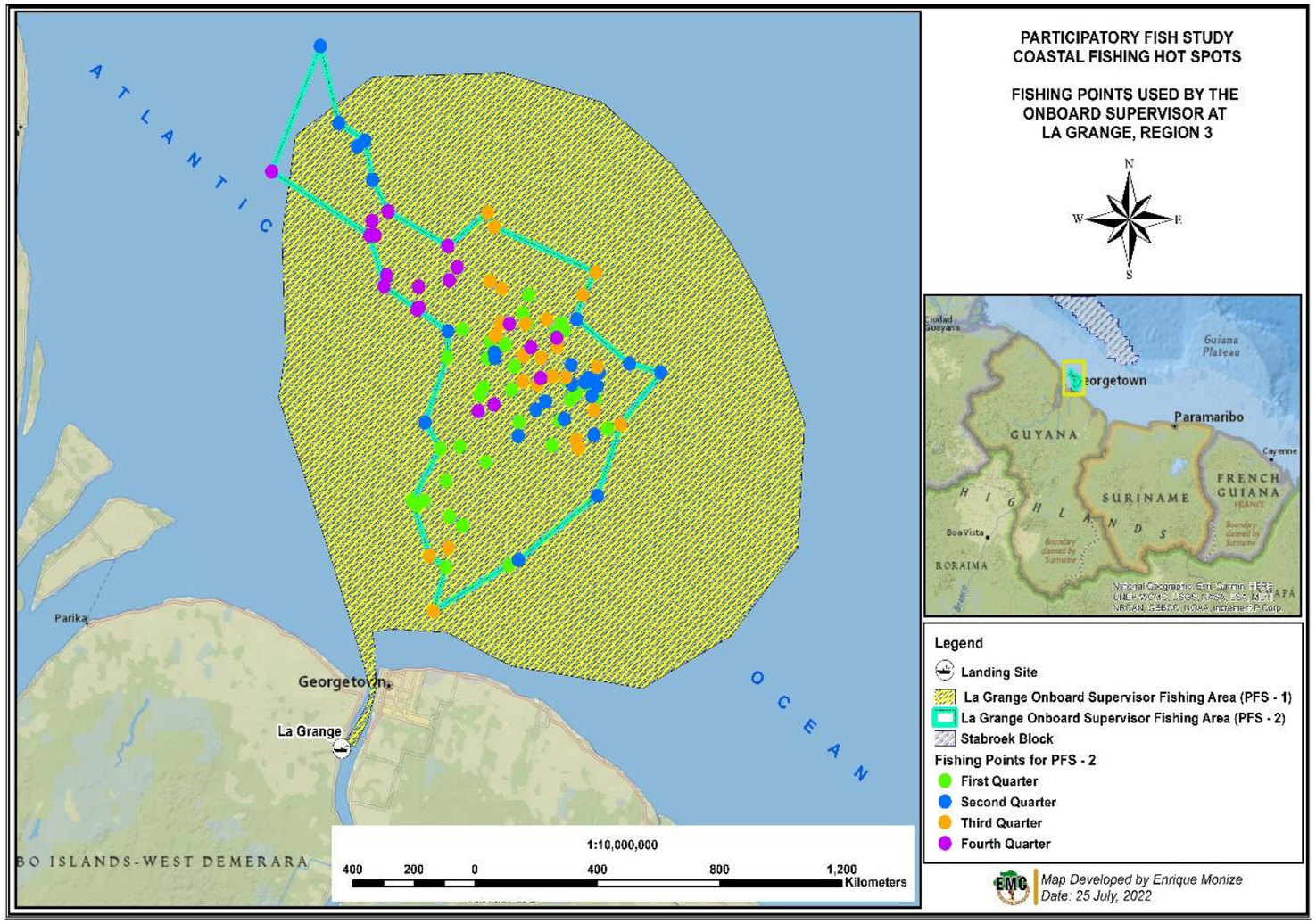


Figure 8-5: Fishing Grounds Used by the Windsor Forest Onboard Supervisor and Distances Travelled Each Quarter in PFS-2 (in Bar Graph)



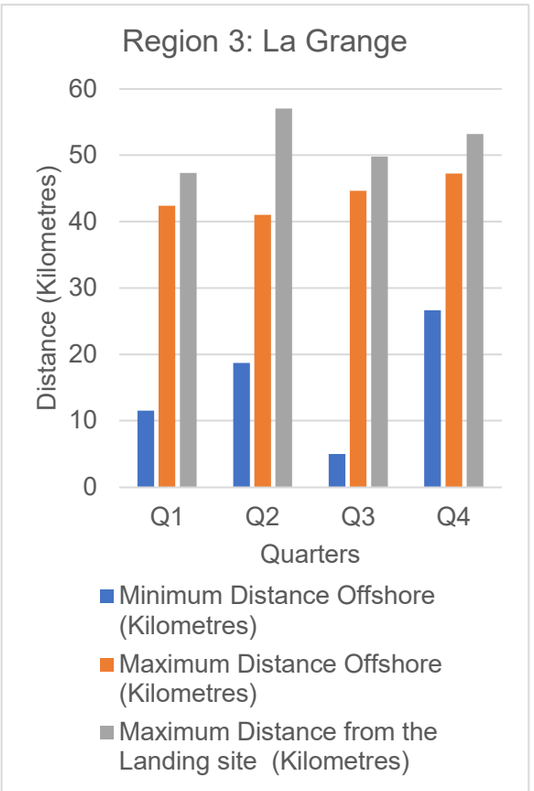
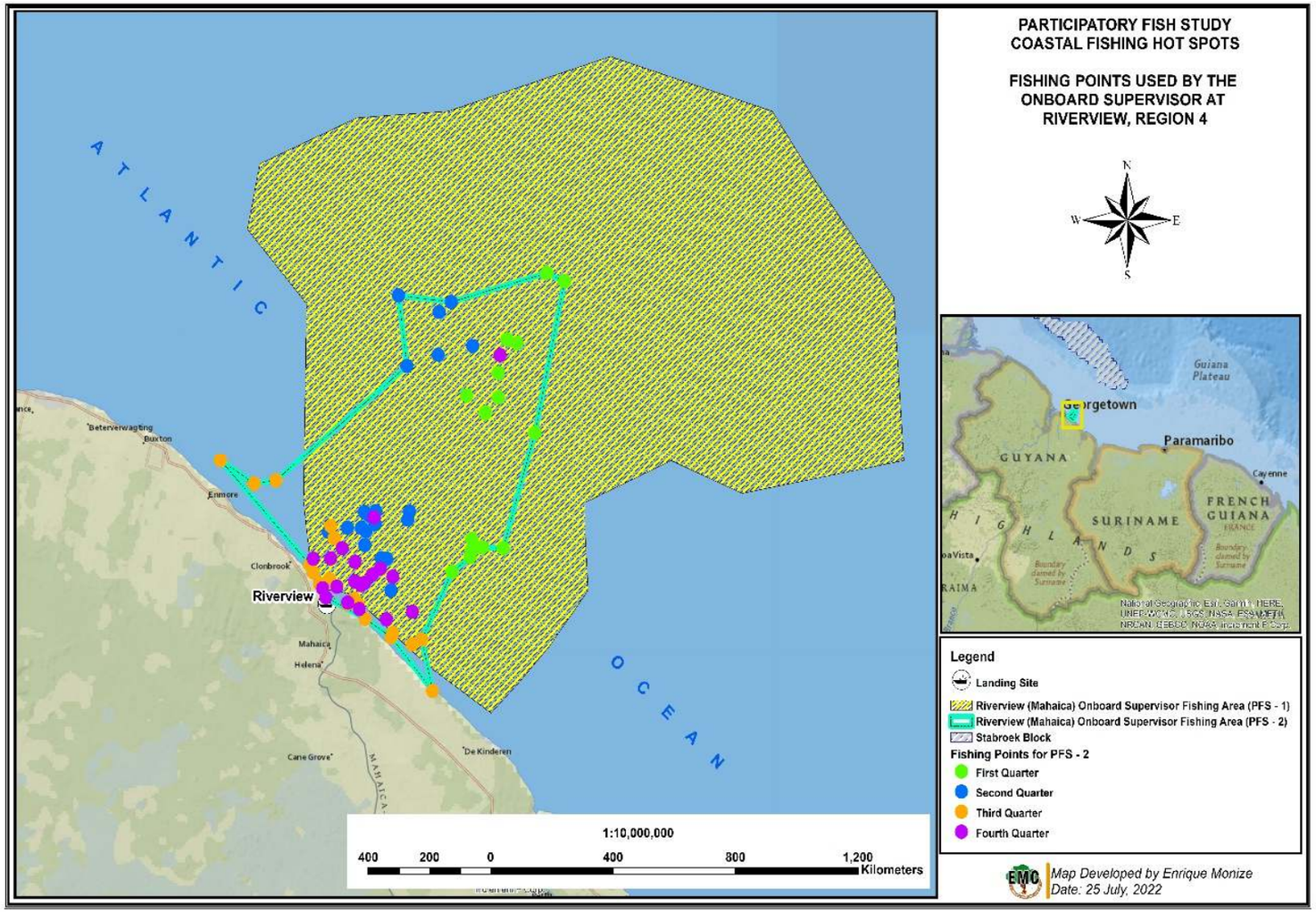


Figure 8-6: Fishing Grounds Used by the Lima Onboard Supervisor and Distances Travelled Each Quarter in PFS-2 (in Bar Graph)



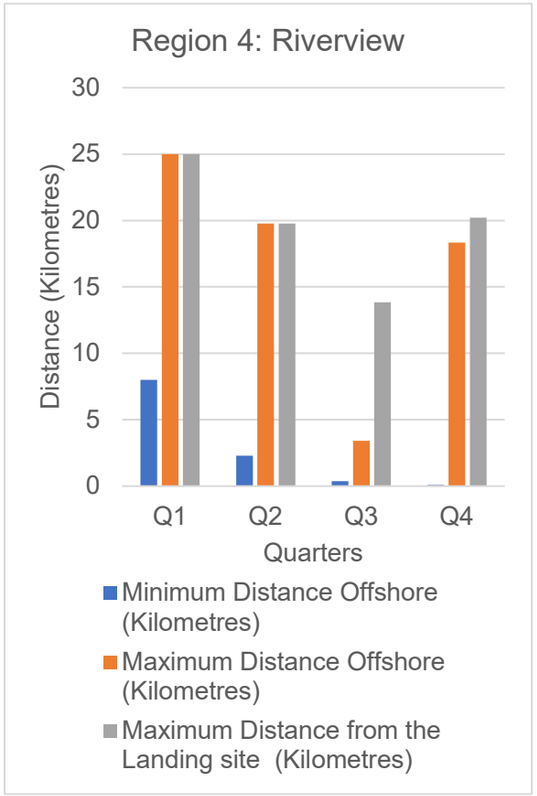
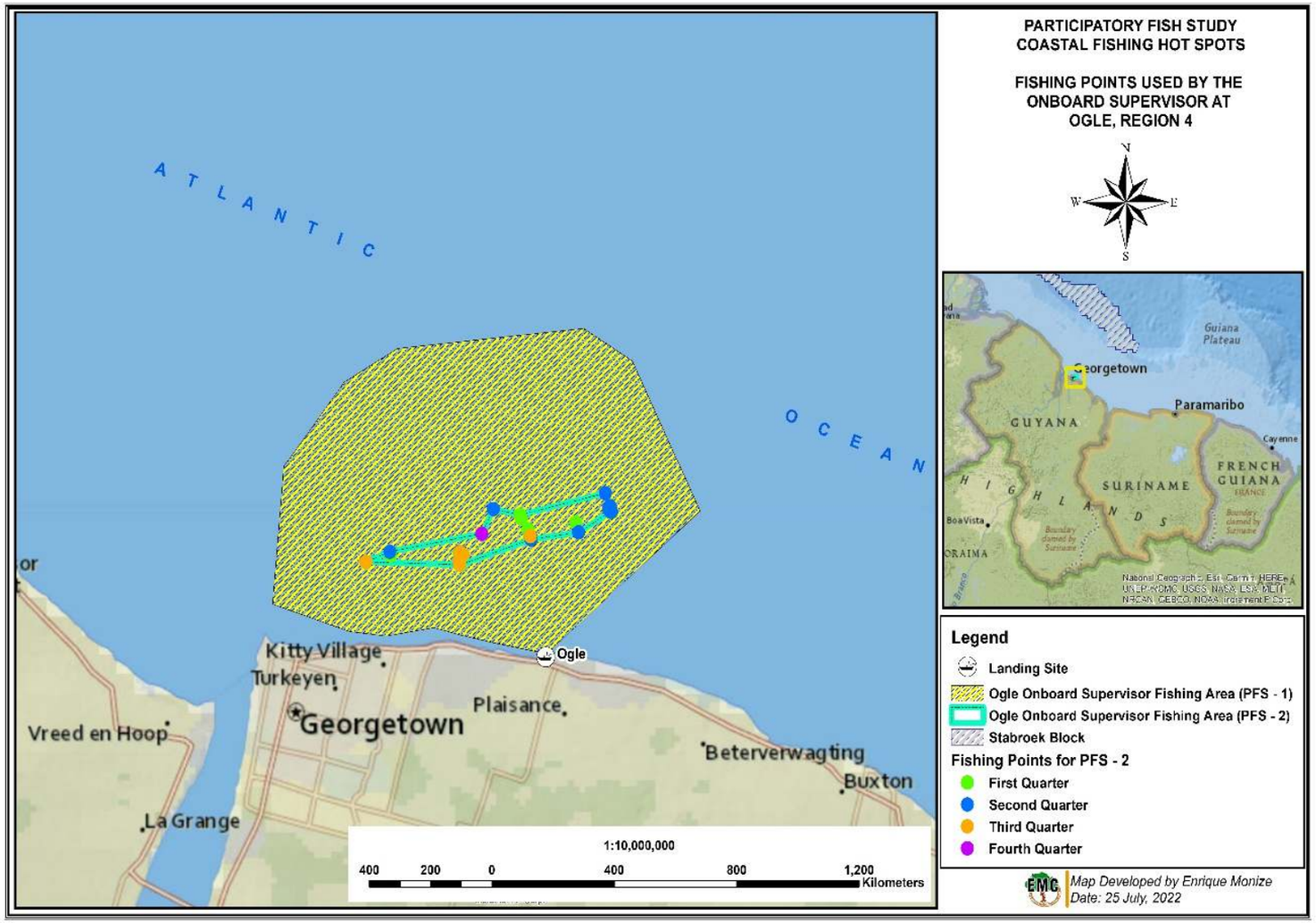


Figure 8-7: Fishing Grounds Used by the Riverview Onboard Supervisor and Distances Travelled Each Quarter in PFS-2 (in Bar Graph)



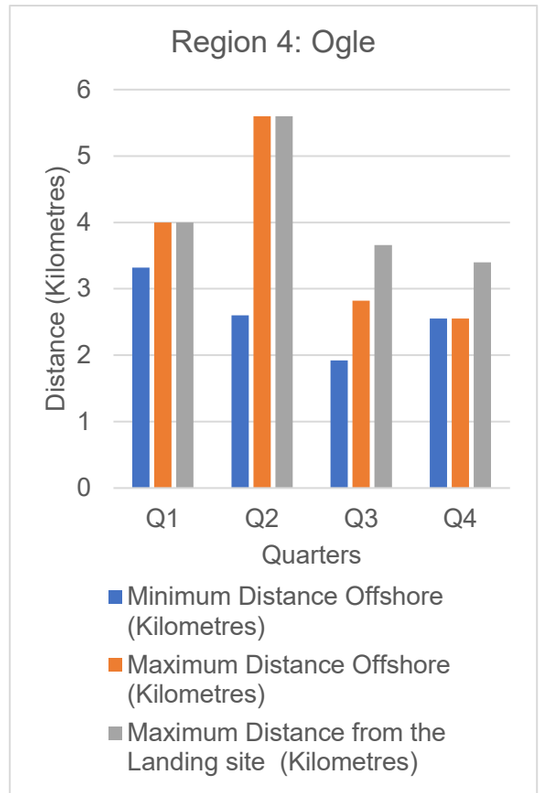
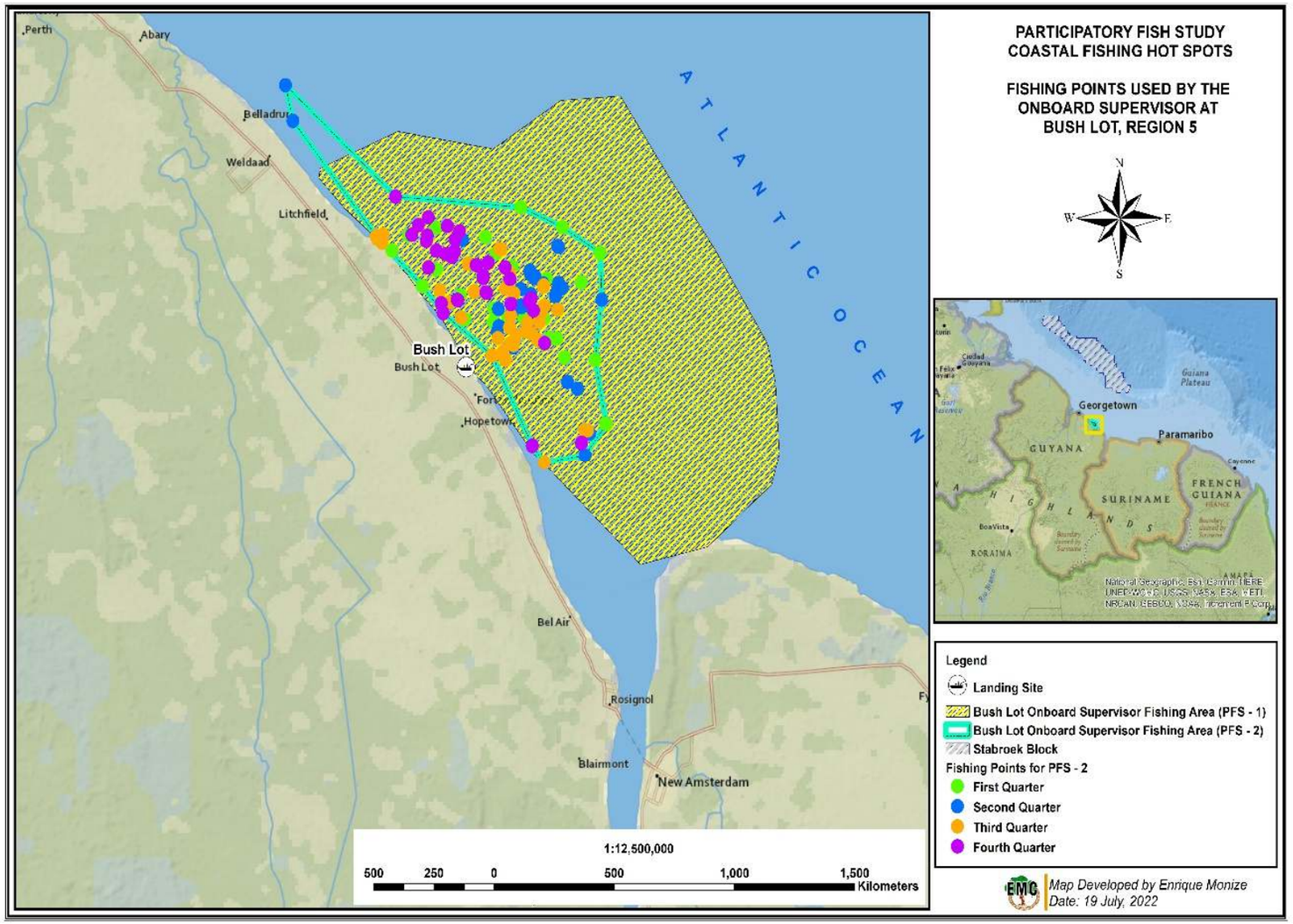


Figure 8-8: Fishing Grounds Used by the Ogle Onboard Supervisor and Distances Travelled Each Quarter in PFS-2 (in Bar Graph)



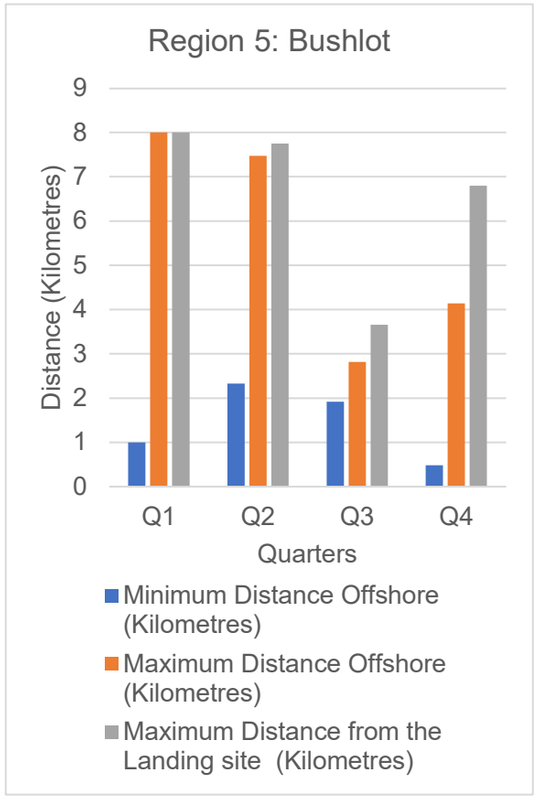
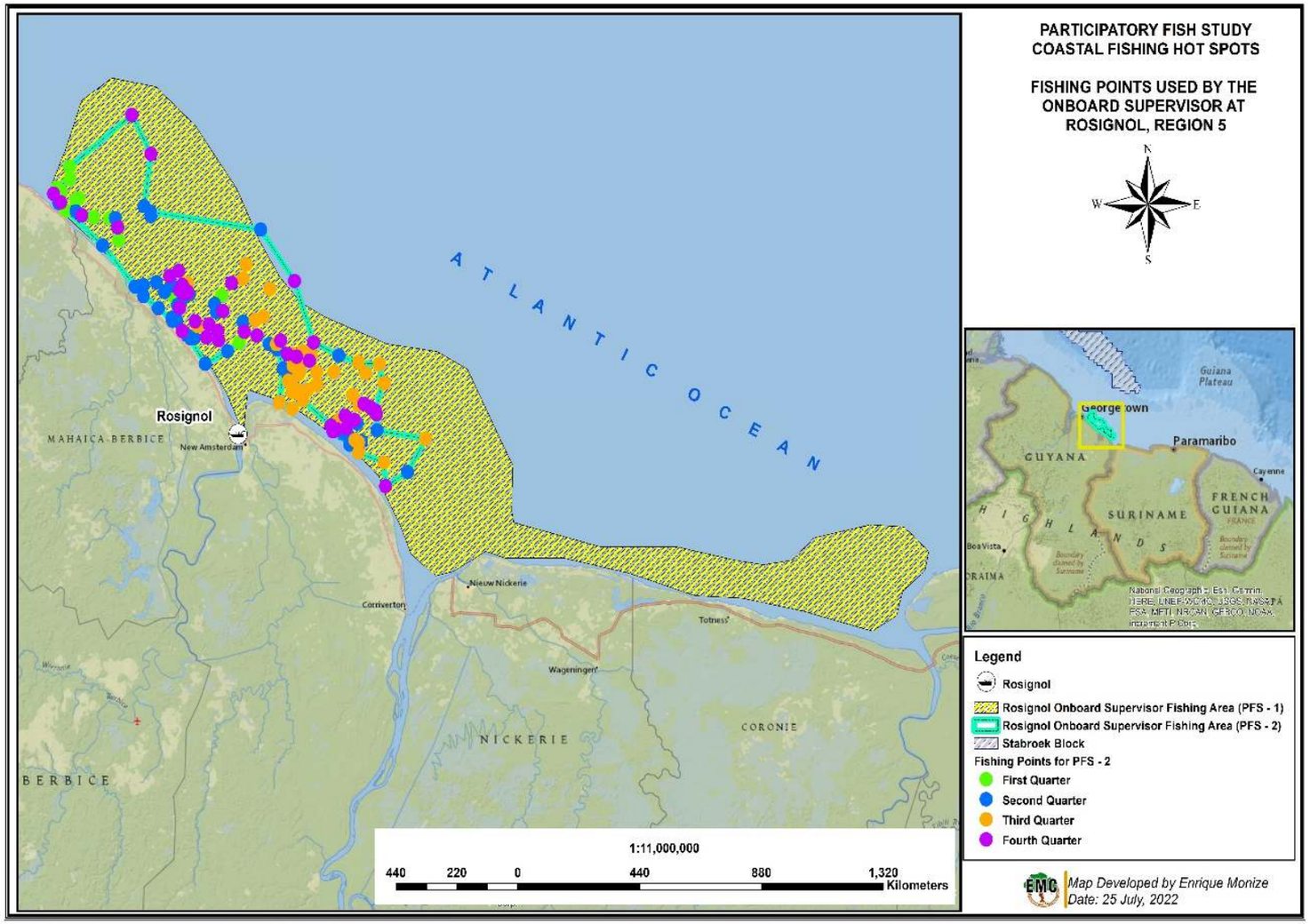


Figure 8-9: Fishing Grounds Used by the Bushlot Onboard Supervisor and Distances Travelled Each Quarter in PFS-2 (in Bar Graph)



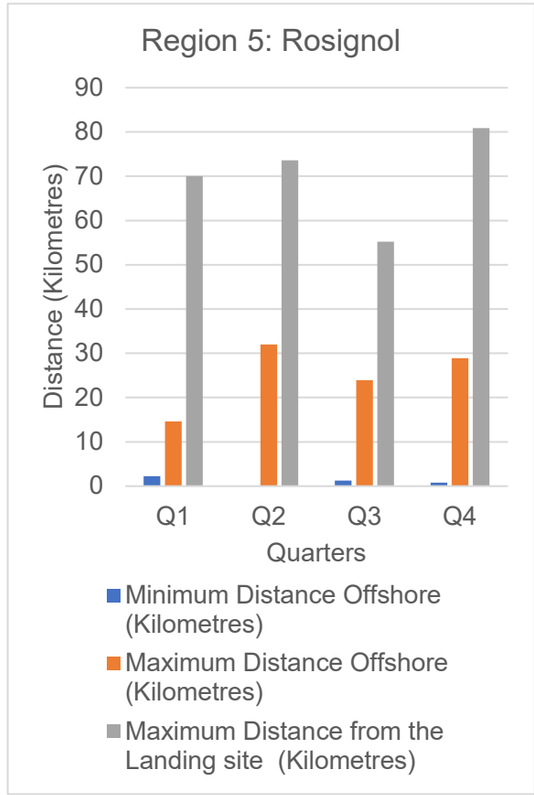
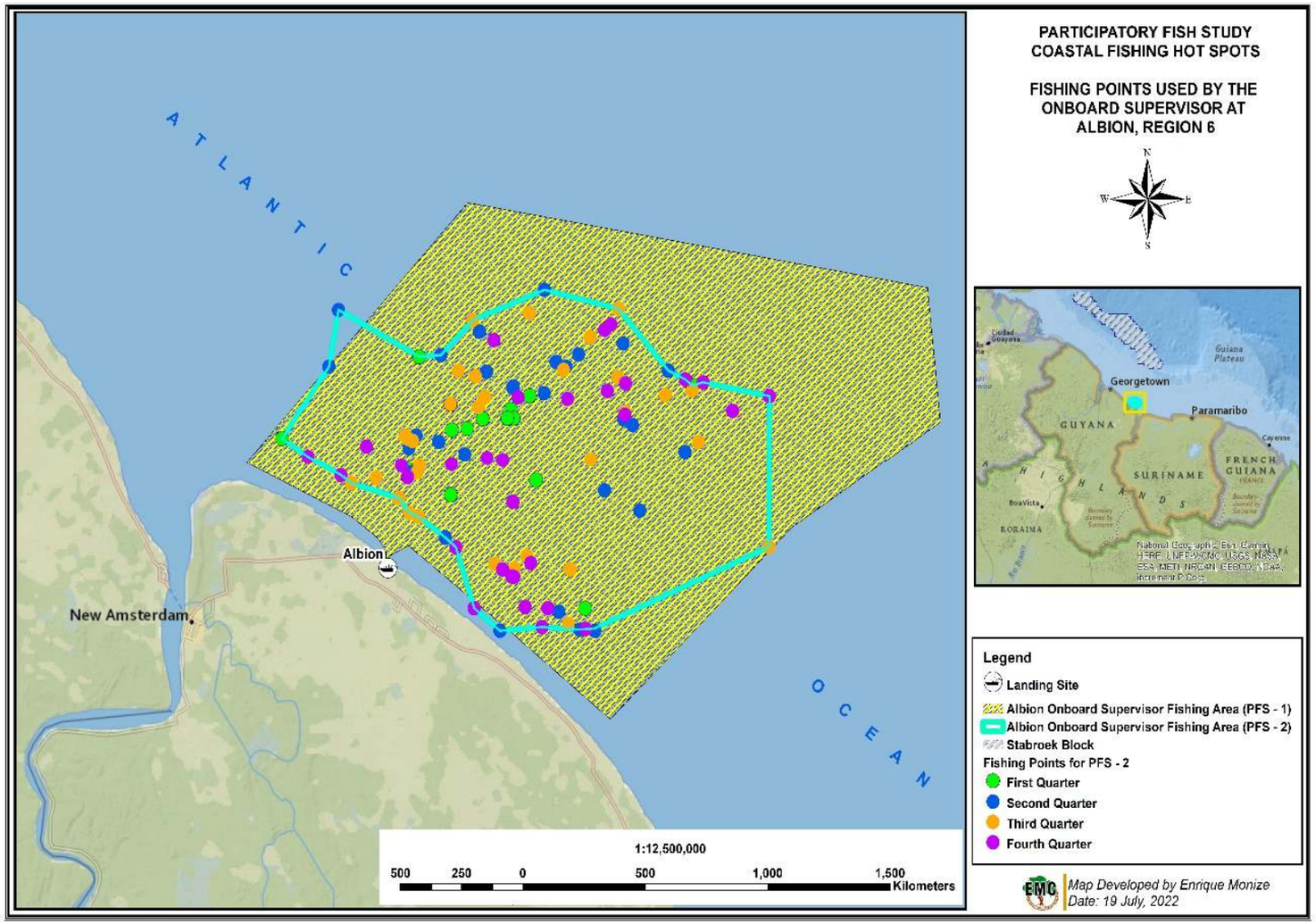


Figure 8-10: Fishing Grounds Used by the Rosignol Onboard Supervisor and Distances Travelled Each Quarter in PFS-2 (in Bar Graph)



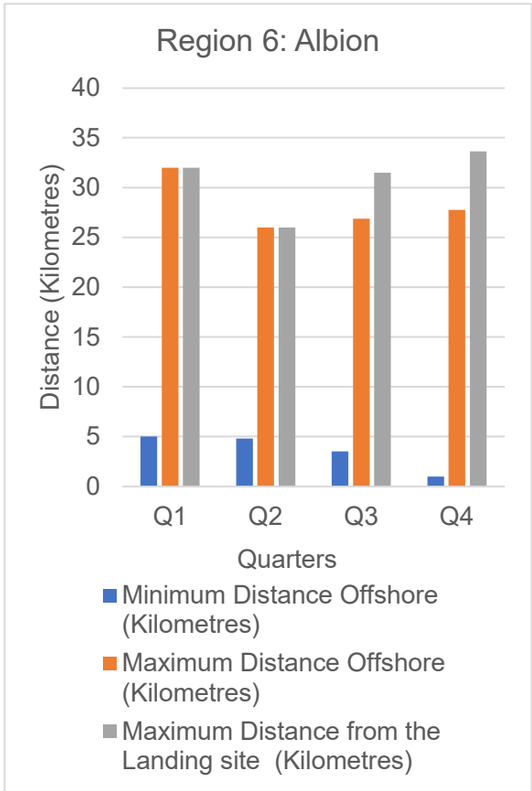
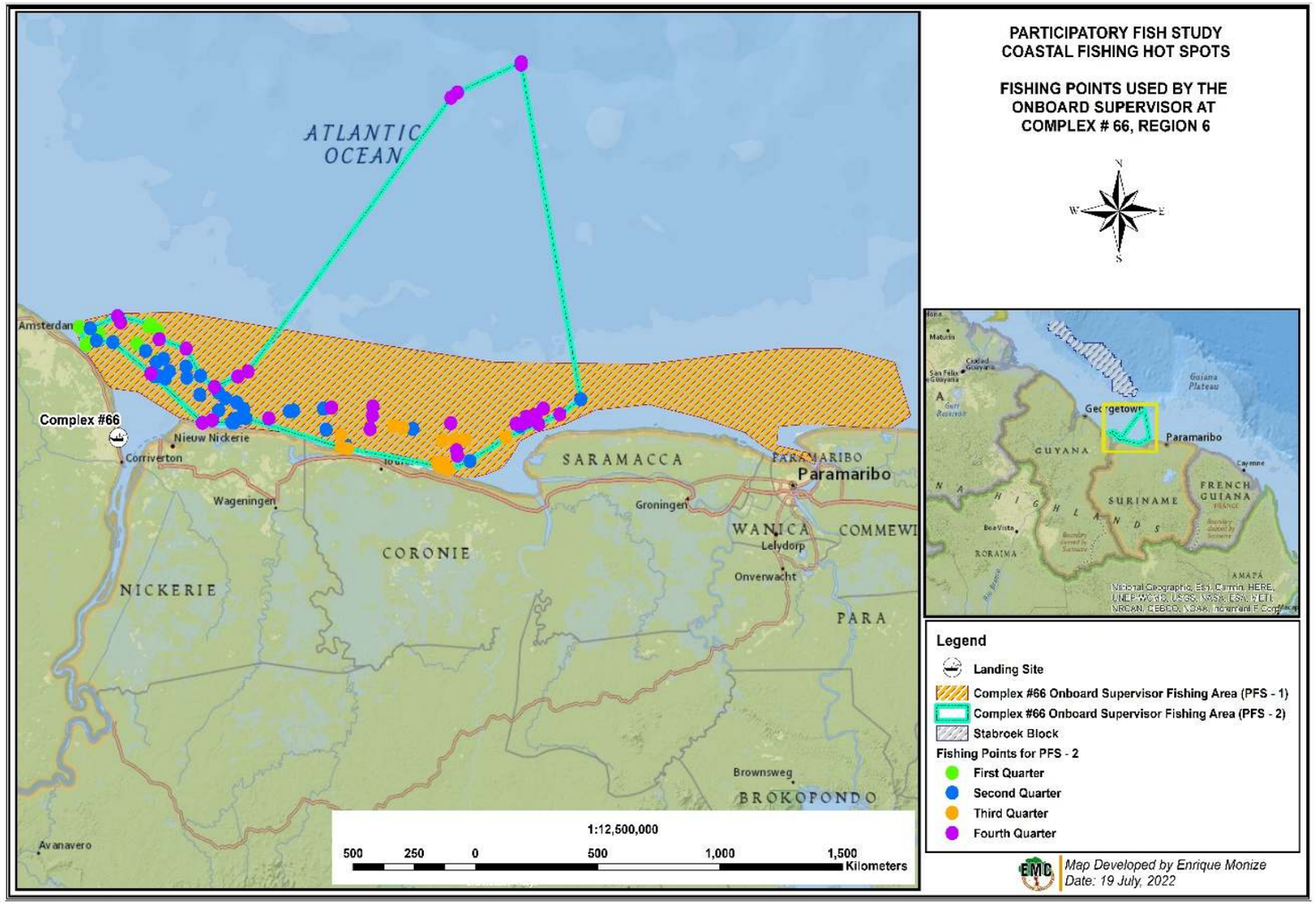


Figure 8-11: Fishing Grounds Used by the Albion Onboard Supervisor and Distances Travelled Each Quarter in PFS-2 (in Bar Graph)



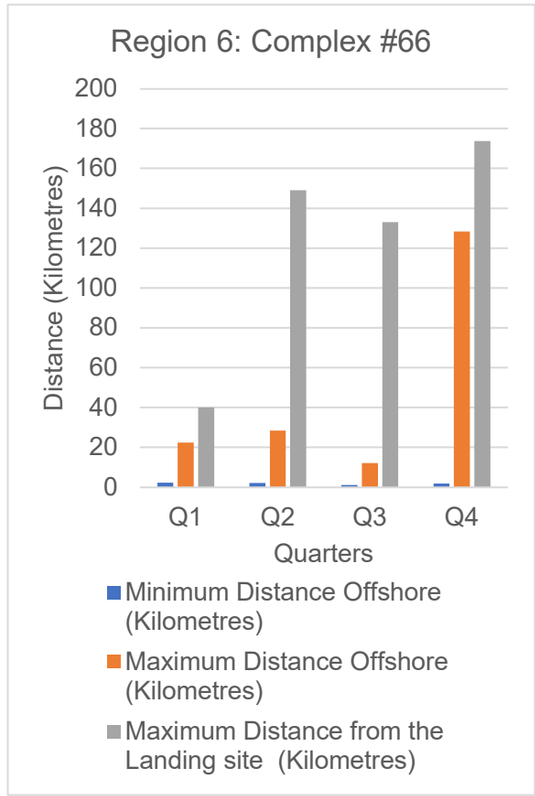


Figure 8-12: Fishing Grounds Used by the Complex #66 Onboard Supervisor and Distances Travelled Each Quarter in PFS-2 (in Bar Graph)

9.0 ENDANGERED THREATENED AND PROTECTED (ETP)SPECIES

Onboard supervisors encountered ETP species either by observations, incidents of catch-and-release as well as by their inclusion in the commercial hauls. Regional supervisors encountered ETP species as part of the hauls of landed vessels. All encounters with ETP species were assigned GPS waypoints based on fishing areas reported by regional supervisors or more precisely, by marked waypoints by the onboard supervisors. These were used to prepare a map of hotspots for ETP species along Guyana's coastline (Figure 4-14). Snapper, a popularly caught and target species, is also classified as "vulnerable" by the IUCN because its population is declining. Due to the abundance with which this species is captured, it is represented by a polygon on the map that covers the full fishing range used by the onboard supervisors. A total of 18 ETP species were recorded in PFS-2 and the locations of capture are presented in a map of ETP species hotspots along during PFS-2 (Figure 9-1).

The species and their status based on classification by the International Union for the Conservation of Nature (IUCN) are presented in Table 9-1.

Table 9-1: ETP Species Encountered in PFS-2

Common Name	Guyanese Common Names	Species Name	IUCN Classification[4]
Brazilian Sharpnose Shark	Water belly shark	*Rhizoprionodon lalandii*	Vulnerable
Leatherback Turtle	Leatherback	*Dermochelys coriacea*	Endangered
Longnose Stingray	Stingray	*Hypanus guttatus*	Near Threatened
Shark	Shark		
Sharpnose Stingray	Stingray	*Maculabatis gerrardi*	Vulnerable
Black Tip Shark	Black Tip Shark	*Carcharhinus limbatus*	Near Threatened
Grey Snapper	Snapper	*Cynoscion acoupa*	Vulnerable
Cownose Ray	Sea Bat	*Rhinoptera bonasus*	Vulnerable
Goliath Grouper	Jewfish	*Epinephelus itajara*	Vulnerable
Nurse Shark	Nurse Shark	*Ginglymostoma cirratum*	Near Threatened
Small Tail Shark	Shark	*Carcharhinus porosus*	Critically Endangered
Smalleye Smoothhound Shark	Green Shark	*Mustelus higmani*	Endangered
Tiger Shark	Tiger Shark	*Galeocerdo cuvier*	Near Threatened
Spinner Shark	Spinner Shark	*Carcharhinus brevipinan*	Near Threatened
Bull Shark	Bull Shark	*Carcharhinus leucas*	Near Threatened
Giant Manta Ray	Giant Manta Ray	*Mobula birostris*	Vulnerable
Hammerhead Shark	Hammerhead Shark	*Sphyrna media*	Endangered
Scalloped Hammerhead Shark	Hammerhead Shark	*Sphyrna lewini*	Critically Endangered

Note: Supervisors did not provide disaggregation of the shark species caught. However, all shark species occurring in Guyana are ETP species.

[4] International Union for the Conservation of Nature (IUCN). 2021. The IUCN Red List of Threatened Species. Version 2021-1

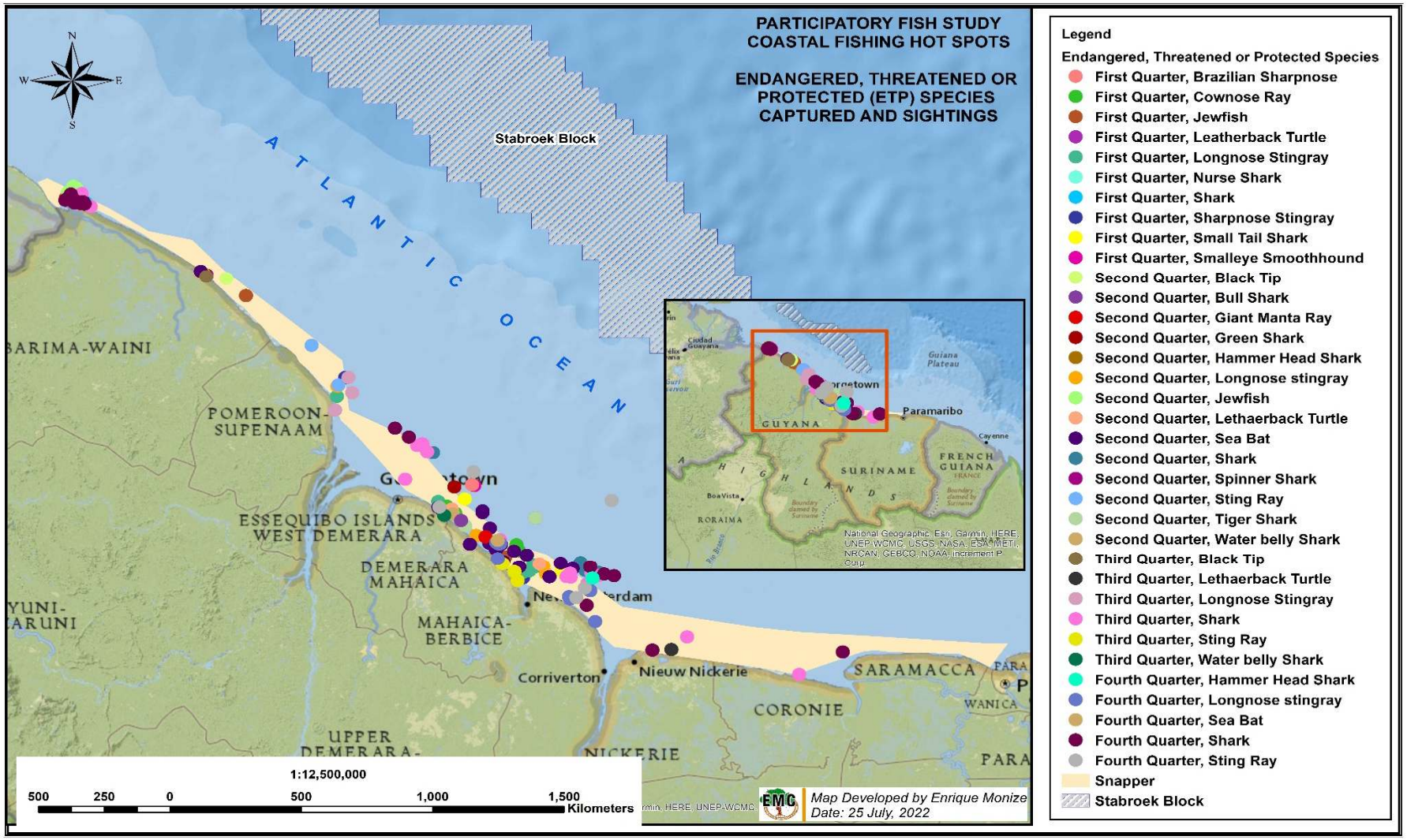


Figure 9-1: Coastal Fishing Hotspots and Sighting for Endangered Threatened or Protected Species During PFS-2

CONCLUSION

The study has collected critical information on Guyana's artisanal fishing sector at a crucial time. Concerns about declining productivity experienced by artisanal fisherfolk have been raised in multiple forums and has become an issue of national importance. A comparison of trends of productivity at the landing sites surveyed have confirmed anecdotal reports of declining catch. However, a direct link to a total reduction of fish abundance cannot be drawn utilizing the data collected from this limited study (state total duration of study here). Indeed, there were reductions in productivity for most types of artisanal fishing practices including for targeting important commercial species like snapper, bangamary and shrimp.

The Participatory Fish Study was the first study of its kind in Guyana and the only study which presents a data-driven and time-series comparison of fisheries productivity. The findings of PFS-2 provides insight into how fisherfolk try to adapt to low catches including changing fishing gear and exploring new fishing grounds.

Another period of data collection for the PFS is underway (PFS-3 to cover the period April 2022 to March 2023). This provides the opportunity to further investigate trends so as to enhance understanding of the dynamics related to artisanal fishing activities.

APPENDIX A – Species Identification Summary Table

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Micropogonias furnieri	Whitemouth croaker	Basher, Basha, Double Belly, Gobi Basha	30	
Cynoscion acoupa	Acoupa weakfish	Snapper, Grey Snapper	42.7	
Cynoscion virescens	Green weakfish	Trout	60.5	
Cynoscion leiarchus	Smooth weakfish	Shine Eye	35	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Nebris microps	Small-eye croaker	Butterfish/ Butterhead	23.8	
Carcharhinus limbatus	Blacktip Shark	Blacktip Shark	157	
Carcharhinus porosus	Smalltail Shark	Sand Shark	72	
Sphyrna lewini	Scalloped hammerhead	Hammerhead Shark	140	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Rhizoprionodon porosus	Caribbean sharpnose shark	Green Shark	60	
Chaetodipterus faber	Atlantic spadefish	Spadefish/ Donkey Fish	13.5	
Sciades sp	Crucifix sea catfish	Kokwari	36.6	
Batrachoides surinamensis	Pacuma toadfish	Pacu	20	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Macrodon ancylodon	King weakfish	Bangamary	23.7	
Stellifer rastrifer	Rake stardrum	Rockhead / White / Rat Mouth	10	
Ctenosciaena gracilicirrhus	Barbel drum	Brickhead/ Rock Head	16	
Scomberomorus cavalla	King mackerel	Kingfish	63.3	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Scomberomorus brasiliensis	Serra Spanish mackerel	Mackerel	37	
Xiphopenaeus kroyeri	Atlantic seabob	Coarse Shrimp/ Seabob	1.0	
Odontognathus mucronatus	Guiana longfin herring	Netly, Platata	12	
Trichiurus lepturus	Largehead hairtail	Silverbelt	50.6	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Lonchurus elegans	Blackfin croaker	Chinese Butterfish	27	
Nematopalaemon schmitti	Whitebelly prawn	White Belly Shrimp	0.8	
Achirus achirus	Drab sole	Flounder	20	
Centropomus undecimalis	Common snook	Snook	42	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Farfantepenaeus sp. and Litopenaeus sp.	Prawns	Prawn	9.8	
Bagre bagre	Coco Sea Catfish	Sea Catfish	21.7	
Lobotes surinamensis	Triple Tail	Paggie/ Sea Congo	38	
Cathorops spixii	Madamango sea catfish	Spring Cuirass	10	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Cathorops sp. and Sciades sp.	Pemecou sea catfish	Cuirass	45	
Sciades parkeri	Gillbacker sea catfish	Gillbacker	46	
Megalops atlanticus	Atlantic Tarpon	Cuffum/ Tarpon	128	
Genyatremus luteus	Torroto grunt	Annafoke/ Old Wife	25	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Mugil cephalus	Flathead grey mullet	Mullet	35.4	
Anchoa spinifer	Spicule anchovy	Small Herring	20 .	
Elops saurus	Ladyfish	Long John	60	
Pomatomus saltatrix	Bluefish	Salmon	30	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Harengula humeralis	Redear herring	Shad	11	
Brachyplatystoma vaillantii	Laulao catfish	Lau Lau	80	
Sciades couma	Couma sea catfish	Cuma Cuma / Blinka	50	
Cetengraulis edentulus	Atlantic anchoveta	Big Eye Herring	13.7	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Anchoviella lepidentostole	Broadband Anchovy	Suriname Mullet	9.4	
Echiophis punctifer	Spoon-nose eel	Mud Eel	100	
Cynoscion similis	Tonkin weakfish	Black Tail Basha	40	
Pellona harroweri	American coastal pellona	Mail Boy	12	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Isopisthus parvipinnis	Bigtooth corvina	Flat Banga	15.9	
Mugil curema	White mullet	Quirman	19.7	
Penaeus monodon	Giant tiger prawn	Tiger Shrimp	1	
Prionotus punctatus	Bluewing searobin	Sea Robin/ Flying Fish	26.2	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Katsuwonus pelamis	Skipjack tuna	Bonito / Tuna	40	
Anableps anableps	Largescale four-eyes	Four Eye	13	
Rachycentron canadum	Cobia	Cabio	43	
Physalia physalis	Portuguese man o' war	Man O War	n/a	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Callinectes sapidus	Blue crab	Crab	11.8	
Amphiarius rugispinis	Softhead sea catfish	Twee Twee	30	
Bunocephalus sp.	Banjo catfish	Banja Man	14	
Mugil sp.	Mullet	Cannapa	35.4	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Selene vomer	Lookdown	Chiny Man / Moonfish	35	
Sphyraena guachancho	Guachanche barracuda	Barracuda	35	
Diapterus rhombeus	Caitipa mojarra	Deep Sea Fish	13	
Pseudauchenipterus nodosus	Cocosoda catfish	Sweet Man	25	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Oligoplites saliens	Castin leatherjacket	Copper Fish / Thing Bad	35	
Epinephelus itajara	Atlantic goliath grouper	Jewfish	128	
Cynoscion sp.	Weakfish or sea trout	Bright Eye	38	
Caranax hippos	Crevalle jack	Crevalle	66	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Rhinoptera bonasus	Cownose ray	Sea Bat	65.3	
Notarius grandicassis	Thomas sea catfish	Thomas	40	
Trachinotus sp.	Pompano	Pompano	58	
Hypanus sp. *Frontitrygon sp.*	Stingray	Stingray	110	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
Narcine bancroftii	Lesser electric ray	Shocking Fish, Electric Ray	65	
Menticirrhus americanus	Southern kingcroaker	Croaker	17.7	
Hypophthalmus edentatus	Highwaterman catfish	Highwater, Dalawala	25.6	
Carcharhinus leucas	Bull shark	Bull Shark	159	No Photo Available
Anchoa spinifer	Spicule anchovy	Herring	*Unknown*	No Photo Available
Hoplias malabracus	Trahira	Houri	17	No Photo Available
Hypanus guttatus	Longnose stingray	Longnose Sting Ray	41	

Species Name	Common Names	Guyanese Common Names	Length of Maturity (Centimetres)	Photograph of Species
-		Manuwarie [5]	-	No Photo Available
Piaractus brachypomus	Pirapitinga	Moracut	34.65	No Photo Available
Mugil liza	Lebranche mullet	Mullet	35	
Colomesus psittacus	Banded puffer	Pintoo	20	
Lutjanus campechanus	Northern red snapper	Red Snapper	30	
Portunus rufiremus	Crab	Sherriga		No Photo Available
Carcharhinus brevipinna	Spinner shark	Spinner Shark	159	No Photo Available
Rhizoprionodon lalandii	Brazilian sharpnose shark	Water Belly Shark	45	No Photo Available

[5] The team was unable to verify this fish species since no pictures were presented.

APPENDIX B – Photographs from Landing Site Assessments

QA/QC and Landing Site Assessment Conducted at Smith's Creek, Region 1

Engagements Conducted with the Waramuri/ Haimokabra Supervisor, Region 1

QA/QC and Landing Site Assessment Conducted with Charity Supervisor, Region 2

QA/QC and Landing Site Assessment Conducted at Hampton Court, Region 2

QA/QC and Landing Site Assessment Conducted at Lima, Region 2

QA/QC and Landing Site Assessment Conducted at Zeeburg, Region 3

QA/QC and Landing Site Assessment Conducted at Windsor Forest, Region 3

QA/QC and Landing Site Assessment Conducted at La Grange, Region 3

QA/QC and Landing Site Assessment Conducted at Riverview, Region 4



Engagements Conducted at the Region 4 Ogle Supervisor

QA/QC and Landing Site Assessment Conducted at Mahaicony Bridge, Region 5

QA/QC and Landing site Assessment Conducted at Bushlot, Region 5

Engagement with Onboard Supervisor at Rosignol, Region 5

Landing Site Assessment Conducted at Adventure, Region 6

QA/QC and Landing Site Assessment Conducted at Albion, Region 6

QA/QC and Landing Site Assessment Conducted at Complex #66, Region 6

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