# Environmental Sustainability Assessment: Guyana artisanal groundfish fisheries

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Prepared by Dr. Jocelyn Drugan, Ocean Outcomes

## Executive summary

This report serves as an environmental assessment of Guyana's artisanal finfish fisheries, and was prepared for Conservation International (CI) and the Food and Agriculture Organization of the United Nations (FAO) under the Caribbean and North Brazil Shelf Large Marine Ecosystems (CLME+) Project. The CLME+ Project aims to catalyze sustainable management of shared living marine resources within the region through an ecosystem approach to fisheries (EAF). We focus on finfish because they are an important resource for Guyanese fisheries, particularly in the artisanal sector. In addition to supporting many livelihoods, Guyana's artisanal fisheries have a significant need for management and ecological improvements.

Guyana's artisanal fishers use a variety of gear types to catch a wide variety of finfish species. Here we focus on the most common gear types used, gillnets and Chinese seines, and six of the most economically important and frequently targeted species: bangamary (*Macrodon ancylodon*), grey snapper (*Cynoscion acoupa*), sea trout (*Cynoscion virescens*), butter fish (*Nebris microps*), gillbacker (*Sciades parkeri*), and cuirass (*Sciades proops*). Artisanal fisheries are monitored to some extent but not in a very robust manner, and harvest management is minimal, which leads to deficiencies across numerous performance indicators. Stock status of the target species is uncertain, and they are subject to substantial fishing pressure and may be overfished. Ecosystem impacts are also uncertain due to lack of information and research. Some of the potentially more serious concerns are a lack of data on discards, fishing mortality on endangered or threatened shark species, and potential habitat impacts from fishing gear. Fisheries management is generally constrained by lack of capacity and weak enforcement. Although fishery objectives aligned with sustainability outcomes are described explicitly in policies and fishery management plans, implementation may not be effective.

# Glossary

| | |
|---|---|
| **AFMP** | Artisanal fisheries management plan |
| **BRD** | bycatch reduction device |
| **CAB** | Conformity Assessment Body |
| **CARICOM** | Caribbean Community |
| **CLME+** | Caribbean and North Brazil Shelf Large Marine Ecosystems (Project) |
| **CEFAS** | Centre for Environment Fisheries and Aquaculture Science |
| **CI** | Conservation International |
| **CITES** | Convention on International Trade in Endangered Species of Wild Fauna and Flora |
| **cm** | Centimeter |
| **CNFO** | Caribbean Network of Fisherfolk Organisations |
| **CPUE** | Catch Per Unit Effort |
| **CRFM** | Caribbean Regional Fisheries Mechanism |
| **EAF** | Ecosystem approach to fisheries |
| **EBFM** | Ecosystem Based Fisheries Management |
| **EEZ** | Exclusive Economic Zone |
| **ETP** | Endangered,Threatened or Protected |
| **FAC** | Fisheries Advisory Council |
| **FAO** | Food and Agriculture Organization [of the United Nations] |
| **FCR** | Fisheries Certification Requirements [for MSC] |
| **FIP** | Fishery Improvement Project |
| **$F_{MSY}$** | fishing mortality consistent with achieving maximum sustainable yield |
| **IUCN** | International Union for Conservation of Nature |
| **km** | kilometers |
| **LME** | Large Marine Ecosystem |
| **LVV** | Ministry of Agriculture, Animal husbandry and Fisheries of Suriname |
| **m** | meters |
| **MARAD** | Maritime Administration Department |
| **MBA SFW** | Monterey Bay Aquarium Seafood Watch |
| **MCS** | Monitoring, Control and Surveillance |
| **MFMP** | Marine Fisheries Management Plan |
| **mm** | millimeter |
| **MOA** | Ministry of Agriculture |

| | |
|---|---|
| **MSC** | Marine Stewardship Council |
| **MSY** | maximum sustainable yield |
| **NBCF** | North Brazil Current Front |
| **NBSLME** | North Brazil shelf large marine ecosystem |
| **NGO** | Non-Governmental Organization |
| **OLDEPESCA** | Latin American Organization for Fisheries Development |
| **PI** | performance indicator |
| **PSA** | Productivity Susceptibility Analysis |
| **RBF** | Risk Based Framework |
| **SBPA** | Shell Beach Protected Area |
| **SICA** | Scale Intensity Consequence Analysis |
| **SSF** | Shelf Slope Front |
| **TAC** | Total Allowable Catch |
| **TED** | turtle excluder device |
| **UoA** | Unit of Assessment |
| **VME** | Vulnerable marine ecosystem |
| **WECAFC** | Western Central Atlantic Fishery Commission |
| **WWF** | World Wildlife Fund |

## Acknowledgements

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# Methodology background

The Rapid Assessment Tool was co-developed by Ocean Outcomes, World Wildlife Fund (WWF) US, and the Sustainable Fisheries Partnership. It is based on Marine Stewardship Council (MSC) performance indicators (PIs) and draws concepts/definitions from both the MSC and Monterey Bay Aquarium Seafood Watch (MBA SFW) standards, specifically the MSC Fisheries Certification Requirements Version 2.0 and the MBA SFW Standard for Fisheries Version 3.2. This assessment is designed to present key information about the fishery and identify major deficiencies in ecological sustainability, for general scoping or to facilitate movement of a fishery into an improvement project. The assessment can also be used to post a basic or prospective fishery improvement project profile on www.fisheryprogress.org. Version 1.0 of the tool is available here: https://fisheryprogress.org/resources/launching-fip

For this assessment we used Version 2.0 of the Rapid Assessment methodology, which primarily differs from Version 1.0 with its inclusion of scoring categories in the 0 to 59 range of the MSC 100 point scale (scoring definitions included in the appendix). Guidance for the lower scoring ranges was partly developed by the Marine Resources Assessment Group Americas for the Certification and Ratings Group, as described in the unpublished document "Lower range assessment of fishery performance: guidance document" (September 2018 version). Ocean Outcomes made some changes to the scoring guidance to improve its flow and applicability for the Rapid Assessment Tool. The intent of incorporating these lower scoring ranges into the assessment tool is to allow for measurement of performance and fishery improvement progress below the MSC 60 level, which is applicable to many fisheries around the world, especially those that do not have long-established, formal fisheries management systems.

# Basic fishery information

| | |
|---|---|
| Target species scientific names and common names | Bangamary (king weakfish, *Macrodon ancylodon*)<br>Sea trout (green weakfish, *Cynoscion virescens*)<br>Butterfish (smalleye croaker, *Nebris microps*)<br>Grey snapper (acoupa weakfish, *Cynoscion acoupa*)<br>Gillbacker (gillbacker sea catfish, *Sciades parkeri*)<br>Cuirass (crucifix sea catfish, *Sciades proops*) |
| Fishery location | Guyana coast to the edge of the continental shelf (Fig. 1). Artisanal vessels are operated in the coastal zone, including coastal lagoons, river mouths and inshore waters, with some vessels traveling farther out up to the 20 fathom contour. |
| Gear type(s) | Focal gears: drift gillnet, Chinese seine<br>Other gears used in artisanal fisheries: pin seine, caddell lines, anchor seine, circle seine |
| Catch quantity (weight) | 16 175 tonnes (finfish, average from 2013-2017). Artisanal finfish production was generally greater than 25 000 tonnes per year from the 1980s to 2006 (Maison, 2007). |
| Vessel type and size | Wooden vessels with outboard or inboard engines, 6-19 meters (m) in length |
| Number of registered vessels | 1 315 according to 2017 Fisheries Department boat count (Fisheries Department, 2018b) |
| Management authority | Fisheries Department under the Guyana Ministry of Agriculture |

Table 1. Catches of finfish (tonnes) in the artisanal and industrial fisheries. Data from the Fisheries Department, obtained 20 June 2019.

| Year | Artisanal | Industrial |
|---|---|---|
| 2013 | 21 288 | 2 440 |
| 2014 | 14 107 | 2 933 |
| 2015 | 13 592 | 2 151 |

| | | |
|---|---|---|
| 2016 | 16 201 | 3 281 |
| 2017 | 15 688 | 2 188 |

This assessment focuses on Guyana's nearshore artisanal fisheries that target finfish. For context, Guyana also has a large industrial fishery targeting penaeid shrimp species, which is subject to relatively robust management oversight, and a semi-industrial fishery targeting snapper species (e.g. red, vermillion and lane snappers). The industrial fishery for Atlantic seabob (*Xiphopenaeus kroyeri*) is likely to be certified against the MSC standard as of 2019. These industrial and semi-industrial fisheries are not evaluated in this assessment.

Most artisanal fishing takes place in fishing zones from estuaries to the edge of the continental shelf, up to 56 km offshore (Fig. 1; Maison, 2007). A variety of gears are used in the artisanal fishery, including gillnets (usually made of nylon or polyethylene), Chinese seines (a type of fyke net), pin seines, anchor seines and caddell lines (a type of longline). Monitoring data to determine relative production by gear type are limited, but according to the 2017 artisanal boat count, most use gillnets and Chinese seines (64% and 23%, respectively; Fisheries Department, 2018b). Thus we focus on those two gear types in this assessment.

There are essentially no regulations on artisanal fishing gear. Some types of gears are supposed to be phased out due to their negative environmental impacts, such as pin seines which catch a lot of juvenile fishes. Fishers use varying mesh sizes depending on the species they are most actively targeting; for example, larger mesh is used for grey snapper than for sea trout. Gillnets are traditionally about 2 kilometers (km) long and pulled in by hand, but some fishers are starting to use 4 km nets and winches to help pull in their nets (P. Jainarine, pers. comm., 19 June 2019). Artisanal fishing vessels are constructed of wood and have crews of three to six persons (Maison, 2007). Larger vessels, typically 12 to 16 m in length, have ice-boxes and are used for fishing trips lasting from about 5 to 21 days (Maison, 2007). Smaller vessels are about 8 to 10 m in length and may or may not have ice boxes, with fishing trips ranging from about 12 hours to 3 days (Maison, 2007; Ministry of Agriculture, 2013).

Catches include a variety of species, but some of the most economically important fishes are from two families, Sciaenidae (croakers and drums) and Ariidae (sea catfish). The species that we have chosen to focus on (Table 2) are known to be significant components of artisanal fishery catches, and are economically and culturally important. A variety of species are caught in the different artisanal gear types, and catch composition data by gear is lacking. Generally speaking, however, polyethylene gillnets have larger mesh sizes and are used to catch grey snapper, sea trout, cuffum, gillbacker, mackerel, and sharks (FAO, 2013a). Nylon gillnets are smaller and used farther inshore to target smaller sea catfishes and bangamary (FAO, 2013a). Chinese seine catches include shrimps and smaller fishes, such as bangamary, butterfish, and sea catfishes (Maison, 2007). Although finfish are not targeted by the industrial trawl fisheries, sciaenids and sea catfishes are caught as bycatch (Southall et al., 2019). Some artisanal fishing gears, particularly polyethylene gillnets with larger mesh sizes, are relatively selective for larger fishes, whereas industrial trawls and Chinese seines are less selective and catch smaller individuals, including juveniles (CRFM, 2014; Maison, 2007).

The target species are distributed in the western Atlantic Ocean, and some stocks are harvested by multiple countries. For example, sea trout and grey snapper are subject to heavy exploitation throughout their range distribution, particularly in Northern Brazil, French Guiana, Suriname, Guyana, and Venezuela (Andrade de Pasquier et al., 1998; Artigas et al., 2003; Chao et al., 2010; Rodrigues et al., 2008). In addition to being caught for food, sciaenids such as grey snapper and sea trout have swim bladders that are a valuable commodity in the Chinese market (Yspol, 2006). In Guyana the dried swim bladders are referred to as 'glue.'

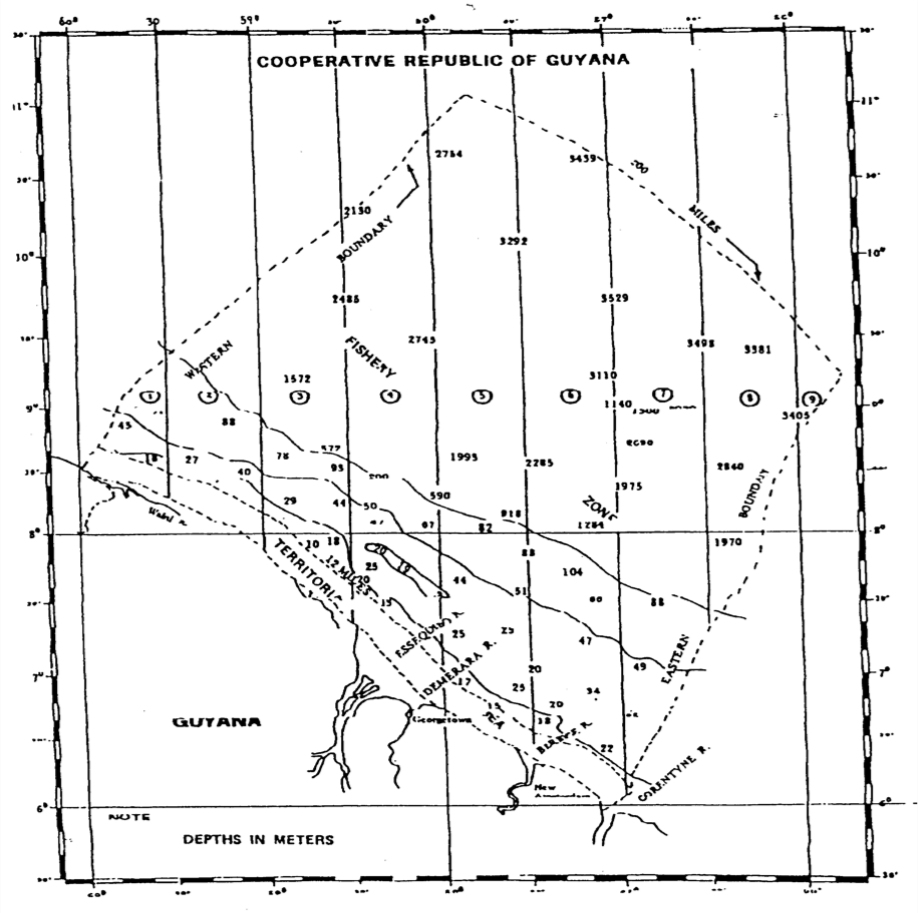



Figure 1. Map of Guyana's Exclusive Economic Zone (EEZ), including the fishing zone. Image from Fisheries Department (2018).

At the local level, management of artisanal fisheries is coordinated by the Fisheries Department under the Guyana Ministry of Agriculture (MOA). The Western Central Atlantic Fishery Commission (WECAFC) is a regional fishery body that also plays an important role in assessment and management of stocks, with the Shrimp and Groundfish Working Group being most relevant to the target stocks.

## Unit of Assessments (UoAs)

Under MSC guidance, UoAs may be defined by the target stock(s) combined with the fishing method/gear and practice (including vessel type/s) pursuing that stock, and any fleets, or groups of vessels, or individual fishing operators or other eligible fishers that are included in the assessment. We have initially defined the UoAs based on the target species and the most common fishing gears used. Although ecosystem impacts from drift gillnets and Chinese seine likely vary, monitoring data that can be used to distinguish their impacts are limited, so we have not separated the UoAs by gear type at this time. The UoAs can be re-defined at later stages, e.g. for development of a fishery improvement project, if stakeholders decide to focus on specific components of the fishery.

Table 2. Units of Assessment and main target species.

| UoA | Species, stock | Method of capture |
|---|---|---|
| 1 | Bangamary (*Macrodon ancylodon*)<br>Western Atlantic from Colombia to Argentina | Drift gillnet and Chinese seine |
| 2 | Sea trout (*Cynoscion virescens*)<br>Western Atlantic from Nicaragua to Brazil | Drift gillnet and Chinese seine |
| 3 | Grey snapper (*Cynoscion acoupa*)<br>Western Atlantic from Panama to Argentina | Drift gillnet and Chinese seine |
| 4 | Butterfish (*Nebris microps*)<br>Western Atlantic from Colombia to Brazil | Drift gillnet and Chinese seine |
| 5 | Gillbacker (*Sciades parkeri*)<br>Western Atlantic from Venezuela to northern Brazil | Drift gillnet and Chinese seine |
| 6 | Cuirass (*Sciades proops*)<br>Western Atlantic from Colombia to Brazil | Drift gillnet and Chinese seine |

## Scoring summary

| Principle | Component | PI # | Performance Indicator | Scoring category |
|---|---|---|---|---|
| 1 | Outcome | 1.1.1 | Stock status outcome | Bangamary, 20-39 |
| | | | | Sea trout, 20-39 |
| | | | | Grey snapper, 20-39 |
| | | | | Butterfish, 20-39 |
| | | | | Gillbacker, 20-39 |
| | | | | Cuirass, 20-39 |
| | | 1.1.2 | Stock rebuilding outcome | <60 |
| | Management | 1.2.1 | Harvest Strategy | <20 |
| | | 1.2.2 | Harvest control rules | <20 |
| | | 1.2.3 | Information and monitoring | <60 |
| | | 1.2.4 | Assessment of stock status | 40-59 |
| 2 | Other species | 2.2.3 | Other species information | 40-59 |
| | | 2.2.1 | Other species outcome | 40-59 |

| | | | | |
|---|---|---|---|---|
| | | 2.2.2 | Other species management | <20 |
| | ETP species | 2.3.3 | ETP species information | 20-59 |
| | | 2.3.1 | ETP species outcome | <60 |
| | | 2.3.2 | ETP species management | 20-39 |
| | Habitats | 2.4.3 | Habitats information | <60 |
| | | 2.4.1 | Habitats outcome | 20-59 |
| | | 2.4.2 | Habitats management | <20 |
| | Ecosystem | 2.5.3 | Ecosystem information | <60 |
| | | 2.5.1 | Ecosystem outcome | 60-79 |
| | | 2.5.2 | Ecosystem management | 40-59 |
| 3 | Governance & policy | 3.1.1 | Legal and customary framework | 60-79 |
| | | 3.1.2 | Consultation, roles and responsibilities | 60-79 |
| | | 3.1.3 | Long term objectives | 80+ |
| | Fishery specific management system | 3.2.1 | Fishery-specific objectives | 80+ |
| | | 3.2.2 | Decision-making processes | 40-59 |
| | | 3.2.3 | Compliance and enforcement | 20-39 |
| | | 3.2.4 | Management performance evaluation | 60-79 |

# Status of target stock(s) - Principle 1

Principle 1 focuses on the status of the target species and stocks.

## Stock status outcome (1.1.1)

| | Scoring category |
|---|---|
| UoA 1 - Bangamary | 20-39 |
| UoA 2 - Sea trout | 20-39 |
| UoA 3 - Grey snapper | 20-39 |
| UoA 4 - Butterfish | 20-39 |
| UoA 5 - Gillbacker | 20-39 |
| UoA 6 - Cuirass | 20-39 |

Rationale:
Stock structure is still being clarified for these species; genetic studies have been conducted for grey snapper and bangamary but not yet for the others. Grey snapper samples obtained from the market at the Braganca port in Brazil showed low genetic variation within and among years, potentially suggesting a single stock off northern Brazil (Rodrigues et al., 2008). A study on bangamary identified two genetically distinct groups, one of which occurs from Venezuela to Pernambuco, Brazil (Santos et al., 2003). For this assessment, we assumed that Guyana fisheries exploit a single stock of each species. In terms of biological characteristics related to fishing vulnerability, many marine sciaenids spawn along the near shore and river margins, and use estuaries as nursery grounds. They are especially vulnerable to fishing mortality when they form large spawning aggregations (Chao et al., 2015). Sea catfishes inhabit near shore areas, river estuaries, and mangrove lagoons (Acero, 2003). They have a specialized reproduction system, where males incubate eggs and brood young in their mouths, so they may not be as prolific as broadcast spawners.

Finfish stocks are not regularly assessed, and catch and effort information is limited, particularly for artisanal fisheries. Fishers report needing to travel farther offshore to catch fish, which is indicative of overfishing. The lack of management controls on fishing capacity exacerbates the possibility that stocks are or will be overfished.

As part of the MSC certification process for Guyana's Atlantic seabob fishery, exploratory stock assessments were recently conducted for the main groundfish bycatch species, specifically bangamary, sea trout, and butterfish (Santos et al., 2018). The assessors used landings sample data collected from 2002 to 2015 by the Guyana Fisheries Department. Data on fish body lengths and weights were collected for multiple gear types (Chinese seine, cadell line, three types of gillnet, pin seine, traps and trawl), with aggregate sampling coverage being best for Chinese seine and gillnets. The assessment method used body length frequency distributions and several life history parameters to estimate length-based indicators relating to conservation of large and small individuals (i.e. whether large or small individuals are caught at disproportionately high levels), optimal yield, and fishing mortality consistent with achieving maximum sustainable yield ($F_{MSY}$). Table 3 shows the length-based parameters that were used.

The assessment results were based on some uncertain estimates of life history parameters and hence are not conclusive, but are still useful as no other recent assessment information is available. WWF-Guianas has a project underway to assess those same three species as well as grey snapper, gillbacker and cuirass, but the results could not be shared at the time of this assessment (S. Edghill, pers. comm., 17 June 2019).

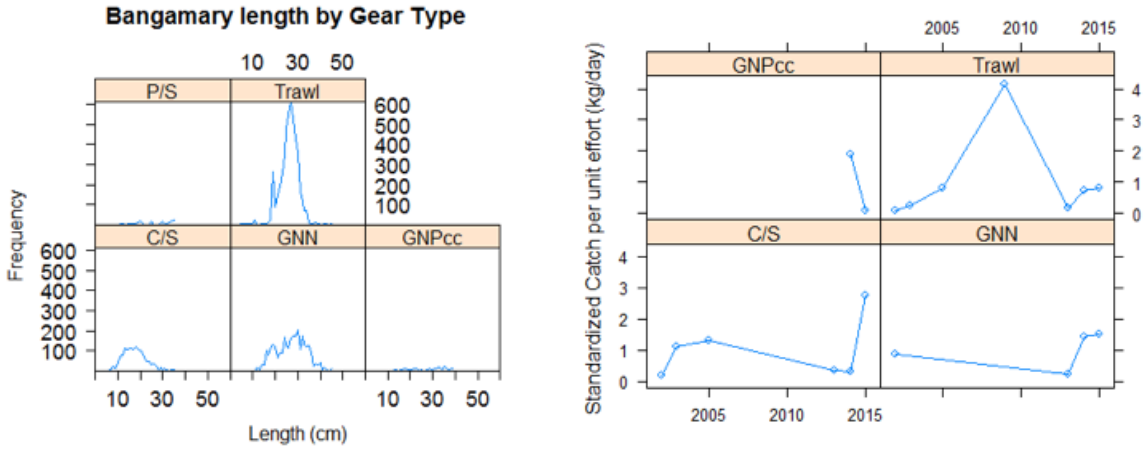
Table 3. Length-based parameters and indicators used in the Santos et al. (2018) stock assessments.

| | Description of parameter or indicator |
|---|---|
| $L_{\infty}$ | von Bertalanffy asymptotic length |
| $L_{mat}$ | length at 50% maturity |
| $L_{opt}$ | length-at-age at which the product of weight-at-age and numbers-at-age is maximized under zero fishing mortality |
| $L_{F=M}$ | mean length in the catch at which fishing mortality is at the same level as natural mortality |
| $L_{max5\%}$ | mean length of largest 5% of individuals |
| $L_{95\%}$ | 95th percentile of length |
| $L_{25\%}$ | 25th percentile of length |
| $P_{mega}$ | proportion of mega-spawners (proportion of individuals above $L_{opt}$ + 10%) |
| $L_c$ | length at first catch (length at 50% of mode) |
| $L_{mean}$ | mean length of caught individuals (mean length of individuals > $L_c$) |
| $L_{maxy}$ | length class with maximum biomass in catch |

Due to the limited stock assessment information, we also conducted productivity susceptibility analyses (PSAs) for the target stocks using the MSC Risk Based Framework (RBF) methodology. The PSA looks at two main elements, productivity and susceptibility, each of which is scored based on risk to the stock. Productivity reflects the ability of a species to reproduce successfully, while susceptibility considers the vulnerability of fish to capture and mortality from fishing. Scoring for productivity and susceptibility is on a three-point risk scale: low (1), medium (2) or high (3), following MSC guidance (see Tables PF4 and PF5 in the appendix). When performing a susceptibility analysis, the relative impacts of all major sources of fishing mortality on the stocks should be considered. Here we considered fishing mortality from both industrial and artisanal fisheries in Guyana, assuming that relative impacts are proportional to the finfish landings reported in Table 1. However, the relative impact of industrial fisheries may be underestimated because they likely discard small size individuals of these finfish species. Ideally we would also factor in fishing mortality from the other countries harvesting these stocks, but the general lack of quantitative data for catches by species makes comparisons difficult. Since these are targeted species, we assumed that they are highly susceptible to being caught and retained by fisheries. Summaries of available stock status information for each species are provided below.

## *Bangamary (Macrodon ancylodon)*

Based on landings samples taken from 2002 to 2015, gillnets catch individuals ranging from about 10 to 40 cm in length, while Chinese seines catch smaller individuals mostly in the 10 to 25 cm length range (Fig. 2a). There was no apparent change in mean length of individuals over that time, and standardized catch per unit effort (CPUE) did not show clear trends (Fig. 2b).




Figures 2a and 2b. Length frequencies of sampled fish by gear type (left; 2a) and standardized CPUE over time (right; 2b) for bangamary (P/S = pin seine; GNPcc = gillnet polytheylene cabin cruiser; trawl = industrial trawl; C/S = Chinese seine; GNN = gillnet nylon). Figures from Santos et al. (2018).

The stock assessment suggested that fishing mortality is at a level consistent with producing MSY catches, based on body length information (Santos et al., 2018). However, many individuals are likely being caught before being able to spawn, and very large individuals (mega-spawners) were rarer than expected (Table 4).

Table 4. Length-based indicators from Santos et al. (2018). Green shading indicates that the estimated indicator exceeds the reference point.

| | Conservation (large individuals) | | | Conservation (small individuals) | | Optimizing yield | | $F_{MSY}/F$ |
|---|---|---|---|---|---|---|---|---|
| | $L_{max5\%}/L_\infty$ | $L_{95\%}/L_\infty$ | $P_{mega}$ | $L_{25\%}/L_{mat}$ | $L_c/L_{mat}$ | $L_{mean}/L_{opt}$ | $L_{maxy}/L_{opt}$ | $L_{mean}/L_{F=M}$ |
| Reference | >0.8 | >0.8 | >0.3 | >1 | >1 | ≈1 | ≈1 | ≥1 |
| Sea trout | 1.03 | 0.97 | 0.63 | NA | NA | 1.29 | 1.31 | 1.05 |
| Bangamary | 0.85 | 0.79 | 0.10 | 0.91 | 0.82 | 0.91 | 1.02 | 1.06 |
| Butter fish | 0.94 | 0.89 | 0.62 | NA | NA | 1.23 | 1.18 | 1.00 |

The PSA for bangamary suggests that fisheries pose a high risk to stock status. This species is productive but susceptible to high levels of fishing mortality, and the PSA score was <60 (Table 5).

Table 5. Productivity susceptibility analysis table for bangamary.

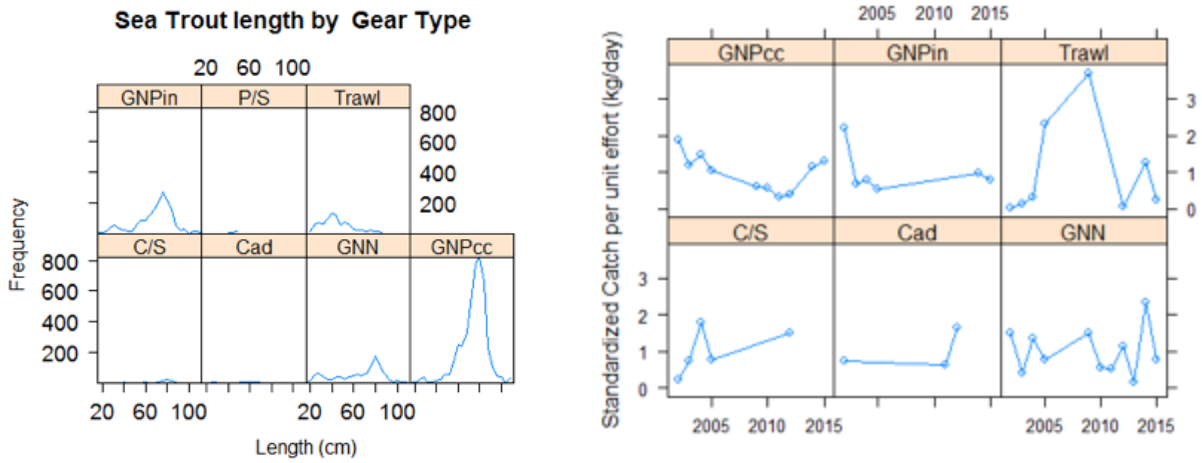
| Productivity attribute | Rationale | Score |
|---|---|---|
| **Average age at maturity** | 2.7 years (Chao, 1978) | 1 |
| **Average maximum age** | 10.6 years (Southall et al., 2019) | 2 |
| **Fecundity** | > 20 000 eggs per year (Chao, 1978) | 1 |
| **Average maximum size** | 45 cm (Chao, 1978) | 1 |
| **Average size at maturity** | 23.7 cm (Southall et al., 2019) | 1 |
| **Reproductive strategy** | Broadcast spawner (Chao, 1978) | 1 |
| **Trophic level** | 3.9 (Chao, 1978) | 3 |
| **Susceptibility attribute** | **Rationale** | **Score** |
| **Areal Overlap** (combined for all fisheries) | This species is targeted by some fisheries (e.g. artisanal) and is incidentally caught in others (e.g. industrial trawl). We precautionarily assume that all fisheries overlap with >30% of the stock's geographical distribution. | 3 |
| **Encounterability** (combined for all fisheries) | Artisanal nets are not restricted to specific depths for fishing. Encounterability may be high. | 3 |
| **Selectivity of gear type** | Artisanal: mesh sizes are not regulated but for drift gillnet may range from about 4 to 8 inches. Fish < than the size at maturity are caught, particularly in Chinese seines (Fig. 2a). Juveniles < half the size at maturity may escape from larger meshed gillnets but not Chinese seines. | 3 |
| | Industrial trawls: wings and body have 4 to 5 cm stretch mesh and the cod end has 2.5 to 3.5 cm stretch mesh (Southall et al. 2019). Fish < than the size at maturity are caught, and juveniles < half the size at maturity cannot escape the gear. | 3 |
| **Post capture mortality** (same for all fisheries) | Bangamary are economically valuable and are generally retained in all fisheries. There are no regulations to release organisms below a minimum size, and most would be dead when released. | 3 |
| **Catch (weight) - artisanal** | 16 175 tonnes (for all finfish species combined, see Table 1) | -- |
| **Catch (weight) - industrial** | 2 600 tonnes (for all finfish species combined, see Table 1) | -- |
| **MSC scoring guidepost** | | <60 |

Between the available stock assessment information and the PSA, we scored the bangamary stock status indicator as red and in the 20-39 scoring range. Although there is no clear quantitative evidence that the stock is healthy or unhealthy, the stock is subject to high fishing pressure from multiple fisheries on juveniles as well as adults, and is likely at least fully exploited if not overexploited.

### *Sea trout (Cynoscion virescens)*

Based on landings samples taken from 2002 to 2015, gillnets catch individuals ranging from about 20 to 100 cm in length, with most being 60 cm or larger (Fig. 3a). Relatively few trout

were sampled from Chinese seines, and they were mostly about 80 cm in length (Fig. 3a). Sea trout mean length decreased from 75-80 cm between 2002 and 2005 to 30-35 cm in 2010 and 2011, a time period when relatively few trout were sampled, and no trawl samples were taken. Mean length increased after 2011, likely due to increased sampling effort on the trawl fishery. Standardized CPUE did not show clear trends for any of the gear types (Fig. 3b).




Figures 3a and 3b. Length frequencies of sampled fish by gear type (left; 3a) and standardized CPUE over time (right; 3b) for sea trout (P/S = pin seine; GNPcc = gillnet polytheylene cabin cruiser; GNPin = gillnet polyethylene inboard engine; trawl = industrial shrimp trawl; C/S = Chinese seine; Cad = caddell line; GNN = gillnet nylon). Figures from Santos et al. (2018).

The stock assessment suggested that fishing mortality is at a level consistent with producing MSY catches, based on body length information (Santos et al., 2018). Large individuals do not appear to have been disproportionately targeted, and there was insufficient life history information on maturity to determine whether small individuals were being caught before being able to spawn (Table 4).

The PSA for sea trout suggested that fisheries pose a high risk to stock status. This species has biological characteristics associated with medium productivity and is susceptible to high levels of fishing mortality, resulting in an RBF PSA score of <60 (Table 6).

Table 6. Productivity susceptibility analysis table for sea trout.

| Productivity attribute | Rationale | Score |
|---|---|---|
| **Average age at maturity** | 3.8 years (Southall et al., 2019) | 1 |
| **Average maximum age** | 18 years (Southall et al., 2019) | 2 |
| **Fecundity** | > 20 000 eggs per year (Cervigón, 1993) | 1 |
| **Average maximum size** | 115 cm (Southall et al., 2019) | 2 |
| **Average size at maturity** | 60.5 cm (Southall et al., 2019) | 2 |
| **Reproductive strategy** | Broadcast spawner (Cervigón, 1993) | 1 |
| **Trophic level** | 4.0 (Cervigón, 1993) | 3 |
| **Susceptibility attribute** | **Rationale** | **Score** |

| | | |
|---|---|---|
| **Areal Overlap** (combined for all fisheries) | This species is targeted by some fisheries (e.g. artisanal) and is incidentally caught in others (e.g. industrial trawl). We precautionarily assume that all fisheries overlap with >30% of the stock's geographical distribution. | 3 |
| **Encounterability** (combined for all fisheries) | Artisanal nets are not restricted to specific depths for fishing. Encounterability may be high. | 3 |
| **Selectivity of gear type** | Artisanal: mesh sizes are not regulated but for drift gillnet may range from about 4 to 8 inches. Artisanal gears catch some fish < than the size at maturity (Fig. 3a). Juveniles < half the size at maturity can escape some gear types but not others. | 3 |
| | Industrial trawls: wings and body have 4 to 5 cm stretch mesh and the cod end has 2.5 to 3.5 cm stretch mesh (Southall et al., 2019). Fish < than the size at maturity are caught, and juveniles < half the size at maturity cannot escape the gear. | 3 |
| **Post capture mortality** (same for all fisheries) | Sea trout are economically valuable and are generally retained in all fisheries. There are no regulations to release organisms below a minimum size, and most would be dead when released. | 3 |
| **Catch (weight) - artisanal** | 16 175 tonnes (for all finfish species combined, see Table 1) | -- |
| **Catch (weight) - industrial** | 2 600 tonnes (for all finfish species combined, see Table 1) | -- |
| **MSC scoring guidepost** | | <60 |

Between the available stock assessment information and the PSA, we scored the sea trout stock status indicator as red and in the 20-39 scoring range. The stock has medium vulnerability, and there is no clear evidence that the stock is healthy, or unhealthy. However, the stock is subject to high fishing pressure and is likely at least fully exploited if not overexploited, especially considering the market demand for sea trout bladders.

### *Grey snapper (Cynoscion acoupa)*

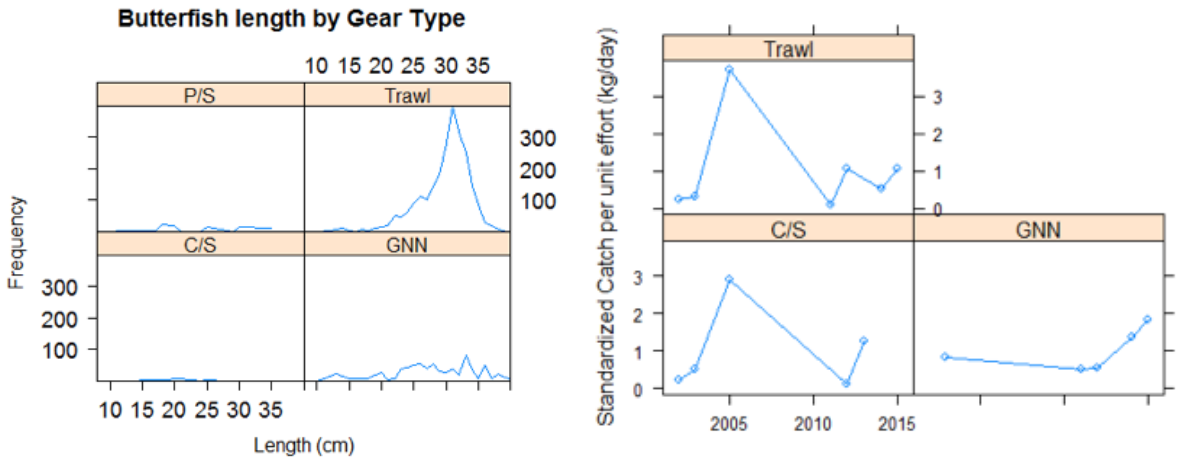
These is no published stock assessment for grey snapper, so the main source of information is the PSA, which suggests that fisheries pose a high risk to stock status. This species has characteristics associated with medium productivity and is susceptible to high levels of fishing mortality, resulting in an RBF PSA score of <60 (Table 7). The stock is subject to high fishing pressure from multiple fisheries in multiple countries, and is likely at least fully exploited if not overexploited, especially considering the market demand for grey snapper swim bladders.

Table 7. Productivity susceptibility analysis table for grey snapper.

| Productivity attribute | Rationale | Score |
|---|---|---|
| **Average age at maturity** | No species data, but one analysis estimated a mean age-at-maturity of 4 years for larger sciaenids (Waggy et al., 2006) | 1 |
| **Average maximum age** | No species data, but may be around 28 years for larger sciaenids (Waggy et al., 2006) | 2 |
| **Fecundity** | > 20 000 eggs per year (da Silva Almeida et al., 2016) | 1 |
| **Average maximum size** | 107 cm (Trindade-Santos and Freire, 2015) | 2 |
| **Average size at maturity** | 42 cm (Morales and Ferrer-Montaño, 2011) | 2 |
| **Reproductive strategy** | Broadcast spawner (Chao et al., 1978) | 1 |
| **Trophic level** | 4.1 (Chao et al., 1978) | 3 |
| **Susceptibility attribute** | **Rationale** | **Score** |
| **Areal Overlap** (combined for all fisheries) | This species is targeted by some fisheries (e.g. artisanal) and is incidentally caught in others (e.g. industrial trawl). We precautionarily assume that all fisheries overlap with >30% of the stock's geographical distribution. | 3 |
| **Encounterability** (combined for all fisheries) | Artisanal nets are not restricted to specific depths for fishing. Encounterability may be high. | 3 |
| **Selectivity of gear type** | Artisanal: mesh sizes are not regulated but for drift gillnet may range from about 4 to 8 inches. For at least some gear types, fish < than the size at maturity may be caught, and juveniles < half the size at maturity might not escape. | 3 |
| | Industrial trawls: wings and body have 4 to 5 cm stretch mesh and the cod end has 2.5 to 3.5 cm stretch mesh (Southall et al., 2019). Fish < than the size at maturity are caught, and juveniles < half the size at maturity cannot escape the gear. | 3 |
| **Post capture mortality** (same for all fisheries) | Grey snapper are economically valuable and are generally retained in all fisheries. There are no regulations to release organisms below a minimum size, and most would be dead when released. | 3 |
| **Catch (weight) - artisanal** | 16 175 tonnes (for all finfish species combined, see Table 1) | -- |
| **Catch (weight) - industrial** | 2 600 tonnes (for all finfish species combined, see Table 1) | -- |
| **MSC scoring guidepost** | | <60 |

## *Butterfish (Nebris microps)*

Based on landings samples taken from 2002 to 2015, gillnets catch individuals ranging from about 10 to 40 cm in length, mostly 20 cm or larger, while Chinese seines catch butterfish about 15 to 30 cm in length. However, sample sizes for this species were relatively small, especially for Chinese seine. There was no apparent trend in mean length of butterfish from 2002 to 2015. Standardized CPUE did not show clear trends for any of the gear types (Fig. 4b).




Figures 4a and 4b. Length frequencies of sampled fish by gear type (left; 4a) and standardized CPUE over time (right; 4b) for butterfish (P/S = pin seine; trawl = industrial shrimp trawl; C/S = Chinese seine; GNN = gillnet nylon). Figures from Santos et al. (2018).

The stock assessment suggested that fishing mortality is at a level consistent with producing MSY catches, based on body length information, and large individuals do not appear to have been disproportionately targeted (Santos et al., 2018). There was insufficient life history information on maturity to determine whether small individuals were being caught before being able to spawn (Table 4).

The PSA for butterfish suggests that fisheries pose a high risk to stock status. This species is productive but susceptible to high levels of fishing mortality, and the RBF PSA score was <60 (Table 8). The high risk score was partly determined by the assumption that artisanal fisheries are not very selective for larger sized fish and may regularly catch juveniles. If juveniles are not regularly being caught, the PSA score would have indicated medium risk.

Table 8. Productivity susceptibility analysis table for butterfish.

| Productivity attribute | Rationale | Score |
|---|---|---|
| **Average age at maturity** | 1.7 years (Chao, 1978) | 1 |
| **Average maximum age** | 6.8 years (Chao, 1978) | 1 |
| **Fecundity** | 100 - 20 000 eggs per year (Chao, 1978) | 2 |
| **Average maximum size** | 40 cm (Chao, 1978) | 1 |
| **Average size at maturity** | 23.8 cm (Chao, 1978) | 1 |
| **Reproductive strategy** | Broadcast spawner (Southall et al., 2019) | 1 |
| **Trophic level** | 3.6 (Chao, 1978) | 3 |
| **Susceptibility attribute** | **Rationale** | **Score** |
| **Areal Overlap** (combined for all fisheries) | This species is targeted by some fisheries (e.g. artisanal) and is incidentally caught in others (e.g. industrial trawl). We precautionarily assume that all fisheries overlap with >30% of the stock's geographical distribution. | 3 |

| | | |
|---|---|---|
| **Encounterability** (combined for all fisheries) | Artisanal nets are not restricted to specific depths for fishing. Encounterability may be high. | 3 |
| **Selectivity of gear type** | Artisanal: mesh sizes are not regulated but for drift gillnet may range from about 4 to 8 inches. Some fish < than the size at maturity may be caught (Fig. 4a). It is not clear whether juveniles < half the size at maturity can escape the gear. | 3 |
| | Industrial trawls: wings and body have 4 to 5 cm stretch mesh and the cod end has 2.5 to 3.5 cm stretch mesh (Southall et al. 2019). Fish < than the size at maturity are caught, and juveniles < half the size at maturity cannot escape the gear. | 3 |
| **Post capture mortality** (same for all fisheries) | Butterfish are economically valuable and are generally retained in all fisheries. There are no regulations to release organisms below a minimum size, and most would be dead when released. | 3 |
| **Catch (weight) - artisanal** | 16175 tonnes (for all finfish species combined, see Table 1) | -- |
| **Catch (weight) - industrial** | 2600 tonnes (for all finfish species combined, see Table 1) | -- |
| **MSC scoring guidepost** | | <60 |

Between the available stock assessment information and the PSA, we scored the butterfish stock status indicator as red and in the 20-39 range. The stock has medium vulnerability, and there is no clear evidence that the stock is healthy, or unhealthy. However, exploitation rates may be high.

## *Gillbacker (Sciades parkeri)*

There is no published stock assessment for gillbacker. This marine catfish species is distributed from Venezuela to northern Brazil, and is listed as vulnerable on the IUCN (International Union for Conservation of Nature) Red List with a decreasing population trend (Betancur et al., 2015). The PSA suggests that fisheries pose a high risk to stock status, with a score of <60 (Table 9). This species has characteristics associated with medium to low productivity and is susceptible to high levels of fishing mortality. Thus we scored the stock status indicator as red and in the 20-39 range.

Table 9. Productivity susceptibility analysis table for gillbacker.

| Productivity attribute | Rationale | Score |
|---|---|---|
| **Average age at maturity** | 2 years (Betancur et al., 2008) | 1 |
| **Average maximum age** | 17 years (Betancur et al., 2015) | 3 |
| **Fecundity** | < 100 eggs per year. Not well-quantified, but the species has low fecundity (Betancur et al., 2015). | 3 |
| **Average maximum size** | 190 cm (Betancur et al., 2008) | 2 |
| **Average size at maturity** | 60 cm (Betancur et al., 2008) | 2 |
| **Reproductive strategy** | External reproduction with parental care (Betancur et al., 2015) | 2 |

| **Trophic level** | 4.1 (Betancur et al., 2008) | 3 |
|---|---|---|
| **Susceptibility attribute** | **Rationale** | **Score** |
| **Areal Overlap** (combined for all fisheries) | This species is targeted by some fisheries (e.g. artisanal) and is incidentally caught in others (e.g. industrial trawl). We precautionarily assume that all fisheries overlap with >30% of the stock's geographical distribution. | 3 |
| **Encounterability** (combined for all fisheries) | Artisanal nets are not restricted to specific depths for fishing. Encounterability may be high. | 3 |
| **Selectivity of gear type** | Artisanal: mesh sizes are not regulated but for drift gillnet may range from about 4 to 8 inches. Data are lacking, so we assumed fish < than the size at maturity may be caught, and juveniles < half the size at maturity may not escape the gear. | 3 |
| | Industrial trawls: wings and body have 4 to 5 cm stretch mesh and the cod end has 2.5 to 3.5 cm stretch mesh (Southall et al., 2019). Fish < than the size at maturity are caught, and juveniles < half the size at maturity cannot escape the gear. | 3 |
| **Post capture mortality** (same for all fisheries) | Gillbacker are economically valuable and are generally retained in all fisheries. There are no regulations to release organisms below a minimum size, and most would be dead when released. | 3 |
| **Catch (weight) - artisanal** | 16 175 tonnes (for all finfish species combined, see Table 1) | -- |
| **Catch (weight) - industrial** | 2 600 tonnes (for all finfish species combined, see Table 1) | -- |
| **MSC scoring guidepost** | | <60 |

## *Cuirass (Sciades proops)*

There is no published stock assessment for cuirass, a marine catfish species that is distributed from Colombia to Brazil. The PSA suggests that fisheries pose a high risk to stock status, with a score of <60 (Table 10). This species has medium productivity and is susceptible to high levels of fishing mortality. The high risk score was partly determined by the assumption that artisanal fisheries are not very selective for larger sized fish and may regularly catch juveniles. If juveniles are not regularly being caught, the PSA score would have indicated medium risk. Since there is a risk that overfishing is occurring, we have precautionarily scored the stock status indicator as red and in the 20-39 range.

Table 10. Productivity susceptibility analysis table for cuirass.

| Productivity attribute | Rationale | Score |
|---|---|---|
| **Average age at maturity** | 2 years (Taylor et al., 1978) | 1 |
| **Average maximum age** | 4 years (Meunier et al., 1994) | 1 |
| **Fecundity** | <100 eggs per year. Not well-quantified, but the family has low fecundity (Betancur et al., 2015) | 3 |
| **Average maximum size** | 100 cm (Taylor et al., 1978) | 2 |
| **Average size at maturity** | 45 cm (Taylor et al., 1978) | 2 |
| **Reproductive strategy** | External reproduction with parental care (Taylor et al., 1978) | 2 |
| **Trophic level** | 4.4 (Taylor et al., 1978) | 3 |
| **Susceptibility attribute** | **Rationale** | **Score** |
| **Areal Overlap** (combined for all fisheries) | This species is targeted by some fisheries (e.g. artisanal) and is incidentally caught in others (e.g. industrial trawl). We precautionarily assume that all fisheries overlap with >30% of the stock's geographical distribution. | 3 |
| **Encounterability** (combined for all fisheries) | Artisanal nets are not restricted to specific depths for fishing. Encounterability may be high. | 3 |
| **Selectivity of gear type** | Artisanal: mesh sizes are not regulated but for drift gillnet may range from about 4 to 8 inches. Data are lacking, so we assumed fish < than the size at maturity may be caught, and juveniles < half the size at maturity may not escape the gear. | 3 |
| | Industrial trawls: wings and body have 4 to 5 cm stretch mesh and the cod end has 2.5 to 3.5 cm stretch mesh (Southall et al., 2019). Fish < than the size at maturity are caught, and juveniles < half the size at maturity cannot escape the gear. | 3 |
| **Post capture mortality** (same for all fisheries) | Cuirass are economically valuable and are generally retained in all fisheries. There are no regulations to release organisms below a minimum size, and most would be dead when released. | 3 |
| **Catch (weight) - artisanal** | 16 175 tonnes (for all finfish species combined, see Table 1) | -- |
| **Catch (weight) - industrial** | 2 600 tonnes (for all finfish species combined, see Table 1) | -- |
| **MSC scoring guidepost** | | <60 |

## Stock rebuilding outcome (1.1.2)

| Scoring category | < 60 |
|---|---|

Rationale:
This indicator must be scored if stock status outcomes does not score green. There are no rebuilding measures in place for any of these stocks; hence the indicator receives a red score.

## Harvest strategy (1.2.1)

| Scoring category | < 20 |
|---|---|

Rationale:
A harvest strategy aims to control fishing mortality to biologically sustainable levels through a combination of monitoring (particularly in relation to stock abundance and exploitation rates), stock assessment, harvest control rules (HCRs) and management actions required for maintaining fishery sustainability. Some monitoring and stock assessments are conducted, but assessments have been largely limited to species that are significant to industrial fisheries. HCRs are lacking, as are management actions for managing fisheries exploitation.

Guyana has an artisanal fisheries management plan (Fisheries Department, 2018b) which states a goal to maintain key stocks at 50% of unexploited level or above. However, there has been limited application of appropriate fishing controls to achieve such a goal. For artisanal fisheries, there are no official input or output controls. Although fishers are required to obtain access licenses and register their vessels, there are essentially no limits on vessel numbers, vessel power, fishing gear, or harvests. There is a practical limit on numbers of Chinese seines that can be deployed due to space availability (pens are supposed to be spaced 70 feet apart), but no official limits. Closed fishing seasons or areas are also not used. In addition, fishing activities occur across national borders and EEZs, and management is not well-coordinated amongst countries. For example, some Guyanese fishers rent Suriname fishing licenses from Suriname nationals and fish in Suriname's waters, and those catches are not regularly monitored.

In summary, a harvest strategy for target stocks is clearly needed, although some strategy elements are starting to be developed.

## Harvest control rules (1.2.2)

| Scoring category | < 20 |
|---|---|

Rationale:
Harvest control rules are a set of defined, pre-agreed rules and management actions that will be taken in response to changes in indicators of stock status with respect to reference points. No HCRs are in place for stocks targeted by Guyana's artisanal fisheries.

## Harvest strategy information and monitoring (1.2.3)

| Scoring category | < 60 |
|---|---|

Rationale:
The Fisheries Department collects catch, effort and size data from a randomly-selected subset of artisanal landing sites in regions 2, 3, 5, and 6. These sampling events do not capture information on any non-landed catch but appear to cover most areas and gears, with greater coverage of the major ports and most commonly used gears (Santos et al., 2018). The data collected are catch (landings), gear type, effort (time at sea and fishing time), and biological data such as fish body length. According to the Fisheries Department, sampling is conducted in Region 4 at least four times per week and in the other administrative regions at least twice per week. At each sampling event, Fisheries Department staff record data for up to about ten

randomly selected vessels, and they also ask the vessel captains for a summary of what they caught during that trip (Y. Laurent, pers. comm. 5 September 2019). Data are checked, entered into a computer, and extrapolated to obtain estimates of landings and CPUE. Discards in artisanal fisheries are not monitored. The Fisheries Department counts numbers of artisanal vessels every four to five years.

To estimate total catches for a given time period and gear type, the sub-sampled catch data are multiplied by a factor corresponding to the size of the sample relative to the overall size of the fishery (number of vessels using that gear, number of trips per vessel over a given time period; Fisheries Department, 2018b). These official estimates group all finfish species together, but some species-specific catch data have been collected for bangamary, butterfish, and sea trout from 2002 to 2015. These data were used in the exploratory stock assessments conducted by Santos et al. (2018).

The target species are caught as bycatch in Guyana's industrial trawl fisheries. Captains of industrial vessels are required to keep logbooks on catches and effort, and submit them to the vessel owners (often the processors), who in turn submit them to the Fisheries Department (Southall et al., 2019). Industrial and small-scale processors are required to submit landings and discards data by the seventh working day every month. These species are harvested by other countries such as Suriname and Venezuela, but estimated catches for other countries are not regularly tracked and considered in management. There are no data on catches from recreational fisheries.

Although there were past attempts to have artisanal fishers complete and submit logbooks (Maison, 2007), artisanal fishers are not currently required to keep logbooks. Nevertheless, some of them do keep catch records. For example, the Upper Corentyne Fishermen's Cooperative Society (#66) regularly collects and collates data from its members, and verifies data for landings made at their complex. However, their members frequently catch and land fish in Suriname, and information on those landings is tracked less closely. Data collected by the cooperatives or individual fishers are not regularly shared with or requested by the Fisheries Department. There is a perception that fishers are resistant to sharing catch information with government authorities, suspecting that the information will be used to increase their tax rates.[1] On the other hand, some fishers have expressed a desire to share their data more regularly with the Fisheries Department, particularly if doing so would assist harvest management and assessment of fish stocks (Maison, 2007; P. Jainarine, pers. comm., 19 June 2019).

In summary, a variety of fisheries data are collected, but they are not very complete, especially for finfish and artisanal fisheries. These data would not be sufficient for supporting a robust harvest strategy. In particular, more data on catch effort are needed, and methods for extrapolating annual catches should be explicitly described and reviewed (Y. Laurent, pers. comm. 5 September 2019).

## Assessment of stock status (1.2.4)

| Scoring category | 40-59 |
|---|---|

Rationale:
Finfish species are not regularly assessed, and there is limited staff and technical capacity to conduct ongoing assessments. Fisheries Department staff regularly sample artisanal fishery landings, but the collected information is not used as a basis for regular monitoring and

[1] https://www.kaieteurnewsonline.com/2013/06/17/majority-of-artisanal-fishing-vessels-unlicensed/

estimation of abundance. No reference points for guiding harvest management have been established for the target species. To aid development of stock assessments, age and growth studies are needed for these species to obtain better estimates of life history parameters (FAO, 2019a).

Most recently, the Centre for Environment Fisheries and Aquaculture Science (CEFAS; based in the United Kingdom) conducted stock assessments in 2018 for bangamary, butterfish and sea trout based on data collected by the Fisheries Department (Santos et al., 2018). WWF-Guianas is also in the process of supporting stock assessment development for the six UoA target species.

# Ecosystem impacts - Principle 2

Principle 2 considers the impacts of the UoA fisheries on the ecosystem, including impacts on other species, habitats, and key ecosystem components. Thus is important to identify the other species caught in the fishery, as well as the characteristics of the fishing gear. The delineation between 'other' and 'target' species is not clear cut for Guyana's artisanal fisheries, which are multispecific (I. Peters, pers. comm., 10 September 2019). Nonetheless, fishers have unofficially identified some species as targets, and thus we evaluated those species under Principle 1. Under Principle 2, we evaluated the status of some of the other species that are commonly caught.

The most recent information we found on relative catch quantities of different species within artisanal fisheries is shown in Table 11. Based on that table, we have preliminarily identified sharks (e.g. *Carcharhinus limbatus*), Spanish mackerel (*Scomberomorus brasiliensis*), and king mackerel (*Scomberomorus cavalla*) as main other species. In addition, the Upper Corentyne Fishermen's Cooperative provided samples of their data recording template and their aggregated catch data for May 2019, which confirmed they catch mackerels and sharks using polytheylene gillnets. We did not have catch composition data for Chinese seines, but they are known to catch Atlantic seabob (*Xiphopenaeus kroyeri*) and whitebelly shrimp (*Nematopalaemon schmitti*; Maison, 2007). We will not focus on these shrimp species here because stock status appears to be relatively healthy for seabob (Southall et al., 2019), and Chinese seine catches of shrimps are small compared to industrial catches.

Table 11. Species with estimated catch from the artisanal fishery greater than 50 tonnes, ordered by size of estimated catch in 2016. From the Marine Fisheries Management Plan (Fisheries Department, 2018b). 'Main' species are those that comprise at least 5% of the total catch by weight.

| Local name | Family | Scientific name | Est. catch (tonnes) | Proportion of total | Category |
|---|---|---|---|---|---|
| Bangamary | Sciaenidae | *Macrodon ancylodon* | 1 455 | 0.234 | Target |
| Sea trout | Sciaenidae | *Cynoscion virescens* | 1 036 | 0.166 | Target |
| Grey snapper | Sciaenidae | *Cynoscion acoupa* | 891 | 0.143 | Target |
| Shark | Carcharhinidae | *Carcharhinus limbatus* | 749 | 0.120 | Main other |
| Cuirass | Ariidae | *Sciades proops* | 537 | 0.086 | Target |
| Spanish mackerel | Scombridae | *Scomberomorus brasiliensis* | 398 | 0.064 | Main other |
| King mackerel | Scombridae | *Scomberomorus cavalla* | 313 | 0.050 | Main other |
| Butterfish | Sciaenidae | *Nebris microps* | 222 | 0.036 | Target |
| Gillbacker | Ariidae | *Sciades parkeri* | 172 | 0.028 | Target |
| Seabob | Penaeidae | *Xiphopenaeus kroyeri* | 165 | 0.026 | Minor other |
| Catfish | Ariidae | *Bagre bagre* | 120 | 0.019 | Minor other |
| Cuffum | Megalopidae | *Megalops atlanticus* | 117 | 0.019 | Minor other |
| Snook | Centropomidae | *Centropomus spp.* | 56 | 0.009 | Minor other |

## Other species information (2.2.3)

| Scoring category | 40-59 |
|---|---|

Rationale:
The Fisheries Department conducts sampling of artisanal fishery landings, and some fishers and fisheries cooperatives record landings information as well. However, discards are not recorded, and monitoring information is insufficient to estimate the impact of the UoA on individual species with respect to their stock status, including those that would be categorized as 'other,' non-target species. Stock assessments are not conducted for these species.

Some qualitative information is available to evaluate the vulnerability of these species to fishing, but better information on fishing activity and life history (e.g. age and growth parameters) would strengthen PSA evaluations, as well as any future stock assessments.

## Other species outcome (2.2.1)

| Scoring category | 40-59 |
|---|---|

Rationale:
Main, other species caught in artisanal fisheries include sharks, such as blacktip shark (*Carcharhinus limbatus*), Spanish mackerel (*Scomberomorus brasiliensis*), and king mackerel (*Scomberomorus cavalla*; Table 11). Sharks are brought in whole or dressed (without the head and fins). Although many landed sharks are reported as being blacktip sharks, it is likely that other species are frequently caught as well. WWF-Guianas conducted a study on sharks landed by artisanal fishers, which involved genetic sampling (Liverpool 2016). Their preliminary results suggested that landings may include hammerhead sharks (family Sphyrnidae), requiem sharks such as Brazilian sharpnose (*Rhizoprionodon lalandii*) and smalltail sharks (*Carcharhinus porosus*), and tiger sharks (*Galeocerdo cuvier*). Some of these shark species are endangered and have been evaluated under the ETP species indicators below (2.3.1, 2.3.2, and 2.3.3).

Since there are no stock assessments or stock status reference points for these species, we used PSAs to evaluate their status for this indicator. Blacktip sharks are currently designated as 'near threatened' on the IUCN Red List (Burgess and Branstetter, 2009), although the assessment was conducted in 2005 and needs updating. Productivity scores were based on information from FishBase and scientific literature. Blacktip sharks have characteristics of low productivity, while the mackerels have characteristics associated with moderate productivity (Table 12). Susceptibility to the fishery was generally assumed to be high, although availability to Guyana's artisanal fisheries was assigned a low to medium risk score because blacktip sharks have a wide geographic distribution, as do the mackerel species to a lesser degree. The PSAs suggested that Guyana's artisanal fisheries pose a medium risk to stock status of these species (Table 12).

Table 12. Productivity susceptibility analysis results for the other main species caught in Guyana's artisanal fisheries.

| Species | Average age at maturity | Average max age | Fecundity | Average max size | Average size at Maturity | Reproductive strategy | Trophic level | Density dependence | Availability | Encounterability | Selectivity | Post-capture mortality | **MSC PSA-derived score** | Risk Category Name | MSC scoring guidepost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blacktip shark | 2 | 2 | 3 | 3 | 3 | 3 | 3 | | 1 | 3 | 3 | 3 | 68 | Med | 60-79 |
| S. mackerel | 1 | 2 | 1 | 2 | 2 | 1 | 3 | | 2 | 3 | 3 | 3 | 77 | Med | 60-79 |
| K. mackerel | 1 | 2 | 1 | 2 | 2 | 1 | 3 | | 2 | 3 | 3 | 3 | 77 | Med | 60-79 |

One concern is that discards of low value fish, such as kokoari (a type of catfish), regularly occur. These discards are not monitored, and management measures are not in place to ensure that the UoA doesn't hinder recovery. Without any monitoring information, it is unclear whether these discarded species may be considered 'main,' and they may not be above biologically based limits. Thus this indicator received a red score.

## Other species management (2.2.2)

| Scoring category | <20 |
|---|---|

Rationale:
There are no management measures or regulations in place for other species being caught. Sharks are often landed dressed, without head and fins (S. Edghill, pers. comm., 11 September 2019). Finning at sea may not occur regularly, but the pratice is not explicitly banned.

## ETP species information (2.3.3)

| Scoring category | 20-59 |
|---|---|

Rationale:
Encounters and incidental mortality of ETP species are not monitored in artisanal fisheries, although WWF-Guianas has developed projects to raise awareness and assist with ETP species monitoring (S. Edghill, pers. comm., 17 June 2019). Thus the impact of the UoA on ETP species cannot be estimated quantitatively. However, information is adequate to estimate productivity attributes for ETP species, and there is some general information on the gear types to evaluate susceptibility.

Monitoring information does not appear adequate to support measures to manage impacts on ETP species.

## ETP species outcome (2.3.1)

| Scoring category | <60 |
|---|---|

Rationale:
The ETP species that may be impacted by artisanal fisheries include sea turtles and potentially some shark species. Fishers report that birds and marine mammals are unlikely to be accidentally caught (P. Jainarine, pers. comm., 19 June 2019). They also try to avoid sea turtles, but incidental catches may occur, especially for large-mesh gillnets (Fisheries Department, 2018b). Although fishers also try to avoid rays, which are thought to be bad luck, they do catch some rays as well as sharks (S. Edghill, pers. comm., 17 June 2019; D. Singh, pers. comm., 11 September 2019). A study conducted by WWF-Guianas found that some sharks species caught in artisanal fisheries are of conservation concern, such as scalloped hammerhead (*Sphyrna lewini*), great hammerhead (*Sphyrna mokarran*), and Brazilian sharpnose (*Rhizoprionodon lalandii*; Liverpool, 2016). On the IUCN Red List these two hammerhead species are classified as endangered while Brazilian sharpnose is classified as vulnerable, although it should be noted that the IUCN assessments need updating (Baum et al., 2009; Denham et al., 2007; Rosa et al., 2004).

Sea turtles nest on the sand and shell beaches, particularly in northwest Guyana, from about February through August (Southall et al., 2019). The four species commonly encountered around Guyana are leatherback turtle (*Dermochelys coriacea*), green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), and olive ridley turtle (*Lepidochelys olivacea*). All of these turtles are included in CITES (Convention on International Trade in Endangered Species) Appendix I. In terms of IUCN Red List status, hawksbill and green turtles are classified as critically endangered and endangered, respectively, while leatherback and oliver ridley turtles

are classified as vulnerable (Abreu-Grobois and Plotkin, 2008; Mortimer and Donnelly, 2008; Seminoff, 2004; Wallace et al., 2013).

There have been no fishery impacts limit set on these species within Guyana, and there are no monitoring data to determine UoA impacts. Thus we used PSAs to evaluate this indicator for Brazilian sharpnose and scalloped hammerhead sharks, the latter of which has similar productivity characteristics as great hammerheads. Productivity scores were based on information from FishBase and scientific literature, which suggested that scalloped hammerheads have characteristics associated with low productivity, while Brazilian sharpnose have characteristics associated with medium productivity. Susceptibility to the fishery was generally assumed to be medium risk, although availability of scalloped hammerheads to Guyana's artisanal fisheries was assigned a low risk score because this species is widely distributed. The PSAs suggested that Guyana's artisanal fisheries pose a medium to high risk to these species (Table 13).

The MSC PSA is not appropriately calibrated for use with sea turtles, so we did not attempt to evaluate sea turtles using this method. Nevertheless, gillnets are known to pose a risk to sea turtles (FAO, 2001), and without evidence to the contrary, we cannot assume that impacts are minimal.

Table 13. Productivity susceptibility analysis results for ETP shark species that may be caught in Guyana's artisanal fisheries.

| Species | Average age at maturity | Average max age | Fecundity | Average max size | Average size at Maturity | Reproductive strategy | Trophic level | Density dependence | Availability | Encounterability | Selectivity | Post-capture mortality | **MSC PSA-derived score** | Risk Category Name | MSC scoring guidepost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S. hammerhead | 2 | 3 | 3 | 3 | 3 | 3 | 3 | | 1 | 3 | 3 | 3 | 55 | High | <60 |
| B. sharpnose | 1 | 1 | 3 | 1 | 2 | 3 | 3 | | 2 | 3 | 3 | 3 | 65 | Med | 60-79 |

Since at least one of the ETP species received a high risk score, and UoA impacts on sea turtles may be a concern, this indicator received a red score.

## ETP species management (2.3.2)

| Scoring category | 20-39 |
|---|---|

Rationale:
There are no rebuilding strategies or protections in place for shark species. Some protective measures exist for sea turtles. Fishers are not allowed to take sea turtles, and are subject to a fine of up to one million Guyanese dollars and imprisonment of at least six months if convicted of possession (Government of Guyana, 2015). Sea turtles are to be released with minimum harm when accidentally caught, and fishers using industrial trawl nets are supposed to use turtle excluder devices (TEDs) and bycatch reduction devices (BRDs). However, artisanal fishers are not required to modify their gear to reduce turtle bycatch, and one study found that they generally do not.[2]

[2] https://www.seafoodsource.com/news/environment-sustainability/majority-of-guyana-s-small-scale-fishermen-do-not-use-turtle-excluders

WWF Guianas recently developed a guide describing 43 ETP species that are known to occur in the Guianas, including sharks, rays, sea turtles and marine mammals, with input from fishers (S. Edghill, pers. comm., 17 June 2019). Their objectives for the guide are to increase awareness of ETP issues, help fishermen and regulatory offices identify ETP species, and facilitate data collection.[3]

Although some efforts are being made to protect ETP species, measures to minimize impacts from artisanal fisheries are limited, and they do not cover ETP shark species.

## Habitats information (2.4.3)

| Scoring category | <60 |
|---|---|

Rationale:
Artisanal fisheries are generally operated over sandy and muddy bottoms (FAO, 2019b; P. Jainarine, pers. comm., 19 June 2019). However, vessel activities are not mapped, and sea bottom habitats have not been mapped since the 1960s, making it difficult to determine overlap between fishing activity and types of bottom habitat. In 2019 the United Kingdom Hydrographic Office provided the Guyana Maritime Administration Department (MARAD) and the Guyana Lands and Surveys Commission with equipment and training to support seabed mapping effort.[4] The main purpose of these efforts is to collect information that will support the shipping industry and offshore oil development, but the data may be useful for considering environmental impacts from fishing activity as well.

In terms of potential vulnerable marine ecosystems (VMEs), mapping conducted in the 1960s found scleractinian, alcyonacean, and soft corals in continental shelf waters within Guyana's EEZ (McConnell, undated). The current status and locations of corals and seagrasses is unknown. Mangroves and tidal mudflats occur along the coast and serve as important spawning and nursery areas for numerous species.

The most common artisanal gear types, gillnets and Chinese seines, are used in many fisheries around the world. Thus the main impacts of those gear types on commonly encountered habitats are broadly understood. However, the types and distribution of the commonly encountered habitats are not broadly understood.

## Habitats outcome (2.4.1)

| Scoring category | 20-59 |
|---|---|

Rationale:
Artisanal fisheries are usually operated over soft, muddy or sandy seabottoms (FAO, 2019b; P. Jainarine, pers. comm., 19 June 2019). Impacts from the most common gear types used, gillnets and Chinese seines, are expected to be temporary and relate to anchoring of nets. However, starting since about 2018, more artisanal vessels have started to use winches to help haul up their nets, rather than solely relying on manual power. The winches have led to increased interactions with corals because nets can be placed deeper and hauled in even with

[3] https://guyanachronicle.com/2019/05/30/wwf-boosts-identification-of-key-marine-species-2

[4] http://guyanachronicle.com/2019/06/02/commonwealth-supports-sustainable-economic-growth-in-guyana

broken corals and rocks (P. Jainarine, pers. comm., 10 September 2019). Without winches, fishers would normally try to avoid corals because broken coral pieces are heavy and difficult to haul in by hand. Some fishers have started to use 'ticklers,' which are bags filled with cement used to weigh down driftnets (P. Jainarine, pers. comm., 10 September 2019). Effects of these ticklers is unknown but may increase interactions with bottom habitats. Sometimes seagrass is brought up with the nets (D. Singh, pers. comm., 11 September 2019). It is not known whether direct impacts from fishing gear on VMEs occurs.

Although it extends beyond the bounds of direct impacts from the UoA, plastic pollution in the environment is significant and merits some concern. During the site visit, we observed significant quantities of artificial debris, such as plastic bottles, around vessel landing sites (Fig. 5). The plastic pollution may affect variety of habitats and contribute to ghost fishing. Fishers in the CLME region have mentioned that data on land based pollution and habitat degradation, including the effects on fisher communities and fish populations, are lacking (FAO, 2019b).

Figure 5. Discarded plastic bottles and other debris around an artisanal fishery landing site in Guyana. Photo taken by J.Drugan, 19 June 2019.

## Habitats management (2.4.2)

| Scoring category | <20 |
|---|---|

Rationale:
There are essentially no management measures in place for ensuring that the UoA does not reduce structure and function of the commonly encountered and VME habitats to a point where there would be serious or irreversible harm. Regulations regarding waste disposal, including disposal of unwanted fishing gear, appear limited.

There are no marine protected areas in Guyana, although Shell Beach in the northwest has been designated as a managed resource protected area (IUCN Category VI). The Shell Beach Protected Area (SBPA) includes nesting grounds for sea turtles as well as one of the largest contiguous mangrove forests on the Guyana coast (SBPA Management Plan, 2014). The SBPA covers approximates 1 204 square km and is bounded by the Moruca, Barabara, Biara, Baramani, and Waini rivers. The SBPA Management Plan describes management goals, specifically conservation of biodiversity, maintenance of cultural heritage, and promotion of sustainable livelihoods. However, the mechanisms for achieving those management outcomes appear to still be under development.

## Ecosystem information (2.5.3)

| Scoring category | < 60 |
|---|---|

Rationale:
Broader features of the ecosystem are understood. Guyana's coastal waters are part of the North Brazil Shelf Large Marine Ecosystem (NBSLME; Fig. 6). The NBSLME consists of multiple habitat types including mud flats, sand beaches, mangrove forests, swamps, and lagoons (WWF, 2010; WWF, 2016). Heavy river runoff, mostly from the Amazon River but also from the Orinoco, Essequibo, Demerara, and Berbice rivers, makes these coastal waters highly productive and able to support extensive fisheries (Cadée, 1975; Smith and Demaster, 1996; Miloslavich et al., 2011). Mangroves and mud flats provide additional feeding and nursery habitat (Heileman, undated), and species diversity is high (WWF, 2016).


Figure 6. Fronts of the North Brazil Shelf Large Marine Ecosystem: NBCF (North Brazil Current Front) and SSF (Shelf Slope Front; most probable location). The yellow line marks the LME shelf boundary. Source: Belkin and Cornillon, 2007.

However, marine ecosystems, food web structure, and fishery impacts on ecosystem components are not well studied in Guyana. Information is therefore inadequate to identify key ecosystem elements and infer the main impacts of the UoA on these elements. Ongoing monitoring is insufficient for detecting increased risk to the ecosystem and managing ecosystem impacts.

## Ecosystem outcome (2.5.1)

| | |
|---|---|
| Scoring category | 60-79 |

Rationale:
One study on the broader NBSLME area suggested that the main threats to ecosystems and habitat quality include climate change, dam building, deforestation, pollution, overfishing, tourism and aquaculture (Isaac and Ferrari, 2017). Of these threats, climate change, pollution, and overfishing appear most directly relevant to Guyana, and artisanal fisheries may contribute to overfishing. Fisheries directly remove fish from the ecosystem, and gear loss or improper disposal may also lead to ghost fishing, which is a noted issue for gillnets (FAO, 2001). Artisanal fisheries are not operating on such a large scale that disruption of key ecosystem elements appears likely, but with the limited monitoring information, it is difficult to evaluate impacts. We have preliminarily scored this indicator at the 60-79 level.

## Ecosystem management (2.5.2)

| | |
|---|---|
| Scoring category | 40-59 |

Rationale:
There is good awareness of the need for ecosystem management, as embodied by past and current efforts to implement an ecosystem approach to fisheries (EAF). For example, the StewardFish project, which will start in 2019, aims to develop pilot projects in which fisherfolk organizations and authorities will demonstrate EAF in practice. The Guyana MOA has been developing a strategy for climate change adaptation, which includes fisheries (Fisheries Department, 2018b).

The Marine Fisheries Management Plan (MFMP) for 2013 to 2020 (Fisheries Department, 2018b) includes actions related to ecosystem management. Two such actions are to: (1) educate fishers about the social, economic and environmental impacts of ghost fishing; and (2) require vessel captains to record occurrences of lost gear and recovery attempts. In addition, the MFMP describes the following requirements for waste management:

- Waste oil and waste-water containing oil must be stored responsibly and brought to shore for proper disposal;
- All in-organic waste (including that caught in the gear) must be brought to shore, and properly disposed of;
- No dumping of processed marine waste into rivers;
- Every two years an annual review waste management in the fisheries sector.

However, it is unclear how many of these measures have been implemented in an effective manner, and none appears to explicitly address overfishing. The lack of regulations for gear and fishing capacity in the artisanal sector means that fishing activity is essentially unchecked. Fishers report that boat activity and use of longer (4 km) gillnets have increased (P. Jainarine, pers. comm., 19 June 2019), which may lead to more frequent gear conflicts and higher risk of gear loss.

# Management - Principle 3

Principle 3 focuses on whether there is an institutional and operational framework appropriate to the size and scale of the UoAs for implementing Principles 1 and 2, capable of delivering sustainable fisheries. Under this principle it is important to look for evidence of a precautionary approach in management.

## Legal and/or customary framework (3.1.1)

| Scoring category | 60-79 |
|---|---|

Rationale:
Fisheries management in Guyana is governed by both regional and national frameworks. In terms of regional frameworks, Guyana is a member of the Western Central Atlantic Fishery Commission (WECAFC), the Latin American Organization for Fisheries Development (OLDEPESCA), the Caribbean Community (CARICOM) and the Caribbean Regional Fisheries Mechanism (CRFM; FAO, 2013b). The Ministerial Council is the highest decision making body of the CRFM, and is responsible for formulating fisheries policies. The Caribbean Network of Fisherfolk Organisations (CNFO) is relevant to artisanal fisheries, especially if fisheries cooperatives become more active in co-management. The WECAFC Working Group on Shrimp and Groundfish in the Northern Brazil-Guianas Shelf provides technical and scientific advisory services relating to these transboundary fishery resources, such as information monitoring,

stock assessments, and cross-national communications.[5] The working group is also in the process of developing a sub-regional management plan for shrimp and groundfish. Guyana actively participates in these regional frameworks (FAO, 2013b). However, the national management system lacks the capacity to cooperate effectively with other countries with regard to some aspects of fisheries management, such collection and sharing of data for shared fish stocks.

The Fisheries Act (2002) is the primary law governing fisheries management in Guyana. The act covers registration of local and foreign fishing vessels, vessel licensing, marine reserves and priority areas for fishing, prohibited fishing methods, fish imports and exports, enforcement, and judicial proceedings. It defines the legal powers of the Minister of Agriculture and the Chief Fisheries Officer with respect to fisheries and identifies the Fisheries Department under the Guyana MOA as the central management unit.

Under the Fisheries Act, fishing-related disputes may be referred to the Chief Fisheries Officer, who in turn may refer the dispute to an arbitrator or conciliator (Fisheries Act, Part IV, Article 15). Any parties aggrieved by a decision can appeal, with proceedings to be conducted in public. Thus an appropriate and transparent approach to disputes is in place, though we did not learn of any specific examples by which to judge the effectiveness of the resolution process. The management authority is not subject to continuing court challenges, and no judicial decisions arising from legal challenges have yet occurred (Southall et al., 2019). At a more local level, fisheries cooperatives may perform a role in mediating disputes amongst artisanal fishers (P. Jainarine, pers. comm., 19 June 2019), but these disputes are often informal and may not require legal action.

The Ministry of Legal Affairs governs the national legal system, and posts Guyana's laws on its website: https://mola.gov.gy/information/laws-of-guyana. The Ministry of Indigenous Peoples' Affairs (https://moipa.gov.gy/) serves to enhance the social, economic and environmental well-being of indigenous peoples in Guyana, who comprise about 9% of Guyana's population. The legal rights of indigenous peoples are recognized in the Constitution of the Cooperative Republic of Guyana Act (1980) and the Amerindian Act (2006). There is a representative from Amerindian Affairs on the Fisheries Advisory Committee.

Based on the above information, a national legal system is in place, and bodies such as the WECAFC, CRFM and CNFO can potentially facilitate cooperation with other nations fishing the same stocks. The management system includes mechanisms for resolving disputes and recognizing legal rights of stakeholders who depend on fishing for food/livelihoods, including indigenous peoples. However, the national management framework may lack the capacity to effectively deliver sustainability outcomes consistent with MSC principles 1 and 2, i.e. (1) management of the stock to MSY and (2) minimizing impacts on other species, habitats and wider ecosystem components. Stakeholders and analysts have repeatedly observed that institutional frameworks could be strengthened (FAO, 2013a, 2013b).

## Consultation, roles, and responsibilities (3.1.2)

| Scoring category | 60-79 |
|---|---|

Rationale:

[5] http://www.fao.org/fi/static-media/MeetingDocuments/WECAFC/WECAFC2019/17/TOR-WG_WECAFC-CRFM-IFREMER_ShrimpGroundfishNorthernBrazil_GuianasShelf.pdf

Roles and responsibilities of organisations and individuals involved in management are generally clear. Under the MOA, the Fisheries Department oversees fisheries management and implementation of fisheries policies. The Coast Guard and Marine Police are responsible for monitoring, control, and surveillance (MCS) activities (FAO, 2013a). To facilitate stakeholder involvement in decision-making, a Fisheries Advisory Committee (FAC) with representation from government institutions and fishers' groups was established in 1986, and the committee currently meets about once per month (O. Dodson, pers. comm., 18 June 2019). FAC members include the Chief Fisheries Officer and MOA Permanent Secretary, as well as representatives from the Ministries of Public Health, Amerindian Affairs, Defense Forces, and Natural Resources. According to the Draft Fisheries Management Plan 2007-2011, an Artisanal Fisheries Advisory Committee was initiated in 1984 to help advise development of the artisanal fishery complexes, but it does not appear to be active currently.

The Fisheries Department has four department programs: Legal and Inspectorate Unit, Research and Development (under the Principal Fisheries Officer), Extension Services and Administration (Fig. 7). The Extension program consists of Fisheries Department staff who are based outside of Georgetown, currently in Regions 2, 5, and 6 (I. Peters, pers. comm. 17 June 2019). Although a Research and Development program exists, scientific infrastructure and capacity are somewhat limited. As a result, fisheries science work, including stock assessments, has largely been funded on an ad hoc basis by external parties. The CRFM, WECAFC, FAO, WWF, and the British High Commission (through their Commonwealth Economies Programme) have provided technical support and/or funding for developing scientific work.

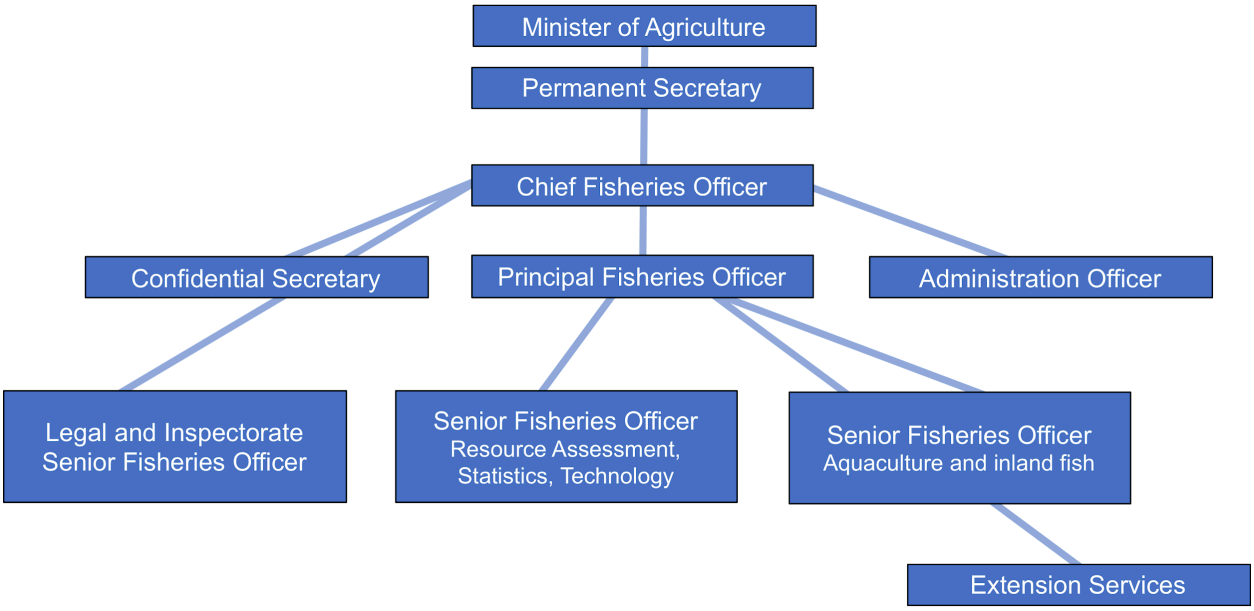



Figure 7. Key positions and programs within the Fisheries Department of Guyana. Adapted from FAO (forthcoming).

The Fisheries Department is responsible for implementing the Strategic Plan for Inland Fisheries and Aquaculture Development and Management in Guyana (2013-2020) as well as associated monitoring. According to the Fisheries Act (2002), the Chief Fisheries Officer of the Ministry is responsible for the following:

- promoting fisheries management and conservation of fisheries resources;
- organizing, participating, and providing technical inputs on national planning processes and regulatory processes;

- harmonization of policies and laws with other countries in the region;
- supporting implementation of sector development and management plans.

There are several other government agencies in Guyana that have responsibilities related to fisheries (FAO, 2013b). The Environmental Protection Agency under the Department of Environment aims to manage human impacts on the natural environment, including marine and coastal ecosystems. The Ministry of Public Health is the competent authority for enforcing health and sanitation of vessels, landing sites and processing facilities.

The management system includes consultation processes to obtain relevant information from stakeholders (FAO, 2013b). The National Policy on Inland Fisheries and Aquaculture (2012) describes a commitment to a co-management approach, and Section II of the Fisheries Act (2002) states, “In the preparation and review of each fisheries plan, the Chief Fisheries Officer shall consult with the local fishermen, local authorities and other persons affected by the fisheries management plan and with any Fisheries Advisory Committee.” An example of the use consultation processes can be seen in the ‘Strategic Plan for Inland Fisheries and Aquaculture Development and Management in Guyana, 2013-2018,’ which was developed using stakeholder input.

However, interactions with artisanal fishers appear to largely focus on landings samplings and vessel registration, and occasional educational workshops. The extent to which the Fisheries Department seeks and considers local knowledge from the fishers may be limited.

Considering the existing capacity limitations, experts have suggested that Guyana adopt a co-management strategy for its artisanal fisheries, where fisheries cooperatives would play a larger and more official role in governing their fisheries (Maison, 2007). The Upper Corentyne Fisheries Cooperative appears to be well organized and capable of contributing to management. Other cooperatives are less organized, but efforts have been initiated to improve their leadership capacity, such as those being developed under the StewardFish project.

## Long term objectives (3.1.3)

| Scoring category | 80+ |
|---|---|

Rationale:
Management of Guyana’s marine fisheries is influenced by various international agreements (described in Table 13), that are referred to in the National Policy on Inland Fisheries and Aquaculture (2012), Marine Fisheries Management Plan (2013-2020), Fisheries Regulations (2015), and the Strategic Plan for Inland Fisheries and Aquaculture Development and Management in Guyana (2013-2018). These management documents include explicit recognition of the importance of environmental sustainability and the precautionary approach. For example, the National Policy (Part V) states the following vision:

> [T]o develop in a sustainable manner the inland fisheries and aquaculture in Guyana, which contributes to the social and economic well-being of the nation, secures the people’s livelihoods and ability to earn a living, relies on and preserves traditional values and local wisdom, and will be able to meet growing demands for aquatic foods and products that are of high quality, safe, and are produced in an environmentally responsible manner, using the existing aquatic resources potential (Government of Guyana, 2012, p. 4).

The National Policy also states that EAF and a precautionary approach shall be adopted (Part XI).

The strategic plan for 2013 to 2018 describes the following ecological objectives:

1. Protect rare or fragile ecosystems, as well as habitats and other ecologically sensitive areas through a combination of co-management, conservation measures, traditional resource management and regulatory mechanisms.
2. Maintain or restore aquatic resources to levels that would enable them to provide the ecosystems services communities need for sustainable livelihoods.
3. Maintain and rehabilitate (where necessary) populations of aquatic species to levels that can produce the optimum sustainable yield.

Thus it is apparent that long term objectives, consistent with the precautionary approach and appropriate management of target stocks and ecosystem impacts, are explicit within and required by management policy.

Table 13. International and regional agreements that inform Guyanese fisheries management.

| Agreement | Abbreviated name, year | Brief description |
|---|---|---|
| United Nations (UN) Convention on the Law of the Sea | UNCLOS (1982) | Outlines the legal basis upon which signatories should ensure protection and sustainable development of marine and coastal environments and the living resources within those environments. Ratified by Guyana on 10 July 2009. |
| UN Convention on Biological Diversity | CBD (1992) | Seeks to ensure the conservation and sustainable use of biological diversity, as well as equitable sharing of benefits from utilization of genetic resources. |
| FAO Agreement on Port State Measures to Prevent, Deter, and Eliminate IUU Fishing | PSM (2009) | Aims to reduce IUU fishing through implementation of robust port state measures. It relies on regional and international cooperation to block the flow of IUU-caught fish into national and international markets. Acceded by Guyana on 7 March 2016. |
| Caribbean Regional Fisheries Mechanism Agreement | CRFM Agreement (2002) | Established the CRFM as a regional fisheries management body that promotes cooperation among member nations in the sustainable use and management of common fisheries resources and their ecosystems. |
| Caribbean Community Common Fisheries Policy | CCCFP (2011) | Provides a framework for collaborative fisheries management among the CARICOM states, to establish appropriate measures for conserving, managing, and sustainably utilizing fisheries and related ecosystems.. |
| Caribbean Community (CARICOM) Liliendaal Declaration on Climate Change and Development | Liliendaal Declaration (2009) | Describes key climate change related interests and objectives of CARICOM member states. |
| Convention for the Protection and Development of the Marine Environment in the Wider Caribbean | Cartagena Convention (1983) | Requires signatories to develop and implement national strategies to sustainably use and protect biodiversity. |

## Fishery-specific objectives (3.2.1)

| Scoring category | 80+ |
|---|---|

Rationale:
The Guyana Marine Fisheries Management Plan (MFMP) for 2013-2020 includes an artisanal fisheries management plan (AFMP). The AFMP includes both long-term and shorter-term objectives such as the following:

- Maintain key stocks at 50% of unexploited level or above.
- Maintain fishing capacity at a level where fishers have sustainable livelihoods at above the minimum acceptable income level.
- Have a co-management system in place such that fishing communities and the Fisheries Department cooperate in developing and implementing management actions for the fishery.
- Ecosystem-level impacts and impacts on endangered species are at an acceptable level.
- Landing sites have a minimum level of facilities and fish is sold in safe and sanitary conditions.
- Maintain and improve the existing catch data collection system. Ensure that the system is operating efficiently.
- Publicise the management plan, regulations and other important issues to fishermen on a regular basis.
- Work with the Coast Guard and other government and law enforcement agencies to highlight the issue of piracy and ensure a minimum level of law enforcement in Guyanese coastal waters. Offer fishermen the opportunity to contribute to a piracy insurance fund.
- Ban large-mesh gillnetting offshore of nesting beaches in Region 1 from 1 April to 30 June each year, to protect nesting turtles. Promote in fishing communities throughout the coastal area.
- Continue the dialogue with Suriname, with the objective of i) establishing a system for dealing with piracy in the border region, and ii) establishing a Fisheries Agreement such that some licences can be obtained for Guyanese fishermen on a legal basis, in return for evidence of compliance with Surinamese regulations.

Capacity for implementation is a separate issue, but it is clear that objectives consistent with the precautionary approach and appropriate management of target stocks and ecosystem impacts are explicit within the fishery specific management system.

## Decision-making processes (3.2.2)

| Scoring category | 40-59 |
|---|---|

Rationale:
The Fisheries Act (2002) explicitly describes the overall framework and relevant processes for decision-making (Part II, Section 5). The Chief Fisheries Officer is responsible for preparing and reviewing fisheries management plans (FMPs), in consultation with local fishermen, authorities, and other fishery stakeholders, including the Fisheries Advisory Committee. FMPs for specific sectors (industrial, semi-industrial, and artisanal) state objectives to be achieved and specify any management measures to be taken, and the plans are submitted to the Minister of

Agriculture for approval. Established decision-making processes that result in strategies to achieve fishery-specific objectives are therefore in place.

However, the effectiveness of these processes is limited, particularly for the artisanal sector. Fisheries Department officers regularly interact with artisanal fishers, but the department has limited staff capacity to collect information and respond to concerns regarding the fishery. For example, the Fisheries Department does not regularly analyze and present fishery data that would be useful to the fishers, or that could be used to support sustainability objectives. There is also limited evidence that decision-making processes use the precautionary approach. Issues relevant to artisanal fisheries include the following, some of which are acknowledged in the MFMP (Fisheries Department, 2018b):

- much of the artisanal fleet is unlicensed;
- monitoring of artisanal fishing effort and catches is limited;
- piracy is a significant risk for artisanal fishermen, and no insurance or compensation is available;
- fishing capacity is not regulated and appears to be increasing. Fishers report greater numbers of boats, larger boats, and gear changes such as larger nets and winches for hauling up the nets more quickly.

The Fisheries Department has made attempts to get more fishers licensed, for instance by having staff travel to regions outside Georgetown to help fishers fill out license applications, but a substantial percentage are still not licensed. The need for improved capacity and efficiency in the administration of fisheries is considerable, and since at least 2007, the Fisheries Department has expressed a goal to become a semi-autonomous agency, which would allow it to be more financially and operationally self-sufficient (Maison, 2007).

## Compliance and enforcement (3.2.3)

| Scoring category | 20-39 |
|---|---|

Rationale:
Guyana acceded to the PSMA in 2016, and under the CRFM, has agreed to collaborate with other regional and multilateral partners to identify, prevent, and eliminate IUU (illegal, unregulated, unreported) fishing within the Caribbean and globally (FAO, forthcoming).

Under the Fisheries Act (2002), the Coast Guard and Marine Police have the authority to enforce compliance with regulations, such as those relating to licensing. The Fisheries Department may assist with enforcement on land, for example by checking for installation of TEDs on industrial trawls, but cannot enforce regulations on their own (FAO, 2013a). Although roles have been defined, surveillance capacity is limited, and communication between the Guyana Coast Guard, Maritime Administration Department, and Fisheries Department is sometimes lacking (Fisheries Department, 2018b).

The Draft Fisheries Regulations (Government of Guyana, 2015) describe the following monitoring, control, and surveillance (MCS) measures:

- All fishing vessels operating in the marine fishery must be registered and obtain/renew a license every year.
- There are vessel monitoring system (VMS) requirements for vessels, to be implemented in stages. All artisanal vessels are to be fitted with a VMS by 2025, and by 2021 if they are over 50 feet.
- Vessel captains are subject to fines (up to two million Guyanese dollars) and imprisonment if they are found to interfere with VMS communications.

Penalties for non-compliance have been applied. During enforcement exercises conducted in 2018, three industrial vessels caught without TEDs were each fined GYD 100 000, and seven artisanal vessels were each fined GYD 50 000 for not having licenses (G. Baird, pers. comm. 18 June 2019). Nevertheless, enforcement is generally considered weak, and the Legal and Inspectorate Unit under the Fisheries Department has difficulty conducting its work because vessel owners, processors, and fishers may not be responsive to their information requests (G. Baird, pers. comm. 18 June 2019).

Fishers, managers, and other stakeholders have identified the following enforcement related issues (Fisheries Department, 2018b):

- much of the artisanal fleet is unlicensed, while about 96% of industrial shrimp trawlers and 62% of semi-industrial domestic snapper vessels were estimated to be licensed (Fisheries Department, 2018a);
- not all industrial and semi-industrial vessels are providing logsheets;
- enforcement of TEDs must be maintained and expanded to include BRDs (bycatch reduction devices) and VMS;
- gear conflicts may occur, where fishers may steal or damage the gear of competing fishers;
- unlicensed foreign vessels are exploiting Guyanese marine resources;
- piracy is a growing risk, particularly for artisanal fishermen, and no insurance or compensation is available.

Considering the limited MCS capacity and oversight, IUU fishing is likely significant, and at the least, many artisanal catches are not monitored or reported. Available information indicates that compliance with regulations is poor, and monitoring is inadequate.

## Monitoring and management performance evaluation (3.2.4)

| Scoring category | 60-79 |
|---|---|

Rationale:
Some reviews have taken place of key parts of the fishery management system, such as the collection of fishing effort and biological data (Mahon, 1998; CRFM, 2014). Guyana's legal and institutional frameworks have also been reviewed in recent years (FAO, 2016, 2019a).

Under the Fisheries Act (2002), the MFMP is required to be revised and updated regularly. The management plan development and review process is supposed to proceed as follows:

1. Fisheries Department formulates or revises the draft FMP.
2. Fisheries Advisory Committee reviews the draft FMP.
3. The draft FMP is submitted for public review by stakeholders.
4. The Minister of Agriculture reviews and approves the final draft of the FMP.
5. The final FMP is released for implementation.
6. The FMP is evaluated at least once every five years by the Fisheries Department, FAC, other stakeholders, and the public.

Thus some internal review processes are in place. However, external reviews have apparently not taken place for the most recent set of fisheries management plans (Southall et al., 2019).

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# Appendix

## Scoring definitions

This assessment methodology uses the following definitions for indicator scoring categories. The color scheme follows that used by MSC and on FisheryProgress.org, with green denoting good to exemplary practice (MSC score 80 or greater), yellow denoting acceptable practice with room for improvement (MSC 60 to 79), and red denoting weak practice (less than MSC 60).

| **Numeric scoring range** | **General definition of management performance** |
|---|---|
| <20 | • No management system or strategy exist, and no control over the fishery is exercised or planned. Fishery may be completely open access with no framework with which to develop management.<br>• No information on stock status exists, nor is there information to evaluate productivity or susceptibility of target species. There is no proposed program to collect data. |
| 20-39 | • Management is very poor and/or critically flawed due to a lack of resources or lack of political will.<br>• Poor information is available on impacts to target stocks and other species, and it suggests overfishing or high susceptibility. There is no basis on which to develop reference points. |
| 40-59 | • Key aspects of management remain insufficient or ineffective, likely due to a lack of resources but not lack of will or framework.<br>• Generic stock reference points are available, but available information suggests that stocks are overfished and that fishing activity causes some impact to the habitat and ecosystem. |
| 60-79 | • Some important management aspects may be lacking, but none are sufficient to prevent a passing rating by themselves. Monitoring and enforcement is in place and believed effective.<br>• Information is available to estimate fishing mortality and effects on non-target and ETP species, and the fishery is unlikely to hinder ETP recovery. Habitat and ecosystem impacts are possible, though the fishery is unlikely to cause serious or irreversible harm. |

| | |
|---|---|
| 80+ | • Management measures in place are expected to be effective, and precaution is accounted for.<br>• Stock-specific reference points are available and show that biomass is highly likely above a limit and is fluctuating around a target (normally MSY). Information is available to assess fishing mortality and impacts on non-target and ETP species. There is strong evidence that the fishery is not causing serious harm to habitats or ecosystems. |

## Scoring tables for PSA

PSA scoring tables (PF4 and PF5) from the MSC Fisheries Standard are provided below. For MSC pre-assessments, only a PSA is required to score PI 1.1.1. However, in a full assessment, a Consequence Analysis would be applied in addition to the PSA, through which stakeholder input would be used to complement available fishery-specific data and scientific literature when determining scores.

**Table PF4: PSA Productivity attributes and scores**

| Productivity determinant | High productivity (Low risk, score=1) | Medium productivity (medium risk, score=2) | High productivity (high risk, score=3 |
|---|---|---|---|
| Average age at maturity | <5 years | 5-15 years | >15 years |
| Average maximum age | <10 years | 10-25 years | >25 years |
| Fecundity | >20,000 eggs per year | 100-20,000 eggs per year | <100 eggs per year |
| Average maximum size (not to be used when scoring invertebrate species) | <100 cm | 100-300 cm | >300 cm |
| Average size at maturity (not to be used when scoring invertebrate species) | <40 cm | 40-200 cm | >200 cm |
| Reproductive strategy | Broadcast spawner | Demersal egg layer | Live bearer |
| Trophic Level | <2.75 | 2.75-3.25 | >3.25 |
| Density dependence ‼ (to be used when scoring invertebrate species only) | Compensatory dynamics at low population size demonstrated or likely | No depensatory or compensatory dynamics demonstrated or likely | Depensatory dynamics at low population sizes (Allee effects) demonstrated or likely |

**Table PF5: PSA Susceptibility attributes and scores**

| Susceptibility attribute | Low susceptibility (Low risk, score=1) | Medium susceptibility (medium risk, score=2) | High susceptibility (high risk, score=3 |
|---|---|---|---|
| Areal overlap (availability)<br>Overlap of the fishing effort with a species concentration of the stock | <10% overlap | 10-30% overlap | >30% overlap |
| Encounterability<br>The position of the stock/species within the water column relative to the fishing gear, and the position of the stock/species within the habitat relative to the position of the gear | Low overlap with fishing gear (low encounterability) | Medium overlap with fishing gear | High overlap with fishing gear (high encounterability)<br><br>Default score for target species (P1) |
| Selectivity of gear type<br>Potential of the gear to retain species | a Individual < size at maturity are rarely caught | a Individuals < size at maturity are regularly caught | a Individuals < size at maturity are frequently caught |
| | b Individuals < size at maturity can escape or avoid gear | b Individuals < half the size at maturity can escape or avoid gear | b Individuals < half the size at maturity are retained by gear |
| Post-capture mortality (PCM)<br>The chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival | Evidence of majority released postcapture and survival | Evidence of some released postcapture and survival | Retained species or majority dead when released<br>Default score for retained species (P1 or P2) |