

# Using fishers' knowledge for sustainable management in the artisanal gillnet fishery in Suriname



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## Summary

The increasing demand for fish is putting pressure on wild fish stocks worldwide. Although artisanal fisheries play a key role for people's livelihoods and food security, these fisheries are often overlooked or undervalued in fisheries' policy and management. Next to the target species, fisheries also put pressure on other species that are caught in fishery operations. This so-called bycatch is an important driver of population declines in several species of elasmobranchs (sharks, rays, skates and sawfish), marine mammals, seabirds and turtles.

There is an increasing interest in the local ecological knowledge of fishers about marine ecosystems. This can be associated with recent attempts of fisheries management to develop more sustainable approaches while also including a local 'voice'. There is a limited amount of studies on the use of local ecological knowledge in fisheries in Suriname.

Hence, this case study, which was part of the author's internship at the World Wide Fund for Nature (WWF) Guianas, explored what local ecological knowledge fishers from the artisanal gillnet fishery in Suriname hold and its (potential) role in fisheries management and conservation efforts by answering the following research question:

***How can fishers' knowledge be incorporated in fishery management and marine conservation efforts?***

All respondents are experiencing a decline in the volume in catches of most fish species and they attribute this to increased fishing effort (both artisanal and industrial). Fishers catch many more fish than just the main target species of Bang-bang (*Acoupa weakfish* or *Cynosicon acoupa*) and Kandratiki (Green weakfish or *Cynoscion virescens*). Most species of sharks, rays, turtles, and dolphins showed in a species guide during the interviews are caught at least sometimes in this fishery and all rays, turtles and dolphins are returned to sea. Most of the time, rays and turtles are found alive while sharks are mostly already dead when found in the net. The fishers also provided information on the season and locations of where they encounter the different species and perceived changes on the number they encounter now as opposed to five years ago. Next to knowledge about the different species, fishers can provide useful information about illegal and unregulated fishing practices and about changes in fishing effort.

The fishers themselves, almost all Guyanese men, do not feel that they are represented by anyone and they are not organized as a group. Members of the fishers' cooperatives involved in this fishery are mostly boat owners who do not go to sea themselves. Fishers might be better included in fisheries management or conservation projects if they are better represented within the fishery cooperatives, or at least within the main cooperative, which has established stronger relationships with the government and NGOs over the years.

**Key words:** gillnet fishery, artisanal fishery, fishers, fishing folk, LEK, ETP-species, *Acoupa weakfish*, *Cynoscion acoupa*, Green weakfish, *Cynoscion virescens*, Suriname

## Samenvatting (Dutch summary)

De toenemende consumptie van vis zet visbestanden wereldwijd onder druk. Hoewel artisanale visserijen een belangrijke rol spelen voor het levensonderhoud en voedselvoorziening van veel mensen worden deze vaak over het hoofd gezien of ondergewaardeerd in visserijbeleid en management. Visserijen zetten niet alleen de doelsoorten onder druk, maar ook andere soorten die in deze visserijen worden gevangen. Deze zogenoemde bijvangst veroorzaakt een significante afname van populaties van verschillende soorten haaien, roggen, zeezoogdieren, zeevogels en zeeschildpadden.

Er is een toenemende interesse in de lokale ecologische kennis van vissers over mariene ecosystemen. Dit kan in verband worden gebracht met pogingen van visserijmanagement om duurzamer beleid te hanteren waarin de 'lokale stem' van vissers ook een plaats krijgt. Er zijn maar een beperkt aantal studies over het gebruik van lokale ecologische kennis in visserijen in Suriname.

Deze studie, die deel uit maakte van een stage van de auteur bij het World Wide Fund for Nature (WWF) Guianas, onderzocht welke lokale ecologische kennis vissers van de artisanale kieuwnet visserij in Suriname in huis hebben en welke (potentiële) rol deze speelt in visserijbeleid en natuurbehoudsinspanningen. Dit is onderzocht door de volgende onderzoeksvraag te beantwoorden:

### ***Hoe kan lokale ecologische kennis van vissers gebruikt worden in visserijmanagement en initiatieven voor mariene natuurbehoud?***

Alle respondenten zien een vermindering in het volume van de vangst van de meeste soorten vis en schrijven dit toe aan de toegenomen visserij-inspanning (van zowel de artisanale als de industriële vloot). Vissers vangen meer dan alleen hun doel soorten Bang-bang (*Cynosicon acoupa*) en Kandratiki (*Cynoscion virescens*). De meeste soorten van de haaien, roggen, schildpadden en dolfijnen waarnaar gevraagd werd tijdens interviews worden wel eens gevangen in deze visserij en alle gevangen roggen, schildpadden en dolfijnen worden terug in zee geplaatst. Roggen en schildpadden worden vooral levend gevonden in de netten, terwijl haaien meestal dood worden gevonden. Vissers hebben ook informatie over het seizoen en de locatie waar zij bepaalde soorten tegenkomen en ze zien veranderingen in de hoeveelheid van bepaalde soorten die ze nu vangen vergeleken met vijf jaar geleden. Naast kennis over de verschillende soorten kunnen vissers ook nuttige informatie verstrekken over illegale en ongereguleerde praktijken in de visserijsector en over veranderingen in de visserij-inspanning.

De vissers zelf, die bijna allemaal Guyanese mannen zijn, hebben het gevoel dat er niemand is die hen vertegenwoordigt en ze zijn niet georganiseerd als een groep. Leden van de visserscoöperaties die betrokken zijn bij deze visserij, zijn voornamelijk booteigenaren die zelf niet op zee gaan. Vissers zouden beter betrokken kunnen zijn in visserij management of mariene milieuprojecten als ze beter vertegenwoordigd zouden zijn in de visserij coöperaties, althans in ieder geval in de grootste en oudste coöperatie, die betere relaties heeft opgebouwd met de overheid en de NGOs in de afgelopen jaren.

**Sleutelbegrippen:** kieuwnet visserij, artisanale visserij, vissers, LEK, ETP-soorten, Acoupa weakfish, *Cynoscion acoupa*, Green weakfish, *Cynoscion virescens*, Suriname

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Figure 1: Landed catch in Nickerie

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## List of Abbreviations

BV	=	Inland fishery (fishing license)
CG	=	Closed Guyana type boat
CPR	=	Common pool resource
ETP	=	Endangered threatened and protected
FAO	=	Food and Agriculture Organization
IUCN	=	International Union for Conservation of Nature
IUU	=	Illegal, unreported and unregulated
LEK	=	Local ecological knowledge
LVV	=	Ministry of Agriculture, Animal Husbandry and Fisheries
MAS	=	Maritime Authority Suriname
NGO	=	Non-governmental organization
OG	=	Open type Guyana boat
SDG	=	Sustainable Development Goal
SK	=	Suriname coast (fishing license)
SSF	=	Small scale fisheries
SUNFO	=	Surinamese National Fisherfolk Organization
VC	=	Fishers' collective of Paramaribo / Commewijne
VMS	=	Vessel Monitoring System
WWF	=	World Wildlife Fund

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# 1 Introduction

Demand for food is rising globally and especially the demand for animal protein is growing as the world population and people's income are rising. Seafood is one of the largest-traded food commodities in the world and more than half of fish exports by value comes from developing countries (FAO, 2018). The increasing demand for fish is putting pressure on the global fish stocks. 33.1% of global fish stocks are fished beyond their biological sustainability according to the FAO (2018). These data are based on stocks for which formal assessments exist, indicating that a higher percentage of fish stocks is overfished when unassessed stocks are included (MSC, 2017). Illegal, unreported and unregulated (IUU) fisheries add extra pressure on food security and causes economic losses. Limited governance in fisheries results in the inability of the institutions in place to address these problems (Pérez-Ramírez, Phillips, Lluch-Belda, & Lluch-Cota, 2012).

This study investigated the catch and fishing practices in the artisanal gillnet fishery in Suriname by interviewing, next to boat owners, government officials and NGO staff, mostly the fishers involved to capture part of their local ecological knowledge and the way they are currently involved in fisheries management and marine conservation. This information is used to answer the research question: *How can fishers' knowledge be incorporated in fishery management and marine conservation efforts?*

## 1.1 Societal background

Globally, Small Scale Fisheries (SSFs), or artisanal fisheries, play a key role in peoples' livelihoods. SSFs are often overlooked or undervalued in fisheries policy and management. This is unfair as they play an important role in poverty reduction and food security (Harper, Zeller, Hauzer, Pauly, & Sumaila, 2013) (Kosamu, 2015). SSFs are generally diverse, decentralized and dynamic and they contribute to around half the global catch, but employ more people than the large-scale sector does, as these fisheries are more labour intensive instead of capital intensive. These fisheries are therefore crucial for employment. However, the diverse, decentralized and dynamic nature of SSF can create significant challenges for effective governance (Salas, Chuenpagdee, Carlos Seijo, & Charles, 2007). In addition, SSFs are often located in regions where governments do not have enough resources and capacity to manage fisheries and enforce policies (Finkbeiner, 2015).

Fishers, managers, conservationists and other fishery stakeholders share incentives to increase the sustainability of such fisheries. Therefore, management approaches that include multiple stakeholders are needed for marine ecosystems (Wallace, et al., 2010). The sharing of knowledge and cooperation between fishers, fishery managers, non-governmental organizations (NGO's) and other fishery stakeholders is necessary to achieve sustainable fisheries.

Local experiences and understandings have been described as a system of local ecological knowledge (LEK). Interest in the ecological knowledge of resource users can be associated with recent attempts of fisheries management across the world to develop more sustainable approaches while also including a local 'voice' in developing and implementing management policies (Bundy & Davis, 2013). This has also been reflected in some of the guiding principles of *The Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries* of the Food and Agriculture Organization (FAO) of the United Nations as they urge to ensure 'active, free, effective, meaningful and informed participation of small-scale fishing communities in the whole decision-making process' and argue that 'fostering of an environment that promotes collaboration among stakeholders should be encouraged' (FAO, 2015, p.3). Recognizing and respecting existing forms of organization and traditional and local knowledge of small-scale fishing communities is also one of the guiding principles of these voluntary guidelines (FAO, 2015).

In 2015, Member States of the United Nations adopted the Sustainable Development Goals (SDG). Sustainable fisheries contribute directly to SDG 2 (zero hunger) and SDG 3 (good health and well-being), as fish contain several important nutrients, and SDG 14 (life below water), as sustainable fisheries respect the maximum sustainable yield of fish stocks and use fishing techniques that limit bycatch and environmental impacts of fishing. Well managed fisheries may contribute indirectly to more SDGs such as SDG 1 (no poverty) and SDG 8 (decent work and economic growth) (UN, 2018)

## 1.2 Scientific background

Bycatch in fisheries is an important driver of population declines in several species of elasmobranchs (sharks, rays, skates and sawfish), marine mammals, seabirds and turtles. These species encounter various types of fishing gear as they move in broad geographic ranges that support many different fisheries. To illustrate, in the period of 1990 to 2008, 5971 turtles have been formally reported as bycatch in gillnets in the Caribbean and 85,028 in gillnets, longlines, and trawlers globally. However, this number is an underestimation due to the small percentage of fishing effort that has been observed and reported (typically less than 1% of total fleets) and the lack of bycatch information from small-scale fisheries (Wallace et al. 2010).

There is a limited amount of studies on the use of local ecological knowledge in fisheries in Suriname. Rodríguez Pérez (2014) made use of LEK in addition to fisheries data sources (such as logbook data and fishing locations) to study the ecology and dynamics of the Atlantic Seabob shrimp in Suriname. Nijbroek examined in his study what different environmental knowledge from which different groups count in the role that mangroves play in protection against sea level rise and coastal erosion. He argues that both local and scientific knowledge on this topic show limitations and that a combined knowledge may be more suitable for developing locally sustainable climate change policies (Nijbroek, 2014). There has also been a socio-economic study on the fisheries sector in Suriname (Smith & Burkhardt, 2017) which collected data through interviews with the Ministry of Fisheries and secondary data collection.

In many tropical countries, funds for carrying out biological research are limited. This makes information provided by fishers an important source of information (Silvano & Valbo-Jørgensen, 2008). Next to just information on catch statistics, research in which fishers are interviewed can also shed light on their fishing practices and the ways they respond to changes in the catch.

## 2 Theoretical Framework

### 2.1 Local Ecological Knowledge

For some coastal fisheries, especially in developing countries, it is difficult to gather the detailed (biological) data often required to support management initiatives because of a lack of resources. Part of the solution could be to use available knowledge held by local fishermen about for example the environment in which they work, target species size and abundance, fish behavior etc. (Machado Martins, Pereira Medeiros, Di Domenico, & Hanazaki, 2018) (Daw, Robinson, & Graham, 2011). Such information from fishers has been treated as anecdotal and of lesser value. However, more and more people are beginning to see that this knowledge can be a useful source of information which could complement fishery data collection by conventional approaches or can be used to formulate hypotheses that can be tested with more conventional research methodologies (Silvano & Valbo-Jørgensen, 2008). Interviews with fishers can contribute to understanding the decline of fish species over time, provide information about changes in ecosystems, and fill in gaps of data in landings for small-scale fisheries.

This type of knowledge can be defined as local ecological knowledge (LEK) which represents a dynamic form of knowledge rooted in social groups and developed through practical experience of a local ecological setting (Pita, Fernández-Vidal, Carcía-Galdo, & Muino, 2016). Fishers' knowledge can in some cases be more up to date than formal scientific knowledge and it often provides a longer historical perspective. Besides, LEK can also have a broader scope since it may include knowledge of ecological, social, technical and economic aspects of fisheries that have not been pinned down by conventional fisheries science. In some cases, landings data is useful for detecting large-scale trends but cannot show trends at smaller scales, while fishers do see them as they know there have been subtle increases in fishing effort for example (Daw, Robinson, & Graham, 2011).

The reliability of fishers' memories however is questionable as it may be unreliable and thus cannot be considered as exact representations of the past. In contrast to scientific collected data, local knowledge is mostly not systematically recorded. However, all types of knowledge, be it scientific knowledge or memories and observations by fishers, can be partial and affected by the context in which they are formed (Murray, Neis, Palmer, & Schneider, 2008). These previous studies show that local ecological knowledge can be a useful source of information be it on the state of fisheries of the past, on current gaps in knowledge in data deficient fisheries, or to shed light on the perceptions and ideas of the fishers themselves.

Besides adding information about fish stocks and the health of marine ecosystems, including LEK also serves to bring local perspectives into conservation debates and fisheries management. This could strengthen the political voices of fishers and improve collaboration between fishers and other fisheries stakeholders. Fisheries management which integrates knowledge and traditions of the local resource users is more likely to succeed as opposed to top-down management that imposes regulations by a central administration. Silvano and Valbo-Jørgensen (2008) therefore argue that properly recording, analyzing and interpreting local ecological knowledge is necessary to foster fishers' participation in management. Daw et al. (2011) too argue that engaging with fishers' knowledge improves the legitimacy of fisheries governance.

### 2.2 Co-management and participatory conservation

The incorporation of LEK into fisheries management can be part of co-management and in the case of incorporating LEK into conservation efforts as participatory conservation. When resources of a natural system are co-managed, the resource management responsibility and authority are shared between users and government agencies (Berkes & Folke, 2000). Conservation efforts and fishery management will have more effect if the design and management fit the locality, with local participation and consultation of the local resource users and their organizations. With the involvement and support of them, conservation measures will have a greater local societal

embedding. Integrating LEK contributes to local participation and prevents top down conservation efforts and fishery management. Top-down governance of SSF has proven difficult and decentralized governance holds potential for greater success in SSF. One of the reasons why the conventional approach has not worked is because of the lack of participation and empowerment (McConney & Charles, 2008).

### 2.3 Ecosystem based management and socio-ecological systems

Although the term *ecosystem-based management* means different things to different people, it is used to describe a holistic resource management that incorporates more parts of the ecosystem than just the species of interest. Ecosystem-based fisheries management recognizes the physical, biological, economic, and social complexities of managing marine resources and the trade-offs between those elements. It thus considers competing objectives and cumulative impacts to optimize the benefits for all fisheries in an ecosystem (Patrick & Link, 2015).

Linked to this ecosystem-based approach is seeing fisheries as *socio-ecological systems*. Social systems involve property rights, land and resource tenure systems, systems of knowledge of environment and resources, and world views and ethics regarding the environment and resources. Ecosystems usually refer to the natural environment in which different organisms and non-living aspects within a certain boundary interact with each other (Berkes & Folke, 2000). Socio-ecological systems are thus a combination of social systems and ecosystems in which there is an interplay of natural resources and resource users which is often complex and unpredictable with multiple causes. There are feedbacks between the natural and social systems that compose a socio-economical system (Basurto, Gelchich, & Ostrom, 2013). Hence, socio-ecological systems offer a holistic view of ecosystems in which resource users (in this case fishers) are incorporated. In this case study the fishery is perceived as such a socio-ecological system in which the resource users are dependent upon the ecosystem and use this ecosystem to maintain their livelihood and in turn impact the ecosystem itself.

### 2.4 Sustainable wild fish resource management

The increasing awareness of the fragility of such socio-ecological systems motivates different actors to manage and develop such systems more sustainably. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987). When applied to fisheries this means that fisheries resources should be used in such a way that fish stocks do not decline and that the ecosystems on which they depend are not degraded so that future generations can still use these resources for their livelihoods (both for own consumption and for employment in the fisheries sector).

Wild fish stocks are common pool resources (CPRs) which can be defined as resources in which “exclusion of beneficiaries through physical and institutional means is especially costly, and exploitation by one user reduces the resource availability for others” (Ostrom et al., 1999, p. 278). These two aspects create possible problems if people follow their own short-term interests which produces outcomes that contradict anyone’s long-term interest. When there are no effective rules in place that limit access and define rights and duties, overuse with negative effects for others can occur (Ostrom, Burger, Field, Norgaard, & Policansky, 1999).

When fish is harvested at a higher rate than the rate of reproduction, overfishing takes place which results in depleted fish stocks. Fishery management therefore aims to ensure that catch rates never exceed the rates of the biological replenishment of fish stocks. Next to overfishing, bycatch and

habitat destruction by fishing gear also negatively affect marine ecosystems. Bycatch in fisheries is an important driver of population declines in several species of elasmobranchs (sharks, rays, skates and sawfish), marine mammals, seabirds, turtles, and non-targeted fish species (Wallace, et al., 2010). Bycatch is often discarded dead at sea. Illegal, unreported and unregulated fishing also undermines efforts to manage fisheries sustainable.

In 1995 the FAO established the Code of Conduct for Responsible Fisheries to strengthen the international legal framework for effective conservation, management and sustainable exploitation and production of living aquatic resources (FAO, 2019). This code recognizes the nutritional, social, economic, environmental and cultural importance of fisheries and the interests of all stakeholders of the fishing industry.

Some of the characteristics of a sustainable fishery which are outlined in the general principles of the Code of Conduct for Responsible Fisheries are: the amount of fish taken from the ecosystem is within its carrying capacity; limited amount of bycatch; the natural habitat is not damaged by the fishing activities; effective monitoring and control; compliance to legal frameworks; transparent decision making processes; consultation and participation of industry, fish workers, environmental and other interested organizations in decision making in relation to the development of laws and policies; fishers are involved in the policy formulation and implementation process; fisheries activities should ensure safe, healthy and fair working and living conditions and meet internationally agreed standards (FAO, 2019).

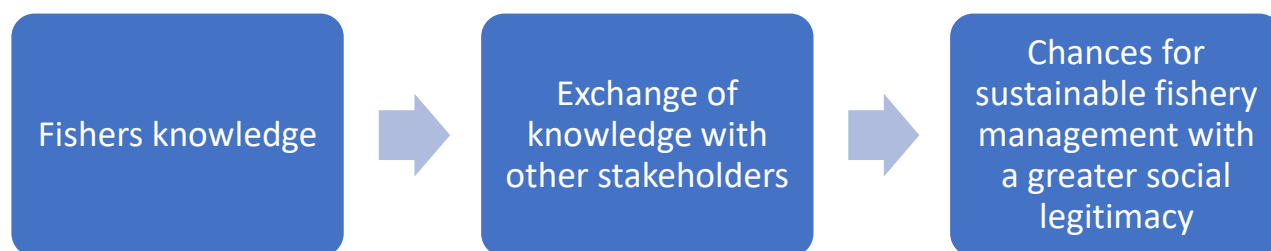


Figure 2: Conceptual framework, authors own.

## 2.5 Knowledge Gap

The potential value of LEK in fisheries is described in the literature, for example in Silvano & Valbo-Jørgensen (2008) and Daw, Robinson, and Graham (2011), but how to systematically incorporate it in fisheries management still forms a research gap. Raymond et al. (2010) highlight the importance of further research on how to integrate multiple knowledge types. Fisheries management traditionally relies mostly on biological data such as catch landings. This does not reflect part of the catch which may be discarded at sea. Fishers' LEK could add information on the interaction between endangered species and coastal fisheries in Suriname, of which there is currently little information available.

There has been a socio-economic study on the fisheries sector in Suriname (Smith and Burkhardt, 2017) which collected data through interviews with the Ministry of Fisheries and secondary data collection. However, no fishers were interviewed in this study. Interviews with fishers can highlight their practices at sea, their knowledge on the resources in question, and provide additional information from the base of the value chain. This thesis aims to contribute to close this research gap on how to integrate LEK into fisheries management and conservation efforts by means of a case study in Suriname in the artisanal gillnet.

### 3 Research aim and research questions

This thesis aims to contribute to the academic and policy debate on the value of local ecological knowledge in sustainably managing fisheries. It does so by identifying pathways by which fishers' knowledge can be incorporated into fishery management and conservation through analysing a case study of the artisanal gillnet fishery in Suriname. The principle target species of this fishery are Bang-bang (*Cynosicon acoupa*) and Kandrati (*Cynoscion virescens*).

This research aim leads to the main research question:

***How can fishers' knowledge be incorporated in fishery management and marine conservation efforts?***

There are three sub questions to answer the main question:

1. *What are the socio-economic characteristics of the fishery?*
2. *What do fishers know about their bycatch and their target species?*
3. *How is fisher's knowledge currently used by the Fisheries Department and NGOs?*

## 4 Operationalization

This section shows how different concepts are defined or measured in this research.

**Bycatch:** refers to the part of the catch of a fishing operation that has been incidentally caught. All bycatch or part of it may be thrown into sea as so-called discards, or it may be taken to shore (FAO, 2019). The meaning of bycatch is slightly different from *non-target species* which can be defined as species caught for which the gear was not specifically set but may have a commercial value and can therefore be desirable to catch (FAO, 2019). In the interviews, respondents were asked about species they do not aim to catch, that they discard at sea and that they cannot sell.

**Target species:** refer to those species that are primarily aimed for by the fishers in a specific fishery (FAO, 2009). In the interviews, respondents were asked about species they can sell.

**Artisanal fishery:** The term artisanal fishery is used for a wide variety of fisheries which can differ significantly in fishing methods and size and varies between countries. The terms artisanal fisheries and small-scale fisheries are often used interchangeably. The FAO defines artisanal fisheries as:

*Traditional fisheries involving fishing households (as opposed to commercial companies), using relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, mainly for local consumption.'* (FAO, 2014).

The term indicates relatively low levels of technology, but this may not always be the case and artisanal fisheries can very well be for commercial ends instead of just for subsistence (FAO, 2014). In this research, the distinction of the artisanal fleet and the industrial fleet of the Ministry of Agriculture, Livestock, and Fisheries is used, which places this gillnet fishery in the artisanal sector.

**Gillnet:** a gillnet is a wall of netting that hangs vertically in the water (see figure 3). In this case study in Suriname, the net is located near the bottom. Fish get trapped when they get stuck with their gills in the net (MSC, 2019)

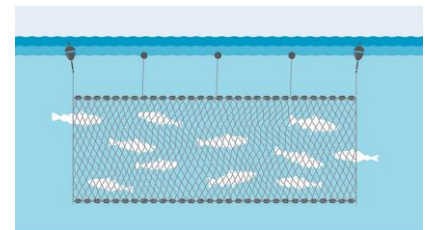


Figure 3: Gillnet (MSC, 2019)

### Local ecological knowledge (LEK):

In the literature academics use the terms *traditional ecological knowledge* and *local ecological knowledge* (LEK) often for the same sort of knowledge. *Traditional ecological knowledge* can be defined as: *a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment* (Berkes & Folke, 2000, p.5). The term *traditional* is generally used to historical and cultural continuity, however, societies continuously redefine what 'traditional' practices are (Berkes & Folke, 2000). Because the term traditional can be ambiguous and ecological knowledge from resource users does not necessarily have to come from traditions passed down by generations, the term *local ecological knowledge* is used in this research which refers to a dynamic form of knowledge rooted in social groups (for example resource users) and developed through practical experience and observations of a local ecological setting (Pita et al. 2016). In the interviews with fishers, questions about their ecological knowledge included questions about their catch, what they do with it, where and when they catch them, perceived changes in the catch over the last five years, and whether they know where, when and where certain species breed.



## 5 Research context

### 5.1 Suriname

Suriname is located in South America and is divided into ten districts (see figure 4). 86% of the total population lives in the coastal districts (Menke, 2016). Suriname is part of the Guianas together with its neighbouring countries Guyana to the west and French Guiana to the east. These countries are part the highly productive North Brazil Shelf Large Marine Ecosystem which extends along north-eastern South America from Brazil heading north to the boundary with the Caribbean Sea and has a surface area of about 1.1 million km<sup>2</sup> (see figure 5). Local rivers discharge nutrients into the sea as well as the Amazon<sup>1</sup>, which nutrients are brought northwest to the Guianas by the North Brazil Current and the Guiana Current. This boosts plankton and other primary organic matter which provides the country with a rich resource of marine life, supporting Suriname's fisheries sector (Willems, 2016).

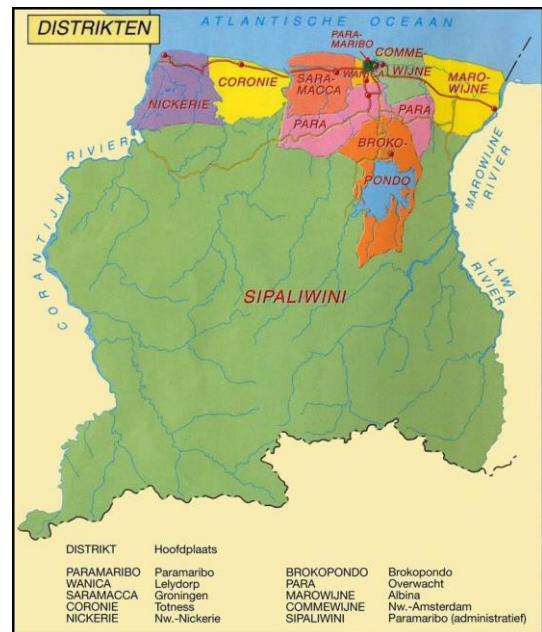


Figure 4: Districts of Suriname



Figure 5: The North Brazil Shelf Large Marine Ecosystem and the Caribbean Large Marine Ecosystem (CLME+ Project, 2017)

<sup>1</sup> On average, the Amazon river discharges 5330 KM<sup>3</sup> into the Atlantic Ocean every year (Dai & Trenberth, 2002).

Suriname has important turtle nesting locations between the Marowijne and Suriname River for several species of sea turtles. The three turtle species that come to shore to nest on the beaches are the leatherback turtle (*Dermochelys coriacea*) (see figure 6), the Green turtle (*Chelonia mydas*), and to a lesser extent the Olive Ridley turtle (*Lepidochelys olivacea*). The populations of the leatherback turtle and the Green turtle are decreasing according to the International Union for Conservation of Nature (IUCN) and have been listed by this organization as endangered (The Northwest Atlantic Leatherback Working-Group, 2019) (Seminoff, 2004). The population of the Olive Ridley turtle is decreasing as well and this species has been listed as vulnerable (Abreu-Grobois & Plotkin, 2008). These sea turtles come to shore and nest on beaches between April and July. The fishing area of the artisanal coastal fishery is partly in front of the most important egg laying area for turtles in Suriname. Poaching of turtle eggs and stray dogs digging up and eating eggs pose an additional threat to the survival of these species.



Figure 6: Leatherback turtle

## 5.2 Fishing industry in Suriname

Suriname's fishery sector is an economically important sector, providing 8000 jobs (Madarie, 2006), and an important contribution to food supply, providing 16% of the animal protein intake for the nation (McConney, Stratoudakis, & Di Cintio, 2017). Within the fishing sector the artisanal fleet plays an important role. The Fisheries Department estimated that the artisanal fleet lands about 50% of the country's fish (personal communication Fisheries Department, 22-08-2019) and of the 790 coastal fishing licenses handed out in 2019, 445 were designated for the artisanal fleet (LVV, 2019). The artisanal fleet is more labor intensive than the industrial fleet, which means that most fishers work in the artisanal fleet (LVV, 2013).

The industrial fisheries in Suriname consist of shrimp and fish trawling and longline fishing for larger pelagic species. The artisanal fisheries use fishing techniques such as fyke net fishing, seine net fishing, line fishing and chase pin fishing in the rivers and river mouths and gillnet fishing in the coastal waters and further from the coast (Smith & Burkhardt, 2017). The total catch in Surinamese waters was 39,993 tons fish and 8,587 tons shrimp in 2017, an increase of respectively 51.1% and 1.8% compared to 2013. The fishing industry represented 4.4% of the GDP in that year (General Bureau of Statistics, 2018). However, these catch statistics are only from the industrial fishery and do not reflect the whole fishing sector.

The Exclusive Economic Zone (EEZ) of Suriname stretches from the coast to 370 kilometres (200 nautical miles) offshore from the 386 km long coastline and is divided into different fishing zones indicated by fathoms (depth). Regarding bathymetry, the artisanal fishery operates until 9 fathoms (16.5 m), the Seabob shrimp fishery operates between 10 (18 m) and 15 fathoms (27 m) extending to 18 fathoms (33 m) in the east, the fish trawlers, other shrimp-trawlers and the longline fishery operate beyond 15-18 fathoms (see Figure 7) (LVV, 2013) (Willems, 2016) (LVV, 2019).

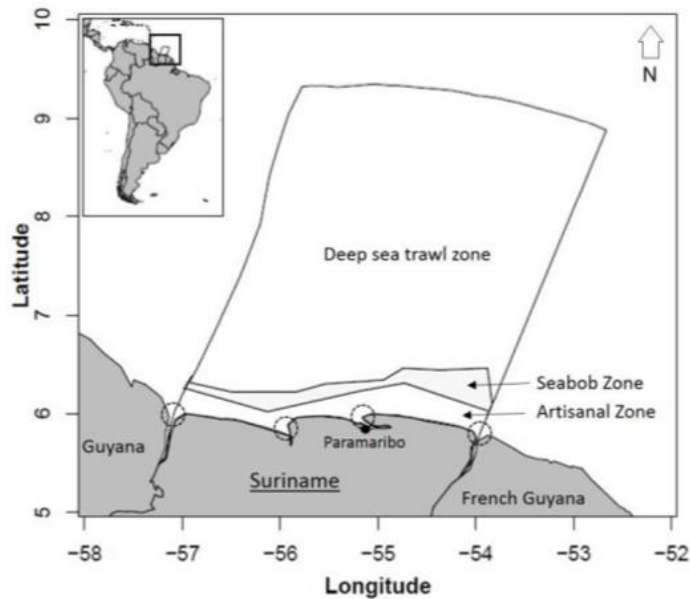


Figure 7: Suriname's Exclusive Economic Zone (EEZ) showing the legal zonation for artisanal, seabob and deep sea trawl fisheries and the four main estuaries in circles from West to East the Corantijn-Nickerie estuary, the Coppename-Saramacca estuary, the Suriname-Commewijne estuary and the Marowijne estuary. From Willems 2016.

Only Surinamese citizens can obtain fishing licenses to fish commercially. Artisanal vessels can get one of three types of fishing licenses: a BV (inland navigation) license is used to fish in rivers and estuaries. A SKB license uses 'open type Guyana boats' with gillnets of max 1 km in length and a minimum of 7.75 cm mesh size to fish until 5 fathoms and targets mainly King weakfish (Bangamary or Dagoetifi) and Smalleye croaker (Botervis). The maximum length of boats used for SKB is 15 meters and they can fish no more than 3 days. The third type of license is SK (Suriname coast) which allows fishers to fish until 9 fathoms along the lengths of the coast. SK fishers stay at sea for two to three weeks at a time and use either 'open' or 'closed' Guyana boats (see figures 8 and 9). The maximum length of the open type boats for SK is 18 meters with a maximum engine power of 75 horsepower and for the closed type boats the maximum length is 20 meters with a maximum engine power of 155 horsepower. SK Open Guyana types can use a net of 3 km and Closed Guyana types can use a net of 4 km long. Both type of boats can use a mesh size of minimum 20 cm for 70% of the net and 12.7 cm for the remaining part of the net (LVV, 2019). The number of SK licenses are limited by the Fisheries Department while there is no limit to the issuing of BV licenses (Smith & Burkhardt, 2017).



Figure 8: Open Guyana type boat



Figure 9: Closed Guyana type boat

All fishers need to register their vessels as required by the Fishing Decree. The register is managed by the Maritime Authority Suriname (MAS). Also, all artisanal and commercial licensed fishermen should install a Vessel Monitoring System (VMS) on their vessel (Smith & Burkhardt, 2017). However, in practice this tracking device is not installed by the artisanal fleet. Some SK vessels use the same SK number, and fishing licenses linked to this number, while this is not allowed (LVV, 2013). This illustrates that despite the regulatory systems and institutions in place, the implementation of and compliance to these rules are not perfect in practice.

### 5.3 WWF Guianas

This study is part of an internship at the World Wildlife Fund Guianas (which operates in Guyana, Suriname and French Guiana). The WWF's mission is to conserve nature and reduce the most pressing threats to the diversity of life on earth (WWF, 2019). One of the aims of WWF Guianas is to reduce bycatch of sea turtles, sharks, rays and estuarine dolphins in fishing nets, of which some are endangered, threatened and protected (ETP). Bycatch of these species in the artisanal gillnet fishery in Suriname is undesirable for fishers as their nets can get damaged and it harms vulnerable species populations. Little information is available on the interaction between these species and coastal fisheries (IUCN, 2019).

'Oceans practices' is one of WWF Guianas main areas of focus (WWF, 2019) and there have been several programs and activities to stimulate a transition towards more sustainable fishing activities in the Guianas. WWF Guianas has been involved in implementing successful 'turtle excluder devices' for industrial shrimp trawlers which reduced the bycatch of sea turtles. The WWF was involved in improving the national industrial Seabob fishery to such a level that it obtained the MSC ecolabel for wild caught sustainable fish in 2011 and the WWF is still involved as it is part of the 'Seabob working group', and together with other stakeholders the WWF improved the organization of the Chinese seine fisheries sector in Suriname's estuaries to enhance traceability and sustainability. More recently the WWF organized species recognition sessions in Guyana with artisanal fishers. Programs still ongoing at the time of writing are a stock assessment with the help of fishers on several species caught in the SK gillnet fishery based on the length of the landed fish and a participatory sea mapping project in which fishers from different fisheries are asked about what kind of activities take place in which areas. Another study that will start this year is an evaluation on the functioning of the different fishers' cooperatives. Fishers will be interviewed for this as well. Conservation International<sup>2</sup> recently started an onboard monitoring study on the catch composition of the SK gillnet fishery and about the lifecycle of Bang-bang and Kandratiki, for which fishers are asked when and where they find the fish with ripe eggs. Captains fill in an assessment form and get 10 USD per day on the fishing trip for doing this.

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<sup>2</sup> Conservation International Suriname has been involved with this fishery since 2017.

## 6 Methods

### 6.1 Data collection

The fieldwork and primary data gathering took place between April and June 2019.

#### Semi-structured interviews

Semi-structured face to face interviews which followed a general script and covered a list of topics were used to stick to certain topics while at the same time allow some space for the interviewee to elaborate further on topics that he or she felt deserved more attention (Bernard, 2011). When the interviewee allowed it, the conversation was recorded and transcribed. Only one respondent did not want to be recorded. Notes were taken during every interview even when it was recorded. This allowed me to take notes about the interview itself (for example: did the researcher use much probing to get to answers) and to write down thoughts to which I wanted to come back later. Although the main data collection method consisted of semi structured interviewing, useful information was used when it popped up in informal conversations. However, this information too has only been used with the consent of that person (see informed consent and anonymity below). During some of the interviews, maps were used in which respondents could point to certain areas in which they for example fish regularly or find certain species.

Fishers at the landing docks were selected based on whether they were available at that moment and sometimes the snowball method was used, where one fisherman recommended another. I conducted complete interviews with 20 fishers, spoke to 18 more fishers who either did not have time for a complete interview or joined the conversation at some point during an interview with another fisher (hence, the 'half semi-structured interviews' in the table below). Of these fishers, two also owned their own boat(s) (see table 1). Seven more boat owners were interviewed of whom two are also in the board of the fishery cooperative of Paramaribo / Commewijne (VC) (see table 2 and table 3). Furthermore, two staff members from Conservation International Suriname, one government official from the Fisheries Department, a former fisher, and a member of the fishers' collective of Nickerie were interviewed. Shorter conversations were held with three more boat owners, of whom one is also a board member of VC, two other staff members of the Fisheries Department, a data collector from the government (who collects data from one of the landing sites), and with three staff members of WWF Suriname throughout the internship (see table 4). With five fishers I met at twice to show them preliminary results of what I had done so far and to receive some feedback.

Most of the interviews took place in Paramaribo at 'Waldring' wharf, but there were also some held at CEVIHAS in Paramaribo, Nieuw Amsterdam in Commewijne and Nieuw Nickerie in Nickerie (see figure 10).



Figure 10: Fieldwork locations in Suriname

#### Key informant

Early in the fieldwork, I met a respondent who owns a boat herself and whose husband is a captain. She introduced me to most other respondents and helped with translating during some of the interviews when the Guyanese accent of some fishers was hard to understand. We built up a good working relationship and she became my key informant.

Table 1: Overview of fishers interviewed

CG = Closed type Guyana boat. OG = Open type Guyana boat. Fishermen who are not a captain are called “workmen”.					
Position	Gender	Background	Type of interview	Date	Location
Captain CG	M	Guyanese	Complete semi-structured	10 April & 17 June 2019	Paramaribo / Waldring
Captain OG	M	Surinamese	Complete semi-structured	12 April 2019	Commewijne/ Nieuw-Amsterdam
Workman OG	M	Guyanese	Half semi- structured	12 April 2019	Commewijne/ Nieuw-Amsterdam
Workman CG	M	Guyanese	Complete semi- structured	17 April 2019	Paramaribo / Waldring
Workman CG	M	Surinamese	Complete semi- structured	24 April 2019	Paramaribo / Waldring
Workman CG	M	Guyanese	Complete semi-structured	24 April 2019	Paramaribo / Waldring
2 Workmen CG	M	Guyanese	Half semi-structured	25 April 2019	Paramaribo / Waldring
Former workman CG	M	Guyanese	Complete semi-structured	01 May 2019	Paramaribo / Waldring
2 Workmen OG	M	Guyanese and Guyanese/ French	Complete semi-structured	07 May and one again 17 June 2019	Paramaribo / Waldring
Workman CG	M	Guyanese	Complete semi-structured	07 May and 20 June 2019	Paramaribo / Waldring
Workman CG	M	Guyanese	Complete semi-structured	08 May & 20 June 2019	Paramaribo / Waldring
Captain CG & boat owner CG	M	Guyanese	Complete semi-structured	20 May 2019	Commewijne/ Nieuw-Amsterdam
Captain OG & 2 workmen	M	Guyanese	Complete semi-structured	24 May 2019	Nickerie / Waterloo
2 Captains OG	M	Guyanese	Half semi-structured	25 May 2019	Nickerie / Waterloo
Workman OG	M	Guyanese	Short conversation	26 May 2019	Nickerie / Waterloo
Captain CG and a captain/owner of one OG and one CG	M	Guyanese and Guyanese but with Surinamese nationality	Complete semi-structured	03 June 2019	Paramaribo / CEVIHAS
Captain OG	M	Guyanese	Half semi-structured	03 June 2019	Paramaribo / CEVIHAS
Captain CG	M	Guyanese	Half semi-structured	04 June 2019	Paramaribo / Waldring
Workman CG	M	Guyanese	Complete semi-structured	12 June 2019	Paramaribo / Waldring
Workman CG	M	Guyanese	Half semi-structured	19 June 2019	Paramaribo / Waldring
Captain OG (wife is boat owner)	M	Guyanese	Complete semi-structured	19 & 20 June 2019	His house in Paramaribo
2 Workmen OG	M	Guyanese	Complete semi-structured	18 June 2019	Paramaribo / Waldring
Workman CG	M	Guyanese	Complete semi-structured	20 June 2019	Paramaribo / Waldring
Workman OG	M	Born in Guyana, since age of 6 in Suriname	Half semi-structured	26 June 2019	Paramaribo / Waldring

*Table 2: Overview of boat owners interviewed*

Position	Gender	Background	Type of interview	Date	Location
Boat owner (he and the next three were interviewed together)	M	Surinamese	Complete semi-structured	26 April 2019 & 25 June 2019	Paramaribo / Waldring
Former boat owner	M	Surinamese	Complete semi-structured	26 April 2019 & 25 June 2019	Paramaribo / Waldring
Boat owner	M	Surinamese	Half semi-structured	26 April 2019 & 25 June 2019	Paramaribo / Waldring
Boat owner	F	Surinamese with a Guyanese background	Complete semi-structured	26 April 2019 & 25 June 2019	Paramaribo / Waldring
Boat owner	F	Surinamese	Complete semi-structured	14 May 2019	Burger King Paramaribo
Boat owner	M	Guyanese	Informal conversation	03 June 2019	Paramaribo / CEVIHAS
Boat owner	M	Surinamese with Guyanese background	Informal conversation	03 June 2019	Paramaribo / CEVIHAS
Boat owner	M	Surinamese	Informal conversation	04 June 2019	Paramaribo / Waldring

*Table 3: Overview of board members interviewed*

Board members	Gender	Background	Type of interview	Date	Location
Board member fishers' cooperative Paramaribo / Commewijne and boat owner SKB	M	Surinamese	Complete semi-structured	16 May 2019	Vissers Collectief Nieuw Amsterdam
Board member fishers' Cooperative Nickerie	M	Surinamese	Complete semi-structured	25 May 2019	Nieuw Nickerie
Board member fishers' cooperative Paramaribo / Commewijne and boat owner SK & SKB	M	Surinamese, but born in Guyana	Complete semi-structured	06 June 2019	Fish market Paramaribo
Board member fishers' cooperative Paramaribo / Commewijne and boat owner SK	M	Surinamese	Informal conversations during meetings	May and June	Paramaribo and Commewijne

*Table 4: Overview of other stakeholders interviewed*

Position	Gender	Background	Type of interview	Date	Location
Three WWF staff members	One man and two women	Surinamese man, Dutch woman and Belgian woman	Informal conversations during the internship period	April - June	WWF office Paramaribo
Two Conservation International staff members	One man and one woman	Surinamese man and Dutch woman	Complete semi-structured	07 May 2019	Conservation International office Paramaribo
Staff member Fisheries Department	M	Surinamese	Complete semi-structured	10 May 2019	Fisheries Department Paramaribo
Data collector	M	Surinamese	Informal conversation	03 June 2019	Paramaribo / CEVIHAS
Two staff members Fisheries Department	M	Surinamese and Belgian	Informal conversations during meetings	April - June 2019	Paramaribo

## Participant observation

Participant observation is used to observe and understand the respondent's way of looking at the research topic and to see what is actually happening (instead of just hearing from people what is happening). During participant observation in fishery related meetings field notes were taken about things seen and heard in these settings. I attended two meetings about updating the Fishery Management Plan for Suriname for which input from the different stakeholders was asked; a training on value chain management, product development and value addition for the small-scale fisheries sector in Suriname organized by Qpoint, Nuffic, SUNFO, and Vissers Collectief; meetings about the methodology of an upcoming study on the functioning of the different fishers' cooperatives; and a participatory mapping meeting organized by among others the WWF in which fishers were asked to point out different fishery related activities on a map (see table 5). Joining fishing trips was not an option due to the working conditions: namely two weeks at sea with limited privacy (no toilet etc.). I observed when fishers landed their catch.

Table 5: overview of meetings attended

Type of meeting	Main organizer(s)	Date	Location
participatory mapping session	WWF, VC	11-April-19	Vissers Collectief Nieuw Amsterdam
Input for the new Fisheries Management Plan	Fisheries Department	20-May-19 & 27-June-19	Vissers Collectief Nieuw Amsterdam & LVV Paramaribo
Methodology workshop for national diagnostics of fisherfolk organizations of Suriname	WWF, LVV, FAO, Duke university	27-May-19 & 28-May-19	LVV Paramaribo
Training on value chain management, product development and value addition for the small-scale fisheries sector	Qpoint, Nuffic, SUNFO, Vissers Collectief	From 11-June-19 till 13-June-19	LVV Paramaribo

## Literature review

Secondary data, such as reports or news articles about the fishing industry in Suriname, were used mainly for mapping the socio-economic context of this fishery.

### 6.2 Data analysis

Throughout the research data was already analysed to see if certain patterns arose and to see if some of the research questions or methods should be adjusted. The interview transcriptions were analysed through open coding, for which parts of interview transcripts and information from documents were categorized to find common threads. With open coding, the codes are derived from the data directly instead of using predetermined codes. In the second half of the research period, a summary was shared with five fishers to validate the data so far and share preliminary findings.

### 6.3 Positionality of the researcher

When conducting fieldwork, I considered my position in relation to the research and the research participants as this may influence aspects of the research, for example the types of information collected or the way it is interpreted (Scheyvens, 2014). In the setting of this fishery, I was an outsider who had never been to these fishing docks. Fishers might have given what they believe are socially desirable answers about their views on the fishery and marine conservation or gave selected information and left other parts out.



Table 6: Research aim, research questions and further subsections and methods to answer the research questions.

Research aim	To identify pathways by which fishers' knowledge can be incorporated into fishery management and conservation on a regular basis by analysing a case study of an artisanal gillnet fishery in Suriname		
Research question	How can fishers' knowledge be incorporated in fishery management and marine conservation efforts?		
	Sub questions	Sub sections / indicators	Methods
<b>1 Socio-economic characteristics of the fishery</b>	What are the socio-economic characteristics of the fishery?	<ul style="list-style-type: none"> <li>- Which stakeholders are involved in this fishery?</li> <li>- How do these relate to each other?</li> <li>- What does the work of fishers entail?</li> <li>- What is the market in which they operate?</li> <li>- Which regulations affect their practices?</li> </ul>	<ul style="list-style-type: none"> <li>- Document analysis</li> <li>- Semi-structured interviews</li> <li>- Participant Observation in fishery related meetings</li> </ul>
<b>2 Fishers knowledge</b>	What do fishers know about their bycatch and target species?	<ul style="list-style-type: none"> <li>- What knowledge do fishers have on the occurrence of their bycatch?</li> <li>- What knowledge do fishers have on the biology and occurrence of their target species?</li> <li>- How do fishers obtain this knowledge?</li> <li>- How do fishers share this knowledge?</li> <li>- How can this knowledge be used to mitigate ETP bycatch?</li> <li>- How can this knowledge be used to manage the target species?</li> <li>- How do fishers deal with bycatch?</li> </ul>	<ul style="list-style-type: none"> <li>- Semi-structured interviews</li> </ul>
<b>3 The place of fishers' knowledge in fisheries management &amp; conservation</b>	How is fisher's knowledge currently used by the Fisheries Department and NGOs?	<ul style="list-style-type: none"> <li>- Are fishers willing and able to participate in conservation efforts?</li> <li>- What are possible barriers for participation?</li> <li>- How are fishers organized into larger groups?</li> <li>- How are fishers involved in decision making and on which levels (government, municipality, fishers' cooperation)?</li> <li>- If there are any barriers for participation, how can a conservation organization such as the WWF remove these?</li> </ul>	<ul style="list-style-type: none"> <li>- Semi structured interviews</li> <li>- Document analysis of NGOs projects in Suriname and Fisheries Department's documents</li> </ul>

## 6.4 Ethics

### **Informed consent**

Informed consent was achieved by ensuring that potential participants had a clear understanding of the research aim, why their opinions and observations are of interest for this research, the way the research will be used, how long the interview would approximately last and who will have access to the information gathered. The participants were able to ask questions about the research. It was also clearly explained to the participants that they could withdraw from the study at any time and that the information they have provided will be removed from the pool of collected data if they would want so. Informed consent was given verbally.

### **Anonymity**

Respondents were asked for permission to record before the start of the interview and they could ask for the recorder to be turned off at any time during the interview. The participants names have not been used.

### **Reciprocity**

The intention of this research is that both the WWF will benefit from its findings by learning in what way fishers' knowledge can be used in their conservation effort and that resource users hopefully will benefit in some point of time if conservation organizations such as the WWF, fisheries managers and the Fisheries Department of the government see value in and ways of incorporating fishers' input into their management. In this way, the research will not only comply with the ethical minimum of 'do no harm' but has the potential 'to do good'. Preliminary research findings were shared with five respondents during the fieldwork to which they could give feedback. One respondent was not interested to see those preliminary findings. When the thesis is finalized, the findings will be shared with those involved in the research through a summary and through a shared link to the thesis online.

## 7 Results

In this section, the results of the interviews and literature study are presented to answer the research question: *how can fishers' knowledge be incorporated in fishery management and marine conservation efforts?* Most results come from the semi-structured interviews. When information is derived from a secondary source, the source is cited. Firstly, the socio-economic context of the fishery along with a short elaboration on its main stakeholders will be introduced. Secondly, the knowledge the fishers have on their target specie and bycatch will be presented. Lastly, the place of fishers' knowledge in fisheries management and conservation is outlined.

### 7.1 Socio-economic context of the artisanal gillnet fishery

#### 7.1.1 Stakeholders

The stakeholders involved are presented in the tables below including their role and position in this fishery.

Table 7: Stakeholders artisanal fishing industry

Stakeholders industry	Role in the fishery
Fishers of the SK fleet	A fishing crew consists of workmen <sup>3</sup> and one captain. The fishers will be introduced in more detail in section 10.1.2.
License owners	License owners should by law be a Surinamese citizen and they can only use the license themselves. However, some rent licenses to Guyanese vessel owners which is against the law. One person can have more than one license.
Boat owners	Boat owners can have more than one boat and can be members of one of the fishers' cooperatives. Most of them do not go to sea themselves.
Fishers collectives	There are five fishers' organizations which represent artisanal fishers in Nickerie, Coronie, Boskamp, Galibi, Paramaribo and Commewijne of which the latter two share one fishers' organization. The board of the cooperative is chosen by its members. The Fishers' collective of Paramaribo / Commewijne (VC) is the oldest and largest and has 99 members who pay 1.35 USD per boat per month (Rens, 2018).
SUNFO (Surinamese National Fisherfolk Organization)	SUNFO is the umbrella organization of the artisanal fishers' organizations of Suriname and has been founded in 2018. Its goal is to strengthen the capacity of the artisanal sector to take part in fishery management on national and regional level (De Boodschap, 2018). Every cooperative has 2 representatives in SUNFO except for VC, they have 3 because they are the biggest and represent 2 districts.
Buyers (middlemen)	There are about 5 buyers from the artisanal fleet (Rens, 2018). One boat owner from Paramaribo said there are only two buyers who buy fish from that particular landing dock. She explained that the buyer has more bargaining power about the price because he or she can buy your whole catch and they do not want to be stuck with part of their catch. There is a separate buyer and supply chain for the fish bladder.
Processors	Processors are mainly for exporting fish. But there are some smaller processors for the local market.

<sup>3</sup> Fishermen who are not a captain are called 'workmen'.

Table 8: Stakeholders government

Stakeholders government	Role in fishery
Fisheries Department of the Ministry of Agriculture, Animal Husbandry and Fisheries (LVV)	LVV is responsible for the fisheries policy and controls compliance with legal regulations. The issuing of licenses to fishers and the registration and control of the number of harvests are among its main tasks. It also designates landing sites where industrial and artisanal fishing vessels are obliged to land their catch. Here the catch data is documented and sent electronically to the Fisheries Department.
Fisheries Department government	The Fisheries Department of the government implements fishery related policy of the ministry of LVV.
Data collectors	Data collectors are employed by the LVV to collect catch data at the landing sites.
The marine	Checks if boats have a fishing license and if they are fishing in the right zones.
The maritime police	The maritime police are part of the Ministry of Justice and Police and it patrols Surinamese waters.
Maritime Authority Suriname (MAS)	registers fishing boats who sail under the flag of Suriname after it has received a request for this from the Fishery Department and makes sure the maritime traffic is safe and efficient. It also checks if the boats are seaworthy.
The coast guard	Their task is to safeguard maritime security by search and rescue operations, disaster relief, support in the practice of science, customs, and control on fisheries, the environment, ship equipment, shipping traffic, and border control.

In theory, the marine, maritime police and the coastguard can all control the fishing vessels at sea. A staff member of the Fisheries Department however, stated that all are currently only partly active and have relatively little resources for inspection on fisheries.

Table 9: Other stakeholders

Other Stakeholders	Role in Fishery
Council for Consultation for Sea Fisheries	Its task is to advise the minister on fishery related meetings. The council consists of seven members: the director of the ministry of LVV, the director of the MAS, and a representative of the ministry of Justice represent the government. A representative of the shrimp trawlers, fish trawlers, coastal fisheries (VC) and of the fish processing industry represent the industry. The term of office is three years (LVV, 2013). They come together once a month and are currently also involved with forming the license conditions, while before this was solely done by the government (personal communication Fisheries Department staff member 28-05-2019).
Non-Governmental Organizations (NGO's)	NGO's involved in this fishery are WWF, Conservation International (CI) and Green Heritage Fund. Their goals are to reduce bycatch, protect marine turtles, dolphins, sharks and rays and their habitats, reduce overfishing, reduce IUU fishing and to increase awareness about those issues (WWF , 2019) (Pool, 2019) (personal communication Green Heritage Fund and CI, 07-06-19). Conservation International Suriname has been involved with this fishery since 2017.

In the figure below, some connections between the stakeholders involved in this fishery are visualized. All Fishers' cooperatives are represented in SUNFO and two staff members of the Fisheries Department are also in SUNFO. Most of the boat owners do not go to sea themselves, however, there are a few who do. Some of the boat owners and license holders are members of a fishers' cooperative. Hence the partial overlap. In theory, all license holders should own fishing boats themselves. In practice, however, this is not the case. There are boat owners who do not hold a license and there are license holders who do not own boats. The latter rents his or her license to a boat owner without one. Some buyers are also member of a cooperative. Boat owners sell their catch to buyers, who in turn sell it to processors or in a smaller part to buyers who will sell it on the local market. The data collectors and the Fisheries Department both fall under the ministry of LVV. The Council for Consultation for Sea Fisheries has representatives of VC, processors, the ministry of LVV, Marine policy and the MAS. The environmental NGO's work together with the fishers' cooperatives and the government on their projects, but they are not part of this council.

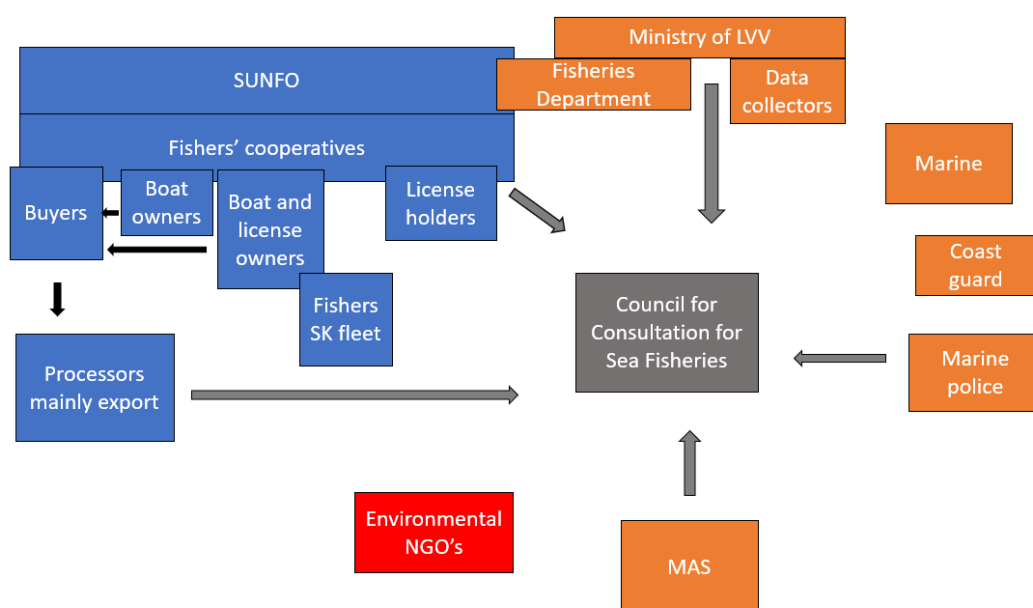


Figure 11: Stakeholders in the artisanal gillnet fishery

### 7.1.2 The fishers: Socio-economic background

According to the respondents, about 95% of the fishers<sup>4</sup> in this fishery are Guyanese. One boat owner and board member of VC explained that they have tried to stimulate Surinamese to work at sea on the fishing boats but without success. They think the reason for this is that most Surinamese are scared to go to sea, and that there is no social security with this job, no pension, and you do not receive a fixed salary at the end of the month. Most of the Guyanese fishers do not have a Surinamese passport and have to go back and forth to Guyana for stamps. Most fishers who depart from Nickerie, the district bordering Guyana in the West, live just across the border in Guyana. There are no national-level migrant interest groups or local community based organizations that represent migrant interests and migrants that do not have a Surinamese nationality are not allowed to vote (Heemskerk & Duijvens, 2019).

The fishers with a Guyanese background interviewed in Paramaribo and Nieuw-Amsterdam have been living in Suriname for 17 years on average (see figure 12) and fishers (including the ones born in Suriname) have been to school until the age of 15 on average.

<sup>4</sup> Some boat owners who do not go to sea call themselves fishers. In this report, fishers and fishermen refer to fishers actually going to sea to catch fish, of which some own boats.

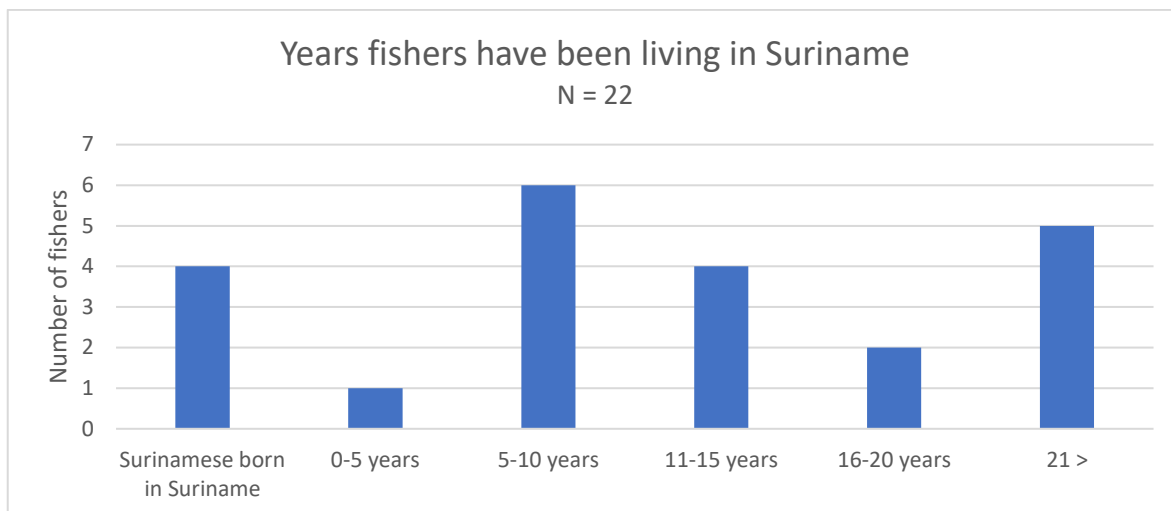


Figure 12: Number of years fishers have been living in Suriname

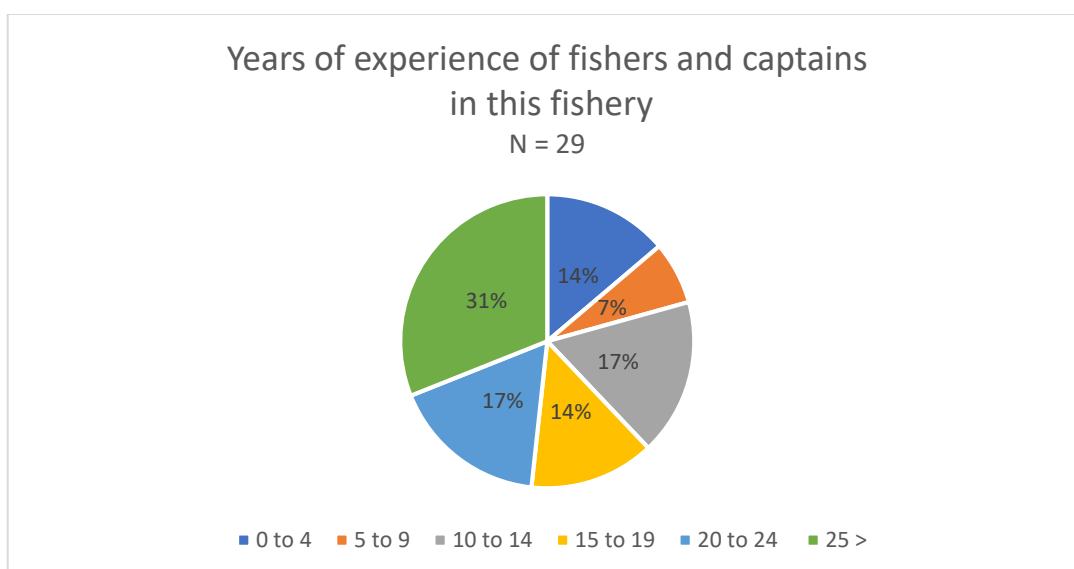


Figure 13: Years of experience of fishers in the gillnet fishery

On average the captains (11 persons in total) had 26.4 years of experience and the workmen (18 persons in total) had 12.7 years of experience in this type of fishery (see figure 13). There are no women fishing in this type of fishery. Although only Surinamese citizens can legally hold a fishing license, and although this is the case according to a board member of the fishers' cooperation of Paramaribo / Commewijne (VC), most boat owners are Guyanese men according to three other Surinamese boat owners. In this research only one boat owner with a Guyanese nationality was interviewed. Some of these Guyanese boat owners rent a license from a Surinamese license holder, which is technically illegal. Some respondents estimate that less than 5% of the boatowners are female. However, 22% of the members of VC that own sea going boats are female according to their list of members. A female boat owner said that there are more women in the sector now than in the past and that small-scale processing plants are often owned by women.

Of the 24 fishermen asked, 9 have family members who are involved in this fishery as well. Of the 18 fishermen asked, 9 have close family (for example wife and kids) in Suriname, 5 have close family in Guyana while 4 have family in both countries. Many fishers thus go to Guyana once every few months to visit family or to get a new stamp to stay in Suriname.

### 7.1.3 The fishing work

The fishers found and learned their profession through family or friends. On board of the open type Guyana boats there are 3-4 workmen and one captain and on board the closed type Guyana boat there are typically 5 workmen and one captain. The captain leads the fishing trip. As one captain explained: *'If you don't show leadership, the whole boat won't go smooth. If they find your weakness, they will exploit your weakness. You have to stand as a leader'*. The captain is the one who decides where to go. One boat owner explained that she gives fishers the chance to be a captain on her boat: *"it is hard to find a good captain; you should be able to trust the person and it should be someone who knows your machine (motor). You don't want him to think: 'it does not work so I will go back'. Last time he did not bring a lot of fish but at least he did not damage my net"*.

The rest of the crew sets out the net and hauls it in, gut the fish, count the fish while putting it in the ice box and they cook their daily meals onboard in turns. They also salt the fish on board if they think those are not fresh enough because they have died too long ago in the net. The crew is gathered a few days in advance by the captain but regularly a crew member who does not show up or can't make it on the day of departure is replaced that very same day by another one. This makes it difficult for boat owners to provide the MAS with an accurate list of crew members.

In general, the boatowner does not fish his or herself and the fishermen who go to sea do not own any fishing gear or boats. According to one respondent, the boat owners that do fish themselves often have only one boat. Of the fishermen asked, there were two captains who own their own boat, one captain who works on his wife's boat and there was one fisherman who has his own net, for which he gets 10% extra from the profits of the trip if he lets the boat owner use it and if he takes care himself of any repairs and maintenance.

The boatowners have agreements instead of formal contracts with captains who work on their boats. They often work for the same boat owner for a longer period. The rest of the fishing crew, the 'workmen', do not work on the same boat with the same captain every time. If someone dislikes the team, he can thus easily choose a different one for the next trip. However, there are some fishers who stay within the same group on the same boat for a longer period. Like one fisher stated *'Sometimes if I like the crew, I stay for 3 to 4 trips with the same group'*. One of the fishers always works on the same boat with his father who is a captain and another one used to work with the same captain and boat for 10 years but is now switching to another one. Although the boat owners do not have any contract or informal agreements with crew members, three boat owners did say that they would help financially for medical treatment needed due to any accidents on their boat. One of them said he paid 65,000 SRD (8750 USD) when a crew member broke his foot on board.

Fishing can be dangerous due to piracy. Last year fifteen men were killed in one pirate attack (Boerboom, 2018). Fishers were afraid to go to sea after this event, which meant that some processors had to close down for weeks due to the limited supply (Rens, 2018). This level of violence is according to some respondents exceptional, but there have been more incidents. During the fieldwork itself three men were killed during fights among crew members at sea.

According to two boat owners there is a shortage of workmen. Most of the time the fishers get a deposit of around 300 SRD. This could be more if they need more money. The eventual profit for fishers depends on the catch. When the fish is sold, the boat owner subtracts all the costs of the trip, such as food for the crew, fuel, ice, etc. For the open type boats, the captain gets 15% of the owners share and the rest is divided among the 4 other crewmembers. For the closed boat the profit is divided in half, of which one half is for the boat owner and one half is divided in seven because the captain gets a double share (in total there are 6 people: 5 crew members and 1 captain). A worker gets about 3200 SRD (427,4 USD) for the fish catch. Any deposit that fishers have received before the trip will be subtracted. The profit of the fish bladder, which is sold separately, is in USD and is divided equally between the captain and crew after the boat owner has taken his or her half. This could be around 400 USD per crewmember.

Most fishers also earn money by repairing the nets when they are on shore (see figure 19). This may be for the boat owner on whose boat they have been fishing on the previous trip or for another boat owner. Depending on the damage of the net (caused by bycatch which damages the net or must

be cut out, by seaweed (sargassum weed) or rocks) it may take up to 3 to 4 weeks to repair a 4 km net with 4 men. With this they earn 150 SRD (20 USD) per day when they work from 7 till 4. If one wants to, he could earn money by repairing nets every day. Two respondents explained how for example manta rays can seriously damage the net: *“When it is finished with your net, the amount of work you have to do, you will cry. They destroy the net and can pull a boat. You have to cut it out. If it is released, he jumps out of the water out of joy”*.

If the boat is stationed further away from the ice building, one can also earn money by bringing and loading the ice. In that case, 300 SRD (40 USD) is divided between the men who do that and the one who ‘stamps’ the ice in the icebox<sup>5</sup>. At the dock in Nickerie, fishermen also salt and dry fish and sharks with which they can earn an extra income (see figures 14-18). These are often fish that are less fresh because they have been dead in the net for a longer time. Part of the catch is also salted on board, but this is a small amount for personal use. One of the boat owners explained that they can have those for free, but they are not supposed to salt the fish and sell them, because then the boat owner does not earn any money with it. She once caught her previous captain with five bags filled with salted fish to sell.

Almost no fishers have any non-fishery related income. As one fisherman said: *“bricklaying may give you work for three months, but then you can be out of work the next two months. The fishing work you have all the time”*. Two young fishermen said they do sometimes work in construction and one fisherman said he also earns money with repairing inboard motors and GPS’s at sea. Heemskerk and Duijvens’ study confirms this as its findings showed that most Guyanese migrants are completely dependent on the artisanal fisheries sector, partly because their typically poor Dutch-speaking skills and limited formal education. They also have limited access to formal and informal safety nets (Heemskerk & Duijvens, 2019).



Figure 14: Dried shark fins



Figure 15: Dried and salted shark

<sup>5</sup> About five tons of ice goes into the boat.





*Figure 16: Mackerel and Kandratiki in salted water for 3 days before it is dried in the sun*



*Figure 17: Fish drying in the sun in Nickerie*



*Figure 18: Close-up of fish drying*



Figure 19: Fisherman repairing a net

#### 7.1.4 Fishing trips

The fishing location at sea is determined for some by the position of the moon in relation to the depth of the water. Some boats have so called fish finders, which work like sonar, but this is on a minority of the boats. When the catch is good at a certain spot the crew throws the net at that same spot again. They also re-use the GPS numbers of previous successful trips.

A fishing trip with a closed Guyana boat lasts about 15.5 days on average. When the catch is good, they can return after 10 or 11 days since they have caught enough fish. When the catch is poor, they may stay up to 18 days at sea. One respondent said that in the past you could be back home in 5-10 days with enough fish, but now you can be away for 18-20 days. They can't stay away longer than that due to limited available food for the crew and because the ice in the icebox will start to melt. Open Guyana boats stay about 8-10 days at sea. Their storage capacity is less.

Most fishers departing from the Suriname river head to the East to fish. During a meeting among boat owners from Paramaribo and Commewijne they all agreed that there is plenty of fish in the sea above the Coppename area (one of the districts on the left of the Suriname river), but they do not fish there because there are more pirates cutting off the nets. They say that most fishers do not dare to go there. Fishers who depart from Nickerie (the most Western province) however do fish in that area.

#### 7.1.5 Fishing effort

In the late seventies the driftnet fisheries from Guyana made its entry into Suriname (LVV, 2013). The maximum amount of fishing licenses for the SK gillnet fleet is 380 and for the SKB gillnet fleet 50 for 2019. The vessels are obliged to have a Vessel Monitoring System installed onboard which continuously gives the geographical position, the speed, and the direction of the vessel (LVV, 2019).

The license conditions for the SK boats used in this fishery are as follows: The maximum allowable length of the nets is 3 km for the Open Guyana type and 4 km for the Closed Guyana type. A maximum of 30% of the net can have 5 to 6-inch (12,5- 15 cm) mesh size and the rest of the net should have a minimum mesh size of 8 inch (20 cm) for the SK fleet. The maximum size of the Open Guyana boats is 18 meters and of the Closed Guyana boats 20 meters, the maximum power of the motor is 75 pk and 155 pk and the maximum storage capacity for fish and ice is 5 and 7 cubic meters respectively (LVV, 2019).

The fishing license for Open Guyana boats costs 750 Surinamese Dollars (SRD) and for Closed Guyana boats 1000 to 2000 SRD (depending on the capacity of the motor) (LVV, 2019). In the license conditions of the SK and the SKB driftnet fleet it is stated that the target species are: 'not applicable'. This gives the impression that the fishers can indeed land anything (except for turtles). All fish should be landed in Suriname at a landing site appointed by the Fisheries Department and should be processed in Suriname (LVV, 2019). These landing sites can be found on the back of the license. However, a staff member of the Fisheries Department said that not all fish is always landed at these designated sites and that the government cannot implement this: *"If something is asked by the government, it does not mean that it is official"*. LVV can adjust the conditions of the licenses which would then be announced at the different landing locations (LVV, 2019).

The published number of licenses for the artisanal gillnet fishery is thus 380 for this year (same as last year), but a staff member of the fishery department of the government said that actually 500 licenses in total have been handed out or renewed (each year vessel owners have to apply again for the license). License holders would like to have licenses for multiple years so that they can go to financial institutions for loans for example, and a multiple year license would give them more security. There are no clear conditions which determines if someone is entitled to obtain a fishing license. Currently, one may get a reply to their request saying that they cannot get a license because this fishery is overfished, while someone else does get a license.

Not just the number of boats determine the fishing effort, also the length of the net, the days at sea, the number of hours the net is in the water (so-called soaking time), and whether you have a winch or not, which is a device to haul in the net. This means you could haul the net quicker and therefore can let it back into the water sooner again. Since about four years there are winches more in use. It costs about 80.000-10.000 USD, but because of the winch, less labour is needed from the fishermen to haul the net back in. Two respondents said that the hands of some fishermen are disformed by pulling the net in. According to a boat owner the use of a winch does not necessarily mean more catch, because without the winch some fish would still get caught in the net while it is slowly pulled in the boat. In the past it took about 5 hours to haul the net in by hand. With the winch it takes about 2,5 hours when the catch is small and 4 hours when there is a lot of fish in the net.

It is estimated that the SK fishery lands about 60% of the total catches of the Kandratiki and Bang-bang in Suriname (pers. Communication Conservation International 07-05-19). Pressure on the fish stocks is also rising from the other types of fisheries. The mesh size determines which size fish are caught. According to SK gillnet fishers, Bang-bang and Kandratiki (both mature and juveniles) are caught by the fish trawlers who use a smaller mesh size<sup>6</sup> and juvenile Bang-bang and Kandratiki are caught by the Bangamery (SKB) and Njawarie fishery which also both use a smaller mesh size. With this smaller mesh size, more types of smaller fish and younger fish of bigger species will be caught in the net too.

In the governments' Fishery Management Plan for 2014-2018 (a new one is yet to come), it has been said that the authorities would reduce the amount of fishing licenses for several fisheries (both artisanal and industrial). There are now 35 licenses for the bottom trawlers of the demersal fisheries, while there were 23 in 2012 even though in the plan it was said that the fish trawl fleet should not grow. During the consultations of that time they also agreed that the SK fleet was too big and that the Bangamery and Njawarie (schutbank) fishery were too damaging to the fish stock. However, the government has issued 15 licenses for the Njawarie fishery in 2018. They also stated that there would be less (maximum of 20) licenses to be handed out to the Bangamery fishery, however there are now 50 licenses. When one of the staff members of the Fisheries Department was asked about this, he said that the policy is weak, that there is no mandatory legislation regarding this and that there is also no control from the assembly on the policy.

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<sup>6</sup> The minimum mesh size of the codend (end of the fishing net) for shrimp trawlers is 4,5 cm and for fish trawlers 8 cm according to a staff member of the Fisheries Department.

In a meeting (20-05-19) organized by the Fisheries Department and VC about updating the fishery management plan, one representative of the government indicated that a lot of these fishing licenses have been given to politicians or people working for the government. Next to the increased number of licenses, the allowed length of the gillnets has gone up from 2 km to 3 km for open Guyana type boats and 4 km for closed Guyana type boats.



Figure 20: Kandratiki



Figure 21: Bang-bang<sup>7</sup>



Figure 22: Bladder of Kandratiki (left) and Bang-bang (right).

*This is the most valuable part of the catch*



Figure 23: Sharks (de-headed)

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<sup>7</sup> Bang-bang caught in deeper water looks more orange while the ones closer at shore look more like Kandratiki according to one respondent.

### 7.1.6 The market

While some fish is sold for the local market (either for supermarkets or the markets), most fish is sold to processing companies for export. In Paramaribo and Commewijne, where most fish are landed, there are 5 middlemen who buy most for export. Most of the fish is exported to the Caribbean, Europe and Asia. Retailers buying the fish are mostly specialized Afro Caribbean / Surinamese shops or restaurants. Frozen fish is exported by boat while fresh fish is exported by air (Rens, 2018). Fish bladder (so called glue) from Kandratiki, Bang-bang and Jarabakka has a different supply chain and is bought by other buyers directly from the landing docks. This is exported to Hong Kong according to two boat owners and mostly bought up by a Korean company. Some fishers said that also the bladder from Coco sea catfish<sup>8</sup> (locally called barbaman) can be sold, but that this brings far less money. According to a receipt of one of the boat owners, the price for Bang-bang is 35 SRD (4,72 USD) per kilo and for Kandratiki 18,5 SRD (2,49 USD) per kilo and bladder from Bang-bang is 180 USD per kilo and bladder from Kandratiki was sold for 60 USD per kilo<sup>9</sup>. The sale from fish from this artisanal fleet does not involve any formal contracts between the buyers and the boat owners.

Fishers and boat owners are complaining that the prices for the fish are dropping while expenses such as fuel and groceries etc. are rising. Some respondents complained that trawlers bring large amounts of kandratiki while they can get tax free fuel, which according to them means that they can offer the kandratiki for less since they have this 'unfair' competitive advantage, as the SK fleet cannot use tax free fuel.

Even though respondents see their catches per fishing effort decline over the years (catch per unit effort), there is plenty supply of fish on the market according to some respondents. In the table below the export volume of Bang-bang shows a decline, while the export of Kandratiki shows an increase (see table 10). According to Conservation International this is due to an increase in fishing effort (personal communication, 07-05-19). One SK boat owner explained that the local market is already saturated: *"the local market does not consume a lot of fish, Surinamese prefer to eat chicken. That is why we have to sell it to the processors for export. The competition on the local market is so high at the moment that there is no space anymore for extra processors for the local market. There is not enough demand, our supply is too big."*

Table 10: Export from 2014-2016 for the Bang-bang and Kandratiki (in metric tons). Taken from CI-Suriname Supply Chain Analysis, preliminary results in (Martinez & Drugan, 2017)

Species	2014	2015	2016
Bang-bang	710.27	543.26	601.42
Kandratiki	135.58	3,295.44	3,324.58
Total	848.85	3,838.71	3,926.00

### 7.1.7 Illegal unregulated and unreported (IUU) fishing

From the literature review and the interviews, it has become clear that the fish stocks of Guyana are poorer than those of Suriname, while Surinamese stocks are also declining. French-Guyana on the other hand contains more abundant fish stocks. This is attributed to their better surveillance on sea against illegal fishing. When asked about regulations affecting their fishing practices, most respondents are aware of the no fishing zone during the turtle season and of the fact that they cannot cross the border with Guyana or French-Guyana. However, some fishermen indicated that they do go to French Guyana's waters to fish. If they would get caught, the boat and the catch will be confiscated. The boats hide in creeks during daytime and fish during night-time. One respondent said that with two days of fishing in French-Guyana you can have an ice box full of fish.

<sup>8</sup> Latin name: Bagre bagre.

<sup>9</sup> The interview took place on the third of June 2019, so the prices may have changed since then.

From the interviews it has also become clear that most fishers go beyond the allowed 9 fathom line for artisanal fishers from time to time. On the other hand, the industrial trawl fishing vessels are often said to come to the fishing area designated for the artisanal fishers, so within the 9-fathom line. Some respondents were not aware that there is a limit to which depths they can fish: "you can go how far you want, but not into the French side". Perhaps the restrictions on crossing the French border are better known than the limits towards the open sea as French Guyana has stronger surveillance at sea than Suriname, which thus makes that restriction more enforced.

A common complaint is that there is no enforcement on the Surinamese sea and that there are no sanctions for illegalities. Renting out licenses is illegal. According to some boat owners, about 100 licenses are rented to Guyanese boat owners using SK-numbers on their boats just across the border of Suriname. They fish in Surinamese waters but land their catch in Guyana. One boat owner expressed his frustration in a meeting as he explained that no actions have been taken when he and others made pictures of those boats in Guyana and sent them to the authorities multiple times. Another boat owner said she made a complaint about three boats that operated under one license, but she did not get any response about this either. A staff member of the Fishery Department of the government said that above the 500 boats legally operating in the gillnet fishery, you should add about 200 illegal boats coming from Guyana without a Surinamese license into Surinamese waters to fish.

One of the plans in the Fishery Management Plan for 2014-2018 was to implement a Vessel Monitoring System (VMS) for the artisanal fleet. The industrial trawlers are already obliged to use this system. In a meeting about the new Fishery Management Plan in Nieuw Amsterdam the boat owners were not in favor of this anymore. The boat owners said that they often see these trawlers fishing too close inshore and they wonder how they can do that while they have a VMS on board, with which the government should be able to check their position anytime. Two fishers said that they have made pictures of trawlers that were too close and have sent this together with the GPS location and time to the authorities. Since the trawlers have a Vessel Monitoring System (VMS) which the Fisheries Department can see real time, they should be able to see when an industrial trawler is fishing in the artisanal fishery area. The fishers said that nobody took any action. Also, two boat owners said that they have asked fishers to send it to them and they once have sent it to the fishers cooperative. They did not hear anything back and they did not know if the government had taken any action in response to the fishers cooperative.

There has also been a pilot project with VMS on board of some artisanal boats. The two boat owners who were participating in the pilot and testing the system said it did not work and after the trial, they were told they had to pay for it. They also do not believe that this VMS system will improve the safety of fishers on board. The argument of the government is that, in case of irregularities, the coastguard can more easily find them. The boat owners argue that the coastguard has too little resources to respond to any SOS. Someone working for the coastguard itself said that their three boats are not enough to control the whole marine zone of Suriname.

One respondent said that some trawler companies have connections with the government and that they can thus fish closer to shore than they are supposed to do without being bothered. He also explained that there used to work someone at the VMS department who mentioned when he saw that some trawlers were fishing too close to shore. He was then fired and the one who works there now is not doing such a good job as his predecessor.

When asked whether sanctions can be placed if there is evidence of a trawler fishing too close to shore (with a picture, date, time, name of boat and the GPS-location) one staff member of the Fisheries Department said they can check the VMS data and sanction the one responsible. The director of LVV, however, responded to this question by saying that the current VMS system is not working properly. And when asked if licences can be withdrawn from fishing operations that violate the license conditions and laws, he answered that it is possible although such a juridical process may take up to three years.

## 7.2 Fishers' knowledge

This section firstly addresses the knowledge fishers have on the fish species caught after which it addresses the knowledge fishers have on the turtles, sharks, rays, and dolphins caught. Finally, their opinion on the future of the fishery will be discussed.

### 7.2.1 Fishers' knowledge on fish species caught

Fishers were asked, with the help of a fish poster, which species they catch and whether they can sell those. Most of the time the workmen know which species they can or cannot sell, but if in doubt, the captain decides on which to take. Almost all fish that they cannot sell is discarded at sea, the rest is either consumed during the fishing trip or taken home or given to friends and family. In the table below, the bold percentages show which species are caught and sold by at least half the fishers.

Table 11: Percentage of fishers who catch and sell the species

Fish species with their English name, local name and scientific name	Catch	Sell
Largehead hairtail / Riemvis ( <i>Trichiurus lepturus</i> ) N = 9	<b>100%</b>	22%
Pacuma Toadfish / Loempoe ( <i>Batrachoides surinamensis</i> ) N = 10	<b>100%</b>	<b>50%</b>
Web burrfish / Kogelvis ( <i>Chilomycterus antillarum</i> ) N = 13	<b>69%</b>	0%
Banded puffer / Bosrokoman ( <i>Colomesus Psittacus</i> ) N = 11	<b>100%</b>	0%
Flathead grey mullet / Aarder ( <i>Mugil cephalus</i> ) N = 11	<b>100%</b>	<b>82%</b>
Drab Sole / Boki, Botje ( <i>Achirus achirus</i> ) N = 10	<b>100%</b>	44%
Duskycheek tonguefish / Botje ( <i>Symphurus plagusia</i> ) N = 9	<b>100%</b>	44%
Atlantic spadefish / Donki, Jackass ( <i>Chaetodipterus faber</i> ) N = 11	<b>100%</b>	18%
Littlescale threadfin / Boko ( <i>Polydactylus oligodon</i> ) N = 9	<b>100%</b>	<b>67%</b>
Triple tail / Paoema, Zeekrobia ( <i>Lobotes surinamensis</i> ) N = 11	<b>100%</b>	<b>100%</b>
Lookdown / moonfish N = 9	<b>100%</b>	33%
Castin leatherjacket / Pompenoe ( <i>Oligoplites saliens</i> ) N = 11	<b>100%</b>	27% <sup>10</sup>
Green weakfish / Kandratiki, trout ( <i>Cynoscion virescens</i> ) N = 12	<b>100%</b>	<b>100%</b>
Tonkin weakfish / witwitie ( <i>Cynoscion similis</i> ) N = 9	<b>100%</b>	<b>67%</b>
Jamaica weakfish / witwitie ( <i>Cynoscion jamaicensis</i> ) N = 9	<b>100%</b>	<b>67%</b>

<sup>10</sup> To some fishermen, I showed the poster and asked, which species can't you sell? When they did not say explicitly that they cannot sell it, I assumed that they can sell it. But since the majority said they cannot sell this specie; it might be the case that two fishers who did not say that explicitly perhaps did not see the fish on the poster. So, with this one and the Whitemouth croaker there might be an error in the results.

Acoupa weakfish / Bang-bang, snapper ( <i>Cynoscion acoupa</i> ) N = 11	100%	100%
King weakfish/ Dagoetifi, Bangamery ( <i>Macrodon ancylodon</i> ) N = 9	100%	89%
Atlantic Bumper / Bijlvis ( <i>Chloroscombrus chrysurus</i> ) N = 9	100%	44% <sup>11</sup>
Torroto grunt / Neertje, Mirky fisi, anafolks ( <i>Genyatremus luteus</i> ) N = 10	100%	90%
American harvestfish / moonfish ( <i>Peprilus paru</i> ) N = 9	100%	22%
Corocoro grunt / Blaka grunt ( <i>Orthopristis ruber</i> ) N = 9	100%	44% <sup>12</sup>
Smalltouth weakfish / Blaka tere witwitie ( <i>Cynonscion steindachneri</i> ) N = 10	100%	90%
Shorthead drum / Surinaamse silver snapper ( <i>Larimus breviceps</i> ) N = 9	100%	67% <sup>13</sup>
Barbel drum ( <i>Ctenosciaena gracilicirrus</i> ) N = 9	100%	67% <sup>14</sup>
Whitemouth croaker / Krokus, Zeekubi, Bashaw, Courbine ( <i>Micropogonias furnieri</i> ) N = 11	100%	81% <sup>15</sup>
South American silver croaker / Koebi ( <i>Plagioscion squamosissimus</i> ) N = 10	90%	78%
Banded croaker / Krokus ( <i>Paralonchurus brasiliensis</i> ) N = 9	100%	67%
Blackfin croaker / Manjafisi, Blaka free ( <i>Lonchurus elegans</i> ) N = 9	100%	56%
Rake stardrum / Stonkubi, Rockhead ( <i>Stelifer rastrifer</i> ) N = 9	100%	67%
Smalleye stardrum / Stonkubi, Rockhead ( <i>Stelifer microps</i> ) N = 9	100%	67%
Swordspine snook / Snoek ( <i>Centropomus ensiferus</i> ) N = 12	100%	92%
Black curbinata / Koebi ( <i>Plagioscion auratus</i> ) N = 10	100%	90%
Smalleye croaker / Botrofisi, botervis ( <i>Nebris microps</i> ) N = 9	100%	67%
Bressou sea catfish / Kodokoe ( <i>Aspistor quadriscutis</i> ) N = 11	100%	82%
Coco sea catfish / Barbaman, Coco ( <i>Bagre bagre</i> ) N = 11	100%	91%
Gillbacker sea catfish / Jarabakka ( <i>Sciades parkeri</i> ) N = 12	100%	100%

<sup>11</sup> To some fishermen, I showed the poster and asked, which species can you sell? They would name the ones they can sell. So, when they did not explicitly say they can sell it, I assumed that they cannot sell it. But since the majority said they can sell it; it might be the case that those fishers perhaps did not see the fish on the poster. So, with this one and a few further down the table, there might be an error in the results. In this case, two did not mention specifically they can sell it.

<sup>12</sup> See footnote 10, three did not mention specifically they can sell it.

<sup>13</sup> See footnote 10, three did not mention specifically they can sell it.

<sup>14</sup> See footnote 10, three did not mention specifically they can sell it.

<sup>15</sup> See footnote 9, two did not mentioned specifically they cannot sell it.



Scaled herring / Sardien ( <i>Harengula jaguana</i> ) N = 9	100%	78%
Broadband anchovy / Ansjovis ( <i>Anchoviella lepidentostole</i> ) N = 9	100%	67%
Softhead sea catfish / Kodokoe, Twitwie ( <i>Amphiarius rugispinis</i> ) N = 9	100%	100%
Tarpon / Tarpoen ( <i>Megalops atlanticus</i> ) N = 12	100%	100%
Guayana pike-conger / Zeesneki ( <i>Cynoponticus savanna</i> ) N = 10	90%	0%
Ocellated moray / Zeesneki ( <i>Gymnothorax ocellatus</i> ) N = 10	90%	0%

The fishers indicated that they do not catch any juveniles of Kandratiki and Bang-bang since their minimum mesh size allows those to pass the net without getting caught. These results show that most fishers indicated that they catch all these species of fish. The catches in this fishery partly overlap those of the industrial fleet.

The overlapping target species of the finfish trawl fishery are Acoupa weakfish/ Bangbang (*Cynoscion acoupa*), Whitemouth croaker (*Micropogonias furnieri*), Green weakfish/ Kandratiki (*Cynoscion virescens*), Corocoro grunt/ black snapper (*Orthopristis ruber*), Largehead hairtail (*Trichiurus lepturus*), and Jamaica and Tonkin weakfish/ Witwitie (*Cynoscion jamaicensis/similis*). Of which the last five species are among the seven most common fish species caught in that fishery. The species mentioned above are all retained in the finfish trawl fishery except for the Largehead hairtail of which 75% is discarded (Meeremans, Babb-Echteld, & Willems, 2017). In this study of the artisanal gillnet the Largehead hairtail is said to be mostly discarded too (by 88% of the respondents).

The most common bycatch species of the Seabob trawl fishery that are also caught commercial species in the artisanal gillnet fishery are smalleye stardrum (*Stellifer microps*), Tonkin weakfish/ witwitie (*Cynoscion similis*), Jamaica weakfish/ witwitie (*Cynoscion jamaicensis*) and rake stardrum (*Stellifer rastrifer*). The first three accounted for nearly 50% of fish bycatch and occurred in all samples of that study. Not included in the five most caught fish in that fishery but also overlapping are Green weakfish/ Kandratiki (*Cynoscion virescens*), of which 71% was discarded at sea, and King weakfish/ bangamery (*Macrodon ancylodon*), of which 40% was discarded at sea in that fishery (Meeremans, Babb-Echteld, & Willems, 2017).

In the shrimp trawls fish account for 49% of the catch by weight. Overlapping species of the shrimp trawls and the artisanal gillnet fishing boats are the Tonkin weakfish/ witwitie (*Cynoscion similis*) and the Jamaica weakfish (*Cynoscion jamaicensis*). These two species were caught in 90% of their samples and 95% of these fish were retained in the shrimp trawls (Meeremans, Babb-Echteld, & Willems, 2017).



Figure 24: Bang-bang loaded in a truck

### 7.2.2 Life-cycle Bang-bang & Kandratiki

Most fishers do not really know when and where Bang-bang and Kandratiki lay their eggs, but some think in the river or near shore (see figure 25), and in in the rainy season or more specifically in August. Most fishers do not know how long it takes for these two species to grow into an adult fish.<sup>16</sup> Conservation International recently started a study about the life-cycle of Bang-bang and Kandratiki. In this study fishers are asked when and where they find the fish with ripe eggs.

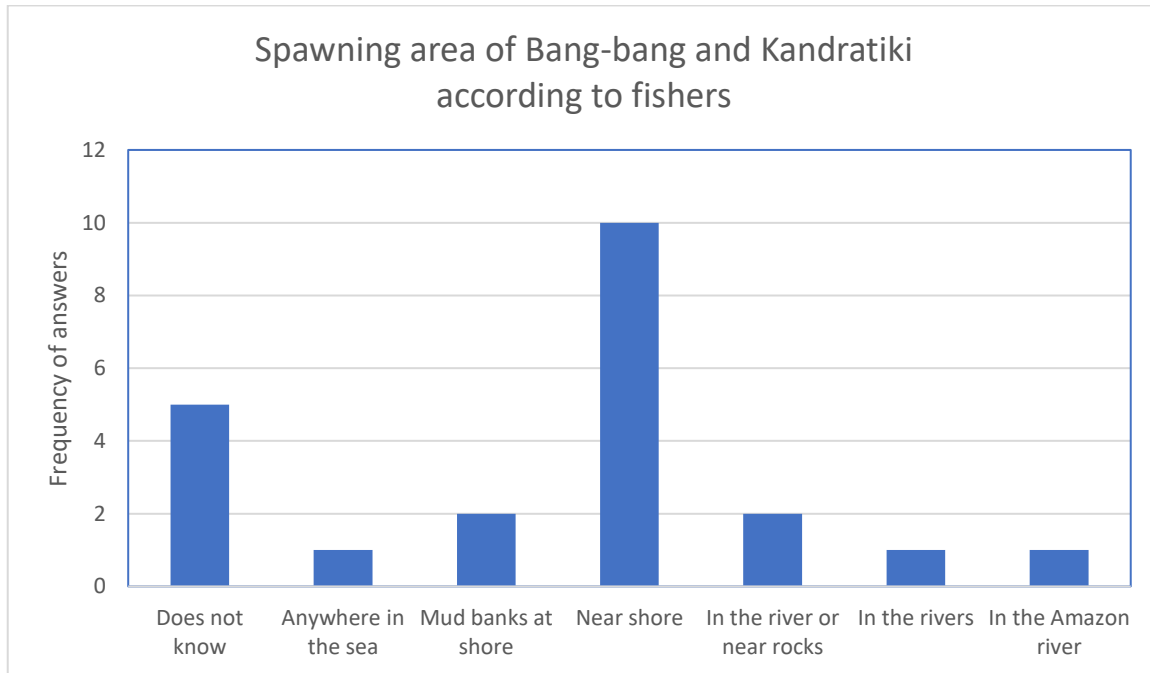


Figure 25: Spawning areas of Bang-bang and Kandratiki according to fishers

### 7.2.3 Perceived changes in the catch over time

36 respondents (including both fishermen and boatowners) indicated that the catch has become less in the last five years and most attribute this to overfishing by too many boats. One fisher explained that he used to spend five days at sea in the past, but that he is now fifteen days at sea to catch the same amount of fish. Another fisher stated: *“It’s not like 20 years ago. There are more boats, and everybody is now thinking of how to catch fish”*.

Of the 17 fishers asked, all except one do not see any changes in the type of species they catch. 8 fishermen were also asked if they have seen any changes in the sizes of the fish they catch now and 5 years ago, one said that ten years ago he found bigger Bang-bang, but the rest did not see any changes in the size<sup>17</sup>.

<sup>16</sup> See Annex 5.

<sup>17</sup> See Annex 4.

## 7.2.4 Fishers knowledge on turtles, sharks, rays, and dolphins

A species guide<sup>18</sup> containing images and descriptions of 21 sharks, 13 rays, 5 turtles and 2 types of dolphins was used to ask fishers whether they sometimes catch the specie in question and if they do, what they do with it (discard or land the catch) and whether they can sell it. The table below shows the results. The species in the guide are likely to be encountered in the Guianan waters and were selected by the WWF based on their relevance to the commercial fisheries in the area or on their vulnerability to exploitation. All catch that can be sold is landed and almost all catch that cannot be sold is discarded at sea. The bold percentages show which species are caught by most and sold by most.

Table 12: Percentage of fishers who catch and sell the species

Sharks	Catch	Does not catch	Fisher not sure	Sell
- = Not applicable				
Blacknose shark ( <i>Carcharhinus acronotus</i> ) IUCN status: Near threatened	<b>94%</b> N = 16	6% N = 16	-	<b>93%</b> N = 15
Spinner shark ( <i>Carcharhinus brevipinna</i> ) IUCN status: Near threatened	<b>94%</b> N = 17	6% N = 17	-	<b>100%</b> N = 16
Silky shark ( <i>Carcharhinus falciformis</i> ) IUCN status: Vulnerable	<b>83%</b> N = 18	11% N = 18	6% N = 18	<b>80%</b> N = 15
Bull shark ( <i>Carcharhinus leucas</i> ) IUCN status: Near threatened	<b>87%</b> N = 15	7% N = 15	17% N = 15	<b>92%</b> N = 13
Blacktip shark ( <i>Carcharhinus limbatus</i> ) IUCN status: Near threatened	<b>100%</b> N = 18	-	-	<b>100%</b> N = 18
Dusky shark ( <i>Carcharhinus obscurus</i> ) IUCN status: Vulnerable	<b>87%</b> N = 15	-	13% N = 15	<b>92%</b> N = 13
Caribbean reef shark ( <i>Carcharhinus perezi</i> ) IUCN status: Near threatened	<b>69%</b> N = 16	6% N = 16	25% N = 16	<b>92%</b> N = 13
Smalltail shark ( <i>Carcharhinus porosus</i> ) IUCN status: Data deficient	<b>75%</b> N = 16	13% N = 16	13% N = 16	<b>92%</b> N = 12
Tiger shark ( <i>Galeocerdo cuvier</i> ) IUCN status: Near threatened	<b>88%</b> N = 17	12% N = 17	-	33% N = 15
Nurse shark ( <i>Ginglymostoma cirratum</i> ) IUCN status: Data deficient	<b>100%</b> N = 18	-	-	5% N = 18
Daggernose shark ( <i>Isogomphodon oxyrinchus</i> ) IUCN status: Critically endangered	<b>67%</b> N = 15	27% N = 15	7% N = 15	0% N = 10
Smalleye smoothhound ( <i>Mustelus higmani</i> ) IUCN status: Least concern	<b>100%</b> N = 17	-	-	35% N = 17
Lemon shark ( <i>Negaprion brevirostris</i> )	<b>82%</b>	18%	-	<b>92%</b> <sup>19</sup>

<sup>18</sup> See <https://online.iucn.nl/srjs-highlights/improved-policies-and-practices/overlay/p4-9-promoting-sustainable-fisheries-in-the-guianas/> to look into the guide.

<sup>19</sup> One was not sure whether they sell the Lemon shark, so he is not included.

IUCN status: Near threatened	<b>N = 17</b>	N = 17		N = 13
Whale shark ( <i>Rhincodon typus</i> ) IUCN status: Endangered	33% N = 15	67% N = 15	-	0%
Brazilian sharpnose shark ( <i>Rhizoprionodon lalandii</i> ) IUCN status: Data deficient	<b>73%</b> N = 15	7% N = 15	20% N = 15	45% N = 11
Caribbean sharpnose shark ( <i>Rhizoprionodon porosus</i> ) IUCN status: Least concern	<b>73%</b> N = 15	7% N = 15	20% N = 15	45% N = 11
Scalloped hammerhead ( <i>Sphyrna lewini</i> ) IUCN status: Endangered	<b>88%</b> N = 17	6% N = 17	6% N = 17	<b>100%</b> N = 15
Scooped shark ( <i>Sphyrna media</i> ) IUCN status: Data deficient	<b>81%</b> N = 16	13% N = 16	6% N = 16	<b>92%</b> N = 13
Great hammerhead ( <i>Sphyrna mokarran</i> ) IUCN status: Endangered	<b>82%</b> N = 17	12% N = 17	6% N = 17	<b>100%</b> N = 14
Bonnethead shark ( <i>Sphyrna tiburo</i> ) IUCN status: Least concern	<b>88%</b> N = 16	13% <sup>20</sup> N = 16	-	<b>79%</b> N = 14
Smalleye hammerhead shark ( <i>Sphyrna tudes</i> ) IUCN status: Vulnerable	<b>88%</b> N = 16	6% N = 16	6% N = 16	<b>71%</b> N = 14
Rays	Catch	Does not catch	Fisher not sure	Sell
Spotted eagle ray ( <i>Aetobatus narinari</i> ) IUCN status: Near threatened	<b>100%</b> N = 14	-	-	0% N = 13
Variegated electric ray ( <i>Deplobatis pictus</i> ) IUCN status: Vulnerable	<b>100%</b> N = 13	-	-	0% N = 12
Sharpsnout stingray ( <i>Fontitrygon geijskesi</i> ) IUCN status: Near threatened	<b>92%</b> N = 13	8% N = 13	-	0% N = 11
Smooth butterfly ray ( <i>Gymnura micrura</i> ) IUCN status: Data deficient	<b>100%</b> N = 15	-	-	0% N = 14
Chupare stingray ( <i>Himantura schmardae</i> ) IUCN status: Data deficient	<b>92%</b> N = 13	8% N = 13	-	0% N = 11
Southern stingray ( <i>Hypanus americanus</i> ) IUCN status: Data deficient	<b>85%</b> N = 13	8% N = 13	8% N = 13	0% N = 10
Longnose stingray ( <i>Hypanus guttatus</i> ) IUCN status: Data deficient	<b>92%</b> N = 13	8% N = 13	-	0% N = 11
Giant manta ray ( <i>Mobula birostris</i> ) IUCN status: Vulnerable	<b>93%</b> N = 14	7% N = 14	-	0% N = 12
Caribbean electric ray ( <i>Narcine bancroftii</i> ) IUCN status: Critically endangered	<b>92%</b> N = 13	8% N = 13	-	0% N = 11
Smalltooth sawfish	<b>85%</b>	15%	-	0%

<sup>20</sup> Some percentages do not add up to 100% because they have been rounded up.

<i>(Pristis pectinata)</i> IUCN status: Critically endangered	<b>N = 13</b>	N = 13		N = 11
Chola guitarfish <i>(Pseudobatos percellens)</i> IUCN status: Near threatened	<b>100%</b> <b>N = 13</b>	-	-	0% N = 13
Cownose ray <i>(Rhinoptera bonasus)</i> IUCN status: Near threatened	<b>100%</b> <b>N = 12</b>	-	-	0% N = 12
Smalleyed round stingray <i>(Urotrygon microphthalmum)</i> IUCN status: Least concern	<b>100%</b> <b>N = 12</b>	-	-	0% N = 11
Sea turtles	Catch	Does not catch	Fisher not sure	Sell
Loggerhead turtle <i>(Caretta caretta)</i> IUCN status: Least concern	<b>53%</b> <b>N = 15</b>	47% N = 15	-	0% N = 8
Green turtle <i>(Chelonia mydas)</i> IUCN status: Endangered	<b>72%</b> <b>N = 18</b>	28% N = 18	-	0% N = 13
Leatherback turtle <i>(Dermochelys coriacea)</i> IUCN status: Endangered	<b>89%</b> <b>N = 19</b>	11% <sup>21</sup> N = 19	-	0% N = 17
Hawksbill turtle <i>(Eretmochelys imbricate)</i> IUCN status: Critically endangered	41% N = 17	53% N = 17	6% N = 17	0% N = 7
Olive Ridley turtle <i>(Lepidochelys olivacea)</i> IUCN status: Vulnerable	41% N = 17	59% N = 17	-	0% N = 7
Dolphins	Catch	Does not catch	Fisher not sure	Sell
Guiana dolphin <i>(Sotalia guianensis)</i> IUCN status: Data deficient	<b>63%</b> <b>N = 19</b>	37% N = 19	-	0% N = 12
Rough-toothed dolphin <i>(Steno bredanensis)</i> IUCN status: Least concern	<b>50%</b> <b>N = 18</b>	67% N = 18	-	0% N = 6
Fish	Catch	Does not catch	Fisher not sure	Sell
Goliath Grouper <i>(Epinephelus itajara)</i> IUCN status: Critically endangered	<b>100%</b> <b>N = 12</b>	0% N = 12	-	<b>75%</b> <b>N = 12</b>

This table shows that the majority of all fishers said they do catch the different shark species, except for the Whale shark, and that they can sell most of the sharks, except for the Tiger shark, Nurse shark, Daggernose shark, Smalleye smoothhound, Whale shark, Brazilian sharpnose and the Caribbean sharpnose. However, fishers do try to avoid sharks since they do not bring a lot of money. Two boat owners indicated that last April and May a lot of sharks were caught and two said that this year a lot were caught. The majority indicated that they catch all the different rays and turtles, except for the Hawksbill turtle, and nobody can sell any of the rays, turtles or dolphins. Half of the fishers said they catch the rough toothed dolphin while most fishers said they do catch the Guiana dolphin from time to time.

<sup>21</sup> One of them mentioned they find the ones with a 'smooth' shield. The Leatherback is the only turtle with a softer shield so he might have meant the leatherback after all.

Five boat owners said they do not have bycatch because the fishers bring everything to shore; *“We can sell everything. First, we provide the processors of what they need, and what is left will definitely be sold to the local market. We can say this with confidence, we do not have any bycatch, everything is utilized. I think our only bycatch is seaweed at the moment.”* According to this respondent they do catch some rays but not so much, the fishers can avoid places where rays are abundant and the ones they do catch they can sell to the local market. But from the interviews with the fishers it becomes clear that they do catch rays, and some type of fish that they discard at sea (see table 11 and 12) and occasionally also turtles and dolphins.

The fishing crew are not happy with this bycatch because it takes time to remove them from the net, the rays and large turtles damage the net, and turtles are sometimes too heavy to lift onboard, so they must cut them out of the net. One said that some turtles are so heavy that the net rips. The stingrays can be dangerous as well because some have a venomous tail. Some fishers said that they remove the bone in the tail from the stingrays for their safety, because if someone gets stung, they must go back to shore. They sometimes catch rays of which the bone has already been removed.

Because of this relatively long list of species there was no time in the interview to ask all fishers explicitly in which season they encountered the different type of specie, where they catch them, whether they are still alive most of the time when they haul their net in, and if they perceive any changes in the number they catch now as opposed to five years ago (see table 13). Especially for the question in which season they mostly encounter the species and for the dolphin related questions only a small number of fishers were asked, which means that the information concluded from those answers is not very rigid.

Two fishers stressed that people wrongly say that fishers are killing the turtles. They argued that they release the turtles straight away and that the ones that are supposed to protect the turtle nests at the beach are selling the eggs in French Guiana. Almost all fishers said that most of the turtles are still alive when they haul the net in. The Green and Leatherback turtle, the Manta ray, and larger sharks are too heavy to lift on board, so they cut them out of the net.

Seventeen fishers were also asked whether they cut off the fins of the sharks and discard the rest of the shark at sea (so-called shark finning). Thirteen indicated that they bring back the sharks with the fins attached and two said that they bring both the sharks and the fins, but the fins already cut off from the sharks. One of them said they do this only for the big sharks and the other said they cut off the fins at sea only when they have time. Another fisher said that if they catch a big shark alive, they release it into the sea, but if it is already dead and if it does not fit into the ice box, they just take the fins. Two fishers from Nickerie said they cut off the fins and if they can get a good price for it, they also bring in the shark. Six respondents explained that shark fins were more lucrative in the past before a ban was put on exports. One fisher explained: *“It is not illegal here but there is no point anymore in shark finning. Before, the exporters of fish bladder also exported shark fins, but now they can’t do that anymore”*. A boat owner reflected on the lucrative past of shark finning: *“In the past we could get 150 USD for a kilo of shark fins. Then we were chasing sharks, but since there is a ban on export it is cheap”*. He explained that in the ‘80s and ‘90s they only brought in the fins. According to him, one now gets 7 SRD for shark meat and 40 USD per kilo of big fins, while someone else said 1 SRD for a kilo of shark meat and about 17 USD for a kilo of shark fins.

Table 13: Information on when and where fishers find the different groups of animals, whether they are found dead or alive in the net and perceived changes in the number they catch. The results are in percentages with the number of fishers between brackets.

	Rays	Sharks	Sea turtles	Dolphins
Season	71% (5) said they find the same number of rays throughout the year, of which one said they do come in flukes sometimes. 14% (1) said they find them in September and 14% (1) said May.	62% (5) said that you can catch them in any season, of which two said especially during low tide, and 38% (3) said they find them specifically in April and May of which two also mentioned June.	29% (2) fishers said they find turtles in their nets mostly from May till August. 14% (1) mentioned from April - June, 14% (1) April - august and 29% (2) particularly august, of which one was specifically talking about Leatherbacks. 14% (1) did not know when most turtles are encountered in the fishing gear.	One fisher said he mostly sees them in January
Location	42% (5) said that they are mostly in the muddy area, three of them and seven other fishers, so 83% (10), said that the rays are close to the coast.	73% (8) said that sharks are mostly deeper than where they fish, however, they do all catch sharks. Also, one boat owner said the sharks have moved to the deep, but he does not know if those are the same species or different ones. 18% (2) said specifically that you can find them at the height of Marowijne at 12 fathoms. 9% (1) on the contrary said that sharks are not deeper than 7-6 meters deep.	25% (4) said that they find turtles beyond 12 fathoms. 25% (4) said they find turtles around 4 fathoms above the Wia Wia creek, of which two say they also find them at 14 fathoms above this creek. 25% (4) said they find them more inshore, of which two said they find them close to Braampunt. 12.5% (2) said the turtles are closer to shore than where they fish, and 6% (1) said they find Green turtles close to Galibi <sup>22</sup> . 12.5% (2) said they are where the sea grass is. 6% (1) did not know where they mostly find turtles.	60% (3) indicate that dolphins are deeper, without indicating how deep. 40% (2, who fish on the West side of the Suriname river) said there is no specific zone where the dolphins are.
Dead or alive	88% (7) said that most rays are alive when they discard them, while 13% <sup>23</sup> (1) said they are dead most of the time.	100% (5) said that most sharks are dead when they find them in their nets. However, two fishers said that most nurse sharks are still alive.	92% (12) said that turtles are most of the time still alive when they are found in the net. 8% (1) said that most green turtles have already died when found in the net.	33% (1) said they find the rough toothed dolphin most of the time dead. 33% (1) said about half the dolphins they find are dead, and 33% (1) said he only caught one so far and that one was dead, both not specifying which type of dolphin.
Change in amount they encounter in fishing gear since the last 5 years	45% (5) said they find less rays in their nets now than five years ago. 45% (5) said the amount has not changed and 9% (1) said they encounter more rays now than 5 years ago.	75% (6) said they find less sharks in their nets now than five years ago. 13% (1) said the amount has not changed and 13% (1) said that he encounters more sharks now than 5 years ago.	58% (7) said that they find about the same number of turtles now as five years ago, while 42% (5) find less turtles in their nets, of which one attributes this to the fact that they are not allowed in the 'turtle zone' <sup>24</sup> during the turtle season. Also, one boat owner said they find less turtles now than 5 years ago.	100% (5) said they find about the same number of dolphins now as five years ago.

<sup>22</sup> Galibi and Braampunt are two of the main sea turtle nesting sites in Suriname.

<sup>23</sup> Some percentages do not add up to 100% because the numbers have been rounded up.

<sup>24</sup> According to the permit conditions, it is forbidden to fish in the North of Galibi and 15 km on the West from Elanti, with a width of 15 km from the 1<sup>st</sup> of March until the 31<sup>th</sup> of July. This area is marked with three buoys (LVV, 2019).

### 7.2.5 Opinion on the future of the fishery

Of the 19 fishermen asked what they think about the future of this fishery and their work, five were positive, with two saying that the work will still cover the costs despite declining catches. As one explained you adapt to the declining fish stocks; *“ten years ago, we only had 8 inches, and now we also have 5 inch (mesh size). So, you adapt. In the past we did not have a winch, we used to do that by hand. You adapt when the years go by”*. Although almost all respondents say that the catch has decreased over the last years. One fisherman who is skeptical about the future said:

*‘I think it is going to end, because we are not fishing anymore. This is what I realize. From the time that I started this work, the fish percentage drop a lot, and this is because the fish has to be divided between the other fishermen. Back in the years there weren’t so many boats, but now there are more boats, so the fish got to be divided between everyone, so the percentage of the catch has to be lower. So, what is happening now, we are not catching fish anymore, we are hunting them down. This is how I see it’.*

Others responded with: *“there is nothing we can do about it”*, and *“in 50 years, there will be no fish, just plastics”*. One of them is worried that it will not bring enough money for a living in the future. Two other fishermen worry about the fact that even though the catches are declining, the prices are currently low; *“with these prices I might not feel like fishing anymore in the future”*. This was also pointed out by one of the boat owners who explained that 5 years ago, the costs of the trip were 7000-8000 SRD (fuel, ice, food on board etc). Now it is 12.000 to 15.000 SRD. So, the price of the fish does not compensate with that.

The artisanal fishers think that the industrial trawlers catch too many fish, including young Kandratiki and Bang-bang which has not had the chance to reproduce yet. Five fishers also said that trawlers come into their fishing ground, so below the 10-fathom line. Two said that the trawlers destroy the bottom and that their discarded dead fish comes in their nets. One also mentioned six Chinese trawlers waiting in front of the coast of Suriname for permission to fish; *“the Chinese trawlers, I guess they will catch all the fish in 10 years”*. These trawlers, belonging to Ros National Fishery, exceed the maximum horsepower and length but the company filed a dispute against the Surinamese government to still try to obtain licenses to fish (Times of Suriname, 2019). Concerns about the different kinds of trawlers operating in Surinamese waters were not integrated in my questions during the interviews, so it is possible that more fishers feel the same.



## 7.3 Place of fishers and fishers' knowledge in fishery management and conservation

### 7.3.1 Catch data collection

The Last stock assessment for Bang-bang and Kandratiki was conducted in 1988. There is no detailed catch record of the SK fishery including the composition of the catch and of the bycatch (Martinez & Drugan, 2017). In the report of the Central Bureau of Statistics of Suriname there are some statistics on fish catches from 2013 to 2017 but those do not include the artisanal fishery (General Bureau of Statistics, 2018). Although Kandratiki and Bang-bang are the most important species of this fishery, it is a multispecies fishery in which many more fish are caught, at least up to 40 fish species (see table 11).

Data collectors from the government collect catch data at the assigned landing docks. They do make a distinction between the different species when they collect the data from the landing sites, but this data is later aggregated into 'finfish'. Information about discarded fish, rays, sharks, turtles, or marine mammals at sea is not collected. The data collectors use a sampling system, in which they retrieve the information of the catch of a couple of boats and extrapolate this data to the total number of boats that land their catch that day. They thus do have the 'raw data' per species but nobody analyses this. An employee of the Fisheries Department stated that *'the statistics are not what they ought to be'*.

One data collector was interviewed, he explained that he writes down all the SK-number of the boats that are present and registers the catch of 1 to sometimes 6 boats. Of these boats he writes down the weight of the catch per specie, the type of boat, the number of days they have been at sea, and the location where they have been fishing. The different shark species are not written down separately, neither does he collect any data on fish bladder. Sharks are often landed without their heads which could make identification of the specie more difficult if the data collectors would want to write it down. He comes from Monday till Saturday as from half past 6. If boats arrive in the afternoon, they do not land the catch yet because there are no trucks to collect the fish. This way the collector does not miss any boats. He used to work with two colleagues, but they have retired, so now he is on his own. I spoke shortly with another data collector at a landing dock in Nieuw Amsterdam and she said that a good relationship with the fishermen and boatowners is important for them to cooperate, especially for when she is not around. She explained that when she is not there, "you can't be in two places at the same time", someone else, such as the woman who was sitting next to her selling the ice, will give the information to her.

Most fishers indicated that they keep a record of their target species on board. They count the fish at sea when they put them in the ice box, and they weigh the fish when they land and sell it. This is often for the captain's personal use. He can then check how much fish he caught in which area. One boat owner also explained that his crew counts the main species (Bang-bang and Kandratiki) and gives a rough indication of the amount of other species, such as 'a quarter of the ice box'. The fish is weighted when they sell it on the landing dock. The boat owner explained that they can then see if the indication of the captain of the amount of a certain fish fits with the weight;

*'A mature Bang-bang for example weighs between 8-10 kilo. You can easily divide it and check if it fits. There are captains who do not give the true catch, they may say that they caught more to exaggerate or something, so we as entrepreneurs wait for the total weight'*.

Some boat owners who land at a different dock indicate that their catch is landed at 4 or 5 o'clock in the morning while the data collector comes at 7. And a board member of the fishers' cooperative in Nickerie said that the data collector comes between 7 in the morning and 3 in the afternoon, while the boats can come 24/7. According to him there is a minimum amount of catch that the boats need to land in a year, so the boat owners do have to show their catch to some collectors at least sometimes.

### 7.3.2 Sharing of information between the stakeholders

All fishers except for one indicated that they share their knowledge and experience in fishing with other fishers. Nine fishers explained that they also share their position with other boats when the catch is good; *“Everyone has their family and kids to look after. It makes no sense to be selfish about the fish”*. One boat owner said that they do not invite everybody to come, just some with which they have good relationships and one fisher said he shares a good spot with others once they are finished there. They also share the positions and the success of their trip when they return to shore.

Most fishers have never been invited to any meeting of any fishers’ cooperative, the Fisheries Department or any other organization. Of the 29 fishers asked, 21 have never been invited to any meeting or discussion about the fishery and of the 21 fishers asked, 19 indicated that they are not involved with the cooperative (see figure 26 and figure 27). Eight fishers said that they have been invited to at least one meeting. Two of them explained that they have had meetings with the boat owner and the crew. Five have been invited at least once by the fishery cooperative. One of them said that when he is back in town he normally does not have time for meetings, one of them is the husband of a female boat owner who is an active member of the cooperative and he indicated that he went to several meetings, and three fishers said that the cooperative came after the piracy attacks from last year to talk to some fishers. Another fisher said he had once been in a meeting organized by the government about fishery legislation and sharks, but he said that was ten years ago. Another fisher said he had seen someone from the cooperative or government here at the landing dock talking to fishers, but at the time he was busy himself. So, the fishermen who have been invited to some fishery related meetings have not been invited systematically to more meetings.

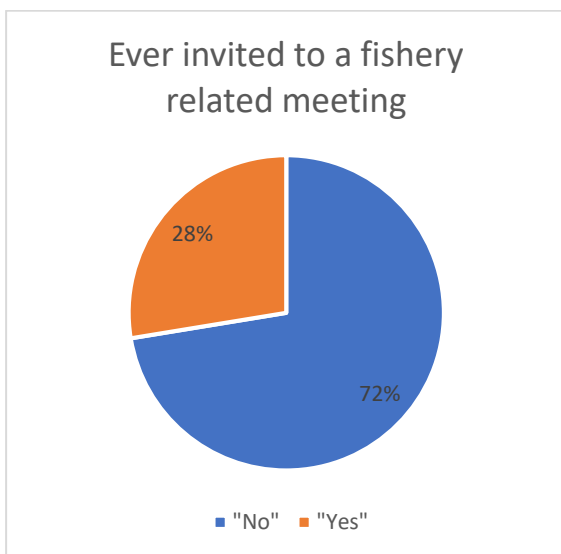


Figure 26: Percentage of fishers ever invited to a meeting

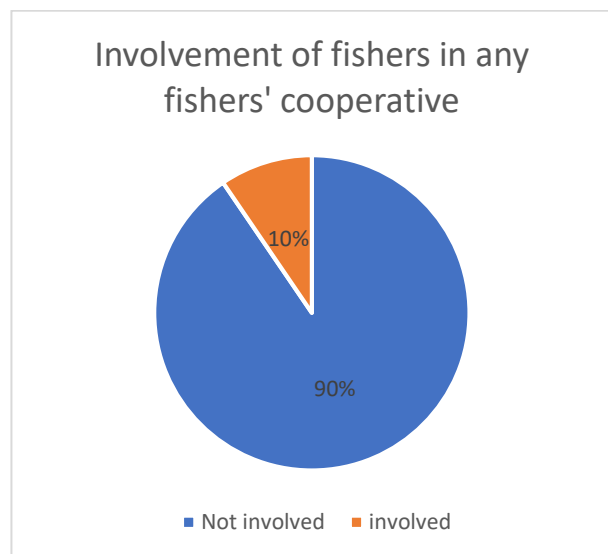


Figure 27: Percentage of fishers involved in any cooperative

Eight members of the cooperatives said that fishermen are invited if they would want to but that they are not interested: *“they have other things to do”*. One board member of the fishers’ cooperation explained that members of the cooperative are in general license holders, so that they are sure the members have an investment in the sector. Some of those license holders may fish themselves or used to fish in the past. He also explained that the boat owners can invite the captains and the captains can in turn invite other fishers (*“workmen”*) to meetings organized by the cooperative. They also hang up posters (A4, in Dutch) at the landing docks about upcoming meetings and share this on their social media network. A boat owner of 26 boats however said he does not invite any captain to any meetings and that those meetings are meant for the boat owners. Another member said that some of the buyers are also members and a board member of the cooperative in Nickerie said that, next to boat owners, and buyers also fish processors are members. He said that he does not know the SK gillnet fishermen because they come and go, and they are illegally staying in Suriname.

Perhaps related to the view of boat owners that fishers are not interested in joining meetings, is their general image of this group. Some respondents (boat owners and board members of the cooperatives) attributed some negative characteristics to the fishers. Five of them mentioned the use of alcohol: *“many just drink beers, have you not seen them with beer? They do not think about tomorrow”*. My key respondent, who is a boat owner, explained that it is better to visit the landing site in the morning as some are already drunk in the afternoon. Some said that fishers are not unified, and some boat owners also said that fishers can be unreliable. They have experienced that some do not show up on the day of departure while they already received their deposit. A fisher might do this with several boat owners. They also said that they don’t show up on and have excuses such as a headache, a sick wife or daughter, or a toothache.

One member of the cooperative said that if the cooperative comes at the landing docks, it is on the occasion of something unusual, such as the pirate attacks. The more regular meetings are at other locations such as CEVIHAS (a bigger landing dock in Paramaribo for several fleets), a government building in Paramaribo, or at the VC building at Nieuw Amsterdam. The meetings are in Dutch or in Surinamese (Sranang) while most fishers only speak English. In the training about value chain management there were no fishers and in the meeting about the update of the VMP there was one boat owner who also goes to sea himself. When I asked someone from the Fisheries Department whether they also want input for the new Fisheries Management Plan from fishers actually going to sea he responded with: *“yes of course”*.

Someone who organized participatory mapping sessions to use the input of fishers to see where certain types of fisheries operate, said that not all fishers see the need to participate because they have the feeling that nothing will change and that some hesitate initially to participate: *“They are sometimes hesitating to give information, but if we tell them it is not for the police or some other authority, they do tell where they fish. Sometimes they say they do not know there was a meeting, while this should have been announced by someone”*. There were no fishers present at the start of the meeting at the landing dock and someone had eventually convinced some fishermen to join.

Some fishers themselves say that such meetings are organized for the boat owners, but seven fishermen who were asked explicitly if they would like to be invited for fishery related meetings said they would. Overall, the fishers who work at sea do not feel that they are represented by anyone, as one fisher summarized: *“We do not have a union, cooperation, association or minister looking out for us”*. When asked whether they are in any way involved in decision making about the fishery, none of the thirteen fishermen said that they are. One said that *“nothing from meetings is shared with us and if a new law or rule is shared then they will change in tomorrow again anyway”*. Two of those fishermen said that involvement in decision making is more for the boat owners: *“he is more experienced in this sector”*.

The board member of the cooperation in Nickerie also explained that boat owners themselves are not always interested in attending meetings. According to him, they are less enthusiastic about meetings concerning the environment than meetings about new licenses: *“when I come with a training, for example with the WWF, concerning the environment, they are less enthusiastic. When I say guys listen, new licenses are on their way, then they are interested. But if I am asking for contribution (20 or 30 SRD), I almost have to beg”*.

Several people have said that the frequent changes<sup>25</sup> of the personnel working at LVV and the Fisheries Department of the government makes it harder to work on projects or facilitate collaboration with the government. One respondent said that during the gaps between an old and new staff member, extra licenses are handed out. A board member of SUNFO and VC said that the communication between the cooperatives is poor: *“We have a shared group app but nobody replies when I send a message”* and that SUNFO members try to shift work to VC since they are the oldest and most experienced. He also said that the representatives of Galibi are present most of the times but that you really have to pull the others: *“If the WWF does not pay for their trip they do not come”*.

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<sup>25</sup> The last minister of LVV only worked on that post for a year. The current minister started in 2019.

Including fishers and boatowners in fishery related meetings or projects is not only desirable for their knowledge but also to understand why they do things the way they do. In one of the meetings a representative of the state-owned oil company (Staatsolie) said that their radar does not always see these Guyana type fishing boats and that these sometimes do not have their lights on. He assumed this was because those were illegal vessels. A boat owner then explained that they also do this so they will not be discovered by pirates. Another example was during a meeting of CI and VC when possible adaptations of the net to reduce bycatch was discussed. A suggestion to paint the floats a different colour so that the leatherback turtles would not confuse them with jellyfish (their diet) was dismissed by the boat owners as they explained that they would not want to do that since their nets will then be more visible for pirates.

During the consultations of the Fisheries Management Plan it was stated that boat owners felt that their 'voice' was heard too little (LVV, 2013). A board member of VC said that now the collaboration with the government is working all right and he and another boat owner said that they are better involved now in fisheries management than in the past:

*"In the past the government was not working closely with the boatowners, but thanks to the fishers' organizations we are more involved with decision-making and forming policy, because we are better organized now. In the past we did not have fishers' organizations, so the government did not have any contact persons".*

Although the collaboration between VC and the government has improved, some SK boat owners still expressed that they feel marginalized as the artisanal sector. Some feel that the government is not taking them seriously. Two boat owners said that the government is corrupt and that it fell short after the pirate attacks since the boat owner on whose boat the incident took place paid himself for the cremations of the victims. The boat owners interviewed in this study are also concerned about the number of licenses that are handed out by the government, they feel that there is what they call "vriendjes politiek" (favouritism).

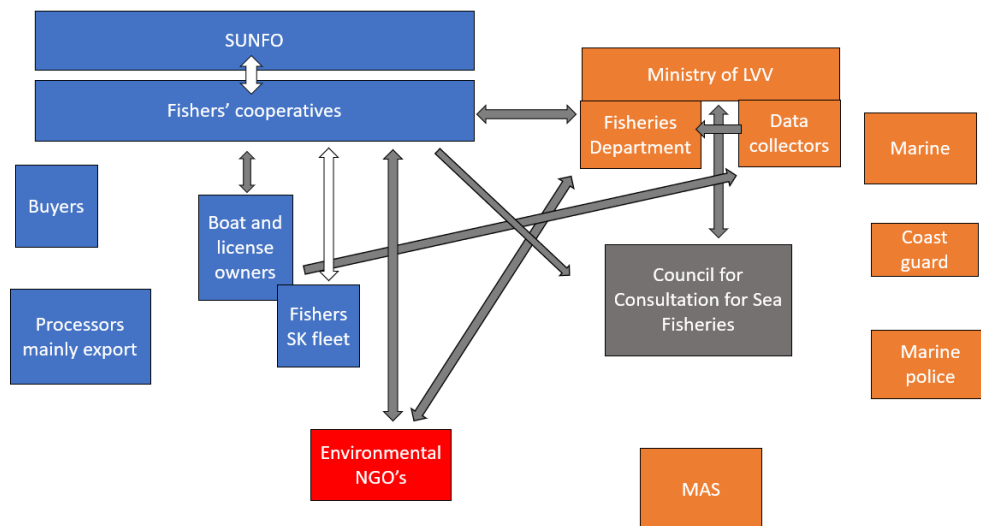


Figure 28: Knowledge flows between Stakeholders

In figure 28, the main knowledge flows between the stakeholders are visualized.

The data collector from the government asks fishers about where they have been, for how many days they have been fishing and he registers the catch. This data is sent to the Fisheries Department where it is aggregated into 'finfish'. In the report of the General Bureau of Statistics there are no statistics on the catch of the artisanal fleet (General Bureau of Statistics, 2018). Hence, there is some room for improvement in the analysis of the data gathered by the data collectors. Boat owners and captains have records of their catches. These may be useful to follow trends if they are willing to share those. Someone from the Fisheries Department stressed that they do not receive any information from the coast guard on, for example boats, that have been caught fishing without a license. This type of information could be shared to enhance monitoring and compliance in the fishery.

The research took place mainly in Paramaribo, which means that most information about cooperatives is about VC, which represents the artisanal industry in Paramaribo / Commewijne. The conclusions drawn are thus mainly related to this cooperative. Although not all boat owners are member of VC, the cooperative shares information with the boat owners through different channels (social media and posters at landing docks). SUNFO has been the umbrella organization for all artisanal fisheries cooperatives since 2018, but so far it is still VC who is taking the lead, and according to two board members SUNFO is not yet functioning the way it should be. VC represents the interests of the artisanal fleet in Paramaribo / Commewijne and board members they say that although most members are boat owners, they also represent the interests of the fishers, because they serve the interest of the artisanal sector as a whole. It has also been said that most fishers are not interested in any meetings. From the interviews, however, it became clear that there are fishers who would like to be invited. There does not seem to be a lot of information flowing from the fishers to the fishers cooperations and the other way around. The overall sentiment among the fishers is that both government and the cooperatives are not interested in their views.

For the previous and upcoming Fishery Management Plan of the government several stakeholders, including the fishers' cooperatives of the artisanal fisheries, are consulted. Board members of VC say they generally have good relations with the NGO's and with the government and respondents from the NGO's and the Fisheries Department confirmed this. So, if fishers would be better represented by, or more involved in the cooperative this could increase their connections to NGO's and the government and in turn may improve their influence on decision making in this fishery. Because of the nature of the work (fishers are often at sea, most do not have access to an email account, outreach is therefore more difficult), the fishers cooperatives could form a means to reach out to them.

## 8 Conclusion

From the literature review, a knowledge gap appeared about the socio-economic dimensions of the artisanal gillnet fishery in Suriname and the use and possible value of local ecological knowledge held by the fishers active in this fishery. In order to contribute to closing this knowledge gap a case study was conducted in Suriname from April till June 2019 lead by the following research question:

*How can fishers' knowledge be incorporated in fishery management and marine conservation efforts?*

To answer the main question, three sub questions were posed:

1. *What are the socio-economic characteristics of the fishery?*
2. *What do fishers know about their bycatch and their target species?*
3. *How is fisher's knowledge currently used by the Fisheries Department and NGOs?*

Semi-structured interviews with fishers formed the main input of information for this thesis, but interviews were also held with boat owners, board members of fishers' cooperatives, NGO staff members, and government officials. I participated in several fishery related meetings and documents related to this fishery were used as secondary sources.

### *1. What are the socio-economic characteristics of the fishery?*

In general, boat owners do not fish themselves and the fishers working on their boats are mainly Guyanese, of which the majority does not have an official permit to work and live in Suriname. There are no women fishing in this type of industry, but there are female boat owners and women involved in small scale fish processing. Although only Surinamese citizens can legally hold a fishing license, there are Guyanese boat owners who illegally rent licenses from Surinamese license holders. Boat owners do not have informal agreements with captains who work on their boats and they do not have any agreements with the other fishers working on their boats. The fact that most Guyanese fishers do not have any other sources of income apart from this fishery makes them vulnerable if this these fish stocks would collapse. The fishers with a Guyanese background interviewed in Paramaribo and Nieuw-Amsterdam have been living in Suriname for 17 years on average and fishers (including the ones born in Suriname) have been to school until the age of 15 on average.

Most of the fish is destined for export. Fishers and boat owners are complaining that the prices for the fish are dropping while expenses such as fuel and groceries are rising. Some respondents complained that trawlers bring large amounts of Kandratiki while they can get tax free fuel, which according to them means that they can offer the Kandratiki for less since they have this 'unfair' competitive advantage, as the SK fleet cannot use tax free fuel. Although the government made commitments to either reduce or halt the increase of licenses for all types of sea fisheries in 2013 after consultation sessions with multiple stakeholders, it handed out more fishing licenses since then. Illegal fishing vessels entering Suriname and fishing vessels operating outside their designated zones increase the pressure on its fish stocks.

### *2. What do fishers know about their bycatch and their target species?*

Although this information is not systematically recorded, fishers can provide useful knowledge on catch trends and on where they catch certain species. All respondents saw a decline in catches of overall all fish species and attributed this to the amount of fishing boats (both artisanal and industrial). They stressed that the fishing effort, which includes the time spend at sea and the size of the nets, has gone up in the last ten years in order to make a profit. This way they adapt to declining fish stocks, but the catches per unit of effort are decreasing. Fishers catch many more different species than the main target species (Kandratiki and Bang-bang). The information and knowledge from data collectors and boat owners is valuable but not complete since they only know the part of the catch that is landed.

All rays, turtles and dolphins caught are discarded at sea. Most species of sharks, rays, turtles,

and dolphins that are included in the ETP and other key species guide for the Guianas used during the interviews are caught at least sometimes by fishers in this fishery. Although fishers are not after sharks as these are not valuable anymore, they do sell most of the shark species, including some endangered species. This shows that what is seen as bycatch can differ among and between fisheries managers, scientists, and fishers.

Most rays and sharks are caught throughout the year while sea turtles are caught between April and August. Rays are found inshore in muddy areas, whereas dolphins and sharks are caught further offshore. Most fishers indicated that they catch turtles close to shore within 4 fathoms, although some also said they find them beyond 12 fathoms. Most of the time, rays and turtles are found alive while sharks are mostly already dead when found in the net. Half of the fishers said that they catch the same number of rays now as five years ago while the other half said that they catch less. Most fishers find less sharks and the same number of turtles and dolphins now as opposed to five years ago. Fishers obtain their knowledge about their work and the species they catch through their experience at sea. This type of knowledge is valuable for policy makers and environmental organizations as a better understanding of where and when certain species are caught can help improve fishing practices.

### *3. How is fisher's knowledge currently used by the Fisheries Department and NGOs?*

For the previous and upcoming Fishery Management Plan of the government several stakeholders, including the fishers' cooperatives of the artisanal fisheries, are consulted. The fishers who are actually going to sea, however, do not feel that they are represented by anybody and most of them have never been invited to any fishery related meeting. Boat owners, who are the main members of the cooperatives, feel that most fishers are not interested to come to such meetings. There may also be a language barrier for the Guyanese fishers, of whom most do not speak Dutch, to go to such meetings. Most fishers who were asked whether they would like to be invited to fishery related meetings said they would. The fishermen interviewed in this study generally feel neglected when it comes to fishery management and fishery related meetings.

There have been some projects initiated by the WWF Guianas and Conservation International in which fishers from the artisanal gillnet fishery are or have been engaged. A project of WWF Guianas was a species recognition session in Guyana. Programs organized by WWF Guianas still ongoing at the time of writing are a stock assessment with the help of fishers on several species caught in the SK gillnet fishery based on the length of the landed fish and a participatory sea mapping project in which fishers from different fisheries are asked about what kind of fishing activities take place in which areas. Another study that will start this year is an evaluation on the functioning of the different fishers' cooperatives. Fishers will be interviewed for this as well. Conservation International recently started an onboard monitoring study on the catch composition of the SK gillnet fishery and about the lifecycle of Bang-bang and Kandratiki, for which fishers are asked when and where they find the fish with ripe eggs. Captains fill in an assessment form and get 10 USD per day on the fishing trip for doing this.

### ***How can fishers' knowledge be incorporated in fishery management and marine conservation effort?***

The fishermen are not organized as a group and they may be at sea when any meetings are planned or announced. This, their irregular work schedule and the fact that they are at sea around two weeks at a time are possible barriers to participate in any fishery related meetings on management or marine conservation. On the other hand, they are often concentrated at the landing sites. Facilitating fishery related meetings at those landing sites will lower the barrier to join those for fishers. However, it may be challenging to organize a meeting outdoors. Organizing meetings in English or Sranantongo (Surinamese) could also facilitate participation by the Guyanese fishers.

The fisheries collective of Paramaribo/Commewijne generally has good relations with the NGOs and with the government. So, if Guyanese fishers would be better represented by or more involved in the cooperative this could increase their influence on decision making in this fishery through the cooperative and it would be easier for the government and other organizations to reach out to them.

Next to local ecological knowledge about the different species, fishermen can also provide useful information when they see trawlers fishing in the artisanal zone. The other way around trawlers

could also make a notification when they find SK boats in their fishing zone. Since the coast guard has limited resources, the government can make use of this information on those irregularities. In the end it is not just about incorporating fishers' knowledge, but fishers input more generally, so including their wishes and priorities in the designing phase of conservation efforts and fishery policies, not just in the implementation of an already established plan. Otherwise, they do not gain anything from sharing their knowledge.



## 9 Discussion

In this last chapter the limitations of the research will be outlined, after which the findings of the thesis will be linked to the theoretical framework. Several policy implications and recommendations are given to advance the incorporation of local ecological knowledge in fisheries management and conservation and finally suggestions for future research are given.

### Limitations of the research

There were some contradictory answers from the respondents about the species they catch, even though those fishermen fish in roughly the same area. Answers about the amount of species in their catch and the regularity of these are not quantitative. For example, if someone said they do sometimes catch a certain type of shark, we do not know if this is twice per year of every trip. There was not enough time during the interviews to go into this detail for all the species. The sample of fishers asked about the location, season, whether the species were found alive or dead and perceived changes in number over the last five years was limited.

I had the feeling that some fishers did not really recognize the different shark species from the species guide but did say that they catch them. Some shark species look similar. On-board monitoring by fishermen with the help of this guide would probably give more accurate results.

The context specific design of this research makes it is difficult to extrapolate findings to broader populations or to draw general conclusions. Because part of the research was about endangered marine species and conservation the *deference effect* might have occurred, which refers to people telling you what they think you want to know to avoid offending you, or the *social desirability effect* might have occurred, which refers to people telling you what they think will make them look good according to prevailing standards of behaviour and thoughts (Bernard, 2011). Respondents thus might have given answers they think are socially desirable.

Most of the boats used in this fishery have a crew of around six men who share a small room to sleep in and are two to three weeks at sea. Because of the lack of space and privacy on board it was not be possible to do participant observation on board.

### Theoretical implications

In this research the concept of local ecological knowledge (LEK) was applied to the artisanal gillnet fishery in Suriname. LEK is a dynamic form of knowledge rooted in social groups and developed through practical experience and observations of a local ecological setting (Pita, Fernández-Vidal, Carcía-Galdo, & Muíno, 2016). Such information from fishers has been treated as anecdotal and of lesser value (Silvano & Valbo-Jørgensen, 2008). In this context, LEK could fill in gaps of information not obtained from the fish landings and the WWF and Conservation International do see the value in this and already have had some projects or are currently working with fishers in their projects. However, fishers' input and opinions more generally are not systematically integrated in fisheries management.

This case study shows that fishers' knowledge can shed light on which type of species they catch, whether they land or discard the catch, where and when they find certain species and the level of fishing effort that was needed for the catch. This information is important for fisheries management as a steady catch does not mean that the fish stock is also steady if fishing effort has gone up in order to catch the same number of fish.

The sentiment in this case study among most of the fishers is that nobody represents them. Although boat owners indicated that their collaboration is better with the government now than in the past, some do feel that the government values the industrial sector more than the artisanal sector and all think that they are careless in their fishing license policy which undermines their credibility. Besides adding information about fish stocks and the health of marine ecosystems, including LEK also serves to bring local perspectives into conservation debates and fisheries management. This could strengthen the political voices of fishers and improve collaboration between fishers and other fisheries stakeholders, such as the Fisheries Department and NGOs active in Suriname. According to Silvano & Valbo-Jørgensen (2008) and Daw et al. (2011), fisheries management which integrates knowledge and

traditions of the local resource users is more likely to succeed as opposed to top-down management that imposes regulations by a central administration. Incorporating the wishes and input from both boat owners and fishers going to sea, could evolve in co-management of fisheries policy and participatory conservation in conservation efforts. This could create a 'social license to operate' and enhance the local social embedding for such fisheries related projects or policies.

This fishery is a socio-ecological system in which there is an interplay of natural resources and resource users. The complexity of such systems means that managing them sustainably can be challenging. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987). When applied to this fishery, it means that fisheries resources should be used in such a way that fish stocks do not decline and that the ecosystems on which they depend are not degraded so that future generations can still use these resources for their livelihoods. In this case, the fish stocks are not managed sustainably as overfishing takes place. This, however, is the result of the accumulation of several fisheries operating in the sea which partly catch the same species or other species in the ecosystem upon which the target species may depend upon. This shows that one fishery or the target species cannot be managed on its own without looking at the socio-ecological system in which it is part.

### **Policy implications**

As seen above, the different fisheries do not operate in isolation of each other. The target species of the artisanal gillnet fishery and the industrial fish trawlers partly overlaps and some of the bycatch of the trawlers are target species of the artisanal fleet. Besides, certain types of fish and occasionally the artisanal and industrial fleet cross the boundaries of the artisanal and the industrial fishing zone. This shows that a holistic fisheries management approach is needed in which all the different fisheries and resource users are considered.

This study also showed that fishers' knowledge is not just about ecological knowledge, but also about other sustainability aspects of a fishery, such as illegal, unreported and unregulated fishing. For example, the knowledge that there are boats illegally landing their catch in Guyana. One way in which fishers' knowledge and experience can already be used for making this fishery more sustainable is by taking their notifications about illegal boats or trawlers fishing inside the artisanal area seriously (and vice versa notifications of the industrial fleet about artisanal boats going beyond their fishing zone). Such information can be low hanging fruit to counter illegal, unreported and unregulated fishing. In a context where the coastguard, marine and maritime police do not have enough resources, fishers at sea, both from the artisanal as the industrial fleet, could serve as the eyes and ears of happens in this environment.

Including the input of the fishers and using a bottom up approach increases the 'social license to operate'. Projects of the government and other organizations will be more legitimate this way and there is a bigger chance that those are supported by the resource users. Including local ecological knowledge gives a voice to resource users and presents an alternative to top-down management. Boat owners' inputs are included in drafting a new Fisheries Management Plan, but this is not yet 'the bottom' as the first chain in the fishery is not included: namely fishers going to sea.

The licensing system for the artisanal gillnet fishery would be more legitimate if there is a transparent process in the number of licenses handed out and if there were clear conditions which determines when someone can obtain a fishing license. Currently, one may get a reply to their request saying that they cannot give a license because this fishery is overfished, while someone else does get a license.

### **Further research**

Suggestions for future research would be to collect more quantitative data on the frequency, location and season of the catches of turtles, rays, sharks and dolphins. The recently started onboard assessment in which Conservation International directly works with captains is a starting point for this. Local ecological knowledge situated in other fisheries in Suriname, such as the inland fisheries or the industrial fisheries, could also be interesting subjects to investigate further.

## Annex 1: Overview respondents

- = Not asked					
CG = Closed Guyana type boat. OG = Open Guyana type boat					
nr.	M/F	Function	Background	Experience in fishing in years	Years in Suriname
1	M	Captain CG	Guyanese	20	Since 2005 (but before coming and going more often)
2	M	Captain OG	Surinamese	12-13	Born in Suriname
3	M	Workman OG	Guyanese	2	10
4	M	Workman OG	Guyanese	7	7
5	M	Workman CG	Surinamese	2	Born in Suriname
6	M	Workman CG	Guyanese	10	'a long time', 50/50 in Suriname & Guyana
7	M	Workman CG	Guyanese	19	Since 2000
8	M	Workman CG	Guyanese	4	-
9	M	Boat owner	Surinamese	-	Born in Suriname
10	M	Boat owner	Surinamese	-	-
11	F	Boat owner	Surinamese (moved as child to Suriname)	-	-
12	M	Ex workman CG	Guyanese	4	10-15
13	M	Workman OG	Guyanese - French	15	2
14	M	Workman	Guyanese	25	10
15	F	Conservation International	Dutch	-	-
16	M	Conservation International	Surinamese	-	-
17	M	Workman CG (father is captain)	Guyanese	17	16 (coming and going)
18	M	Workman CG	Guyanese	5	5-6
19	M	Fisheries Department - Monitoring & inspection - Statistics & research	Surinamese	-	-
20	F	Boat owner OG	Surinamese	-	Born in Suriname
21	M	Secretary Visserscollectief Boat owner OG	Surinamese	-	Born in Suriname
22	M	Captain and owner of 1 CG	Guyanese	22	15 (coming and going)
22B	M	2 workmen	Surinamese	23	Born in Suriname
23	M	Captain OG	Guyanese	35	Since 70's
24	M	Workman OG	Guyanese	10	4 years working in Suriname (lives just across the border in Guyana)
25	M	Captain OG	Guyanese	35	-
26	M	Captain OG	Guyanese	>25	-

27	M	Chair Fishers cooperation Nickerie	Surinamese	-	-
28	M	Workman OG	Guyanese	15	Lives in Guyana
29	M	Captain CG	Guyana	>30	-
30	M	Captain and owner of one OG & one CG	Guyana but Surinamese nationality	>30	-
31	M	Data collector	Surinamese	-	-
32	M	Buyer	-	-	-
33	M	Boat owner	Guyanese	-	-
34	M	Boat owner (26 boats)	Guyana but Surinamese nationality	32 (not anymore)	-
35	M	Captain OG	Guyanese	25 (10 years as captain)	-
36	M	Boat owner (one boat)	Surinamese		-
37	M	Captain CG	Guyanese	26	-
38	M	Boat owner (one SK gillnet (open), one SKB and one Njawarie)	Surinamese (born in Guyana but moved to Suriname as a baby)	-	-
39	M	Workman CG	Guyanese	20	30
40	M	Workman CG	Surinamese, mother from Guyana	3	Born in Suriname
41	M	Workman OG	Guyanese	13 this type specifically, but since age of 7 fishing	21
42	M	Workman	Surinamese nationality but Guyanese background	-	8
43	M	Workman CG	Guyanese	14	14
44	M	Captain OG	Guyanese	29	30
45	M	Workman	Born in Guyana but raised in Suriname	20 (since age 14)	27 (since the age of 6)

## Annex 2: Socio-economic background fishers and boatowners

- = Not asked CG = Closed Guyana type boat. OG = Open Guyana type boat						
nr.	M/F	Function	Background	Time in Suriname	Other source of income	Education (until what age)
1	M	Captain CG	Guyanese	Since 2005, but already before back and forth	No	-
2	M	Captain OG	Surinamese	Born here	No	-
3	M	Workman OG	Guyanese	10 years	No	-
4	M	Workman OG	Guyanese	7 years	No	< 14
5	M	Workman CG	Surinamese	Born here	Sometimes in de building sector	-
6	M	Workman CG	Guyanese	'a long time'	No	18
7	M	Workman CG	Guyanese	Since 2000	-	12
8	M	Workman CG	Guyanese	-	No	11
9	M	Boat owner	Surinamese	Born here	-	-
10	M	Boat owner	Surinamese	Born here	-	-
11	F	Boat owner	Guyanese	Born Guyana (came as a child)	-	-
12	M	Former workman CG	Guyanese	10-15 years	Not fishing anymore, selling drinks and snacks at landing dock. He earned more with fishing.	-
13	M	Workman OG	Guyanese - French	2 years	Housebuilding. He earns more with fishing.	-
14	M	Workman	Guyanese	10 years	-	-
17	M	Workman CG (father is captain)	Guyanese	16 years (coming and going)	No	-
18	M	Workman CG	Guyanese	5-6 years	No	14
20	F	Boat owner OG	Surinamese	Born here	No	-
21	M	Boat owner OG	Surinamese	Born here	-	24
22	M	Captain and boat owner CG	Guyanese	15 years (coming and going for stamp)	No	14
23	M	Captain OG	Guyanese	-	-	19
24	M	Workman OG	Guyanese	Lives in Guyana just across the border	-	
25	M	Captain OG	Guyanese	-	-	10 (started working from the age of 10)
26	M	Captain OG	Guyanese	-	-	16
28	M	Workman OG	Guyanese	Lives in Guyana just across the border	-	14
29	M	Captain CG	Guyanese	40 years	No	17
30	M	Captain and	Guyana but	40 years	According to him the	17

		owner of one OG & one CG	Surinamese nationality		only captain who also repairs nets. And at sea repairs inboard motors and fixes GPS	
34	M	Boat owner and ex fisher (26 OG boats)	Guyanese	34	-	Has been fishing on OG from the age of 13
35	M	Captain OG	Guyanese	-	-	16
36	M	Boat owner	Surinamese	-	-	Studied journalism
37	M	Captain CG	Guyanese	10		19
38	M	Boat owner	Surinamese (born in Guyana, moved as baby)		-	-
39	M	Workman CG	Guyanese	30	No	16-17 (in Guyana and Suriname)
40	M	Workman CG	Surinamese	Born in Suriname	No	Lower school
41	M	Workman OG	Guyanese	21	No	16
42	M	Workman	From Guyana but Surinamese passport	8	No	15
43	M	Workman CG	Guyana	14	No	18
44	M	Captain OG	Guyana	30	No	15-16
45	M	Workman	Surinamese	Born in Suriname	-	14 (after which he went fishing)

Annex 3: Pictures used to ask fishers when and where they find Kandratiki or Bang-bang with ripe eggs

**ONBOARD CATCH MONITORING  
- FISH MATURITY ASSESSMENT-**

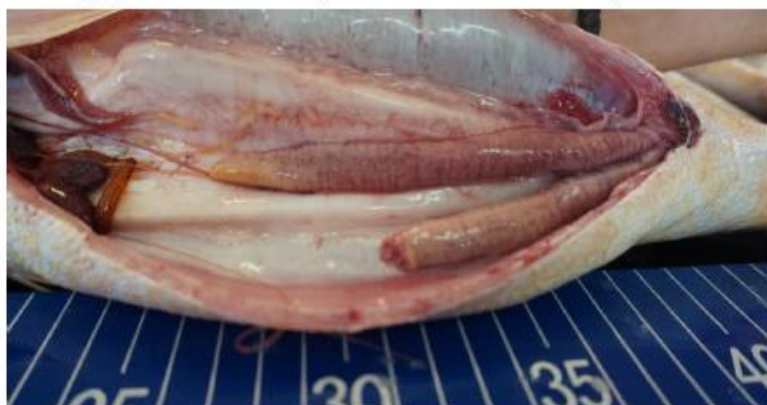
**NO EGGS:** no eggs visible (male of immature female)



**UNRIPE:** thin egg mass, yellow-orange in color (immature female)



**RIPE:** thick egg mass, orange with red veins (mature female)



## Annex 4: Changes in catch observed by fishers and boatowners

Respondent	Increase / decrease / or no changes in amount of catch over the last 5 years	Changes in the species composition	Cause & Quotes
1	Decrease	-	<p><i>'Its not like 20 years ago. There are more boats and everybody is now thinking of how to catch fish'.</i></p> <p><i>'You have trawler workers now. Everybody is working for a living. Everyone has a family, so you have to do this'.</i></p>
2	Decrease	No	<p><i>'Je weet nooit wat je gaat krijgen. Deze trip hadden we 500 stuks vis de trip soms is het meer en soms is het minder'.</i> <i>'You never know what you will get. This trip we had 500 fish, sometimes it is more or less'</i></p> <p><i>'Vroeger zouden we maar 5 of 6 dagen werken. Nu moeten we 15 tot 12 dagen werken. Dus vis is echt verminderd hoor'.</i> <i>'In the past, we would only work for 5 to 6 days. Now we have to work for 15 to 12 days. So the fish has really decreased'</i></p> <p><i>His net was partly taken by a trawler: 'kijk hoe ik problemen heb met die trawlers. Zij moeten eigenlijk boven 10 lijn zitten. En niet een was dat, er waren vier. Ik heb niet geslapen de hele avond was ik bezig om mn netten te zetten. En je kan kijken hoeveel ik ijs ik in mn box heb, ik kom alleen met ijs binnen. En dan kom jij in mijn territorium, nou wat moet ik doen? Ik ben bang, dat is ijzer en dit is hout. Daarvoor ben ik bang.'</i></p> <p><i>'Look at the problems I have with the trawlers. They should be above the ten fathom line. And there were four, not just one. I have not slept because I was busy with the nets the whole night. You can see how much ice I have in my box, I am just bring ice. When you come into my territory what should I do? I am scared, that is iron and this is wood. That is what I am scared of.'</i></p>
4	Decrease	No. Also same sizes	Also More boats (different kind of boats).
5	-	-	- No clear answer and only works for 2 years
6	Decrease	No	<i>'A lot more boats are now fishing'</i> (SK boats)
7	Decrease	-	<p><i>'We catch less and less. There are more boats fishing'.</i> (any type of boat)</p> <p>It changed around 2012 according to him.</p>
8	Decrease	-	<p><i>'Now we get like 200 Kandra, in the past maybe 2000, 2500'.</i></p> <p>It changed around 2012 according to him.</p>
9 (boat owner)	Decrease	-	<i>'Er is totaal geen controle op zee. Heel Guyana is hier. Illegale vissers. Illegale burenen'.</i> <i>'There is absolutely no</i>



			<p><i>surveillance at sea. Everyone from Guyana is here. Illegal neighbours’.</i></p> <p><i>“40 jaar terug gingen boten van de Leonsberg om 4 uur ’s ochtends weg en kwamen 4 uur ’s middags terug en dan hadden ze 200 jarabakas. Nu zijn ze uitgeroeid. Mijn boten hebben nooit jarabakas. “ik ben bang dat hetzelfde gaat gebeuren met Bang-bang”. “40 years ago boats left Leonsberg at 4 in the morning and came back at 4 in the afternoon with 300 jarabakas. Now these are extinct. My boats never catch Jarabaka. I am afraid that the same will happen with Bang-bang.”</i></p> <p>There are more boats now.</p>
10 (boat owner)	Decrease	-	<p><i>‘De vangsten zijn geslonken met 60%. dat is al bijna 3 jaar hoor’. ‘The catches have decreased with 60%, this has been the case for almost 3 years’.</i></p> <p><i>On another day he said: “now there is 40% less fish then in the past. In the past the high season was about now<sup>26</sup>, while now it is the other way around. Now February is a good time. Then the water is rough which brings nutrients up which attracts the fish. But in rough water boats can more easily get damaged.”</i></p> <p><i>Vroeger kon een closed Guyana boat 8 dagen varen en dan had je al genoeg binnen. Nu moeten ze 17 dagen op zee blijven om genoeg te vangen. ‘In the past, a closed Guyana boat could catch enough within 8 days. Now they have to stay at sea for 17 days to catch enough’.</i></p> <p><i>‘Die trawlers mogen niet op de 10 vadem lijn komen maar dat doen ze toch dus dat is het’. ‘Those trawlers are not supposed to fish on the 10-fathom line but they do it anyway so that is also part of the reason’.</i></p> <p>There is no surveillance.</p> <p>There are more boats now.</p>
10.1 (boat owner)	Decrease	Je ziet andere soort vissen zoals die bangateri	<p><i>Climate and no surveillance. ‘Die trawlers mogen hier ook niet in het ondiepe water, maar ze komen toch’. ‘The trawlers are not allowed in the shallow water, but they come anyway’.</i></p> <p>He said there are more boats now.</p>
11 (boat owner)	Decrease	-	<p><i>Hektrawlers. ‘Ze komen in de buurt van waar wij vissen. Ze vangen al die kleine kandra van ons in hun net. Zulke kleine kandra en dan verkopen ze die blaas ook in tonnen!’ ‘the trawlers come to were we fish and they catch all the kandra in their net. Such small kandra and then they sell their bladders in tonnes!’.</i></p>

<sup>26</sup> This interview was in June.

			<p><i>'Vroeger had je 300- 400 Bang-bang per trip. Die duurt ongeveer 2 weken. We praten over ongeveer 4/ 5 jaar geleden.</i></p> <p><i>Nu moet je blij zijn als je er 150 ofzo vangt. Maar soms in zo'n zelfde trip vang je maar 30 Bang-bang bijvoorbeeld'.</i></p> <p><i>'In the past you could have 300-400 Bang-bang pe trip, which would last for 2 weeks. We are talking about 4 / 5 years ago. Now you should be happy if you catch 150. Sometimes you only catch 30 Bang-bang for example'.</i></p> <p><i>'Als je thuis wordt beroofd en je belt de politie. Dan hebben ze ook geen wagen om te komen, moet je voorstellen als het al zo erg is bij de politie hoe het dan op zee is.' 'If you get robbed at your house and you call the police, then they don't have a vehicle to come to you. If it is this bad with the policy, imagine how bad it is at sea'.</i></p> <p>There is no surveillance</p> <p>There is overfishing</p>
12	Decrease  <i>'Sometimes you catch plenty sometimes a little bit'</i>	No	<p>Climate change</p> <p><i>"Four years ago, it was more quick, in ten days you could go back".</i></p> <p><i>"There are plenty boats". Me: any type of boats? "Yes. The sea needs to rest. Trawlers fish for 10 months per year".</i></p>
13	Increase	No	
17	Decrease	No	<i>'We have plenty boats and the catch is getting more and more small'</i>
18	Decrease	No & same size	<p><i>'We are getting less fish and its harder to catch it. The snapper is kind of difficult to catch now. Me: especially the snapper? He: yes. Me: and the trout? The trout we catch a lot'</i></p> <p><i>"There are more boats".</i></p>
20 (boat owner)	Decrease		<i>"Trawlers take everything"</i>
21 (boat owner)	Decrease > 50%	No, neither changes in size	<p>Overfishing. And there are too many licenses and illegal boats.</p> <p><i>"In theory this<sup>27</sup> should the fishing season, but we are still not catching fish. Between August and October, November, the fishing is good. Also, when the rainy season starts, and the wind does not blow hard. So, it is supposed to be good now. You should already start to notice that the good season is coming, but unfortunately, we don't. Even the rain season is hard to predict</i></p>

<sup>27</sup> The interview was held in May

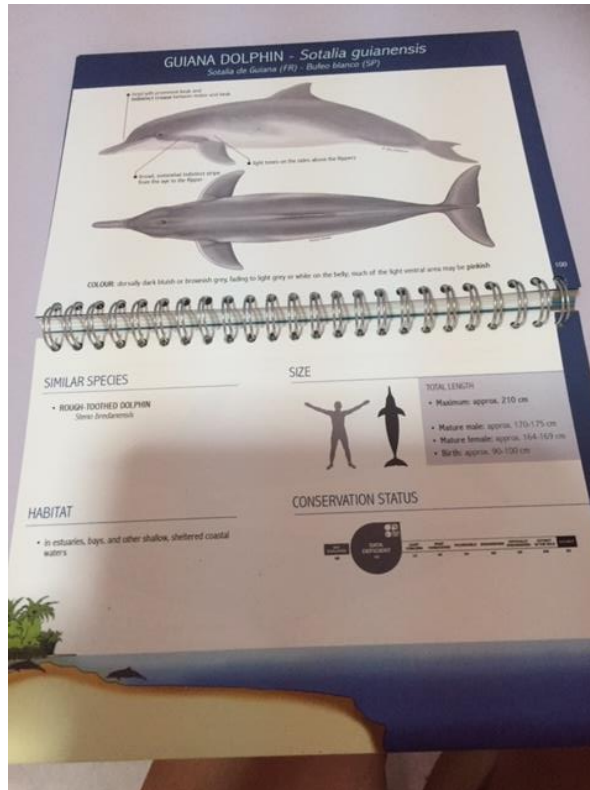
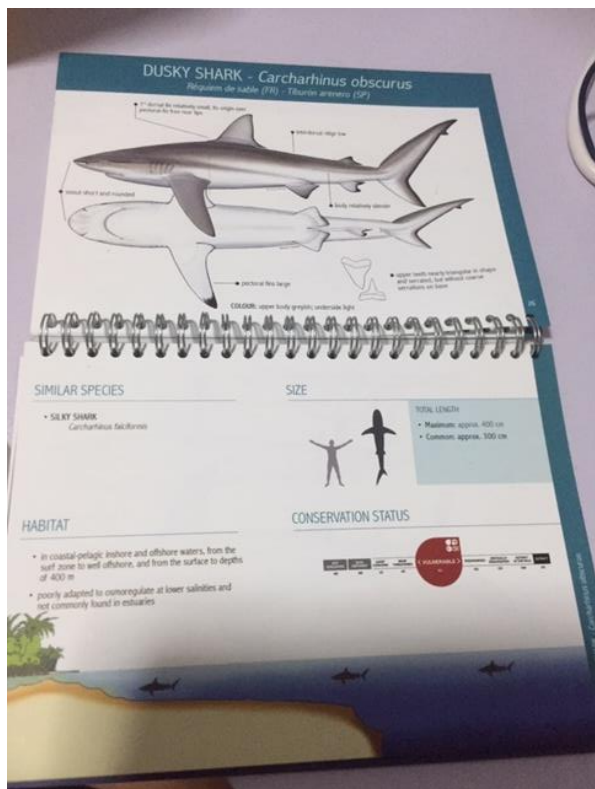
			nowadays. I think this has to do with climate change, that is definitely a factor besides overfishing.”
22	Decrease (for the last 10 years)	No	
23	Decrease	No	There are too many boats.
24	Rapid decline	No	“Used to spend 5 days at sea and now 15 days to catch the same amount”
29	Decrease	No	
34 (boat owner former fisher)	Decrease	No, neither changes in size	
36 (boat owner at Waldring)			<i>“The sector is not the same as 15 years ago. Then we had a net of 1.5 km, where at sea for a shorter period, we had smaller boats and a crew of 3-4 men”.</i>
37	Decrease	10 years ago more big Bang-bang	
39	Decrease	No, neither changes in size	There are more boats of all different types.
40	Decrease (he said he heard that from people who fish longer than him, he himself is working for 3 years)	-	There are too many boats
41	Decrease since the past 6-7 years	-	Too many trawlers came. “They catch in tonnes. 30-40 tonnes snapper and trout they catch. A lot of fish. They kill the market for us. We can’t do anything we are the small guys”.  “This is the time of fish March – sept/ okt. It is the time when it is full of fish and we should make money and provide for our families. This is the good season, but it is the worst time for us because we are not finding them”.
43	Decrease.	No, same type and size of fish as before	More boats have been coming to fish. “Maybe that could be one of the reasons why.”  When I just came into the work (14 years ago), we used to get 300-500 snapper (bang bnag). Now we get 40-30 snapper”. Kandra also declining
44	Decrease.	-	The climate and the seabed where the fish find their food is changing. There are more SK boats.  “Earlier you went to sea with only 8 inches. Then we didn’t need the 5 inches. Because there were so many fish. You catch the trout, bang, Kofon, the jarabaka, all the fish with the big seine. Now the big seine, you cannot catch a lot of small fish that you do not need. But after the big fish get so little, the 5 inch comes. You find the

			<p>trout more. Now you get more smaller fish which we sell”.</p> <p>We used to spend 8 days at sea, now 10-12 days (open type boat) and “I never brought less than 200 Bang-bang as a captain, but now if we reach a 100 we are very happy”</p>
45	Decrease	No, same type of fish and size	
Owner of inland fishery boats in Nickerie	Decrease	-	<p>“Twee jaar geleden ving een boot elk getij (6 uur) 200 kilo bangamery , kandratiki en koepila Nu niet eens 50 kilo. Van alle soorten is minder. Er is overbevissing”.</p> <p>“Two years ago a boat could catch 200 kilo of bangamery, kandratiki and koepila every tide (6 hours). Now not even 50 kilo. There is less of all species. Overfishing is taking place”.</p>
Two fishermen at Waldring	Decrease		“There are too many boats”.
Fisherman at Waldring	Decrease		“Maybe because of climate change”.
Fisherman at Waldring	Decrease		“In the bible it is said that the catch will decrease. This is what I believe”.
Fisherman at Waldring	Decrease		<p>“There can never be too many boats. The Atlantic Ocean is very big. Climate changes every 2, 6, or 10 years. I have been fishing since 6 years old. With my legs in the mud catching crabs. You find the fish where they eat. If I know where you eat, I can catch you. They are at de mud banks, and these move. Me: so how do you know where they are? He: from the surface of the water”.</p> <p>Me: so you don’t think for example Bang-bang will go extinct? He: no.</p>
Captain at Waldring	Decrease		“now there is about 60% less fish than 5 years ago”
Boat owner 1 BV driftnet / board member cooperative Nickerie	Decrease	No	“In Nickerie there are not more licenses, is has decreased as a fact. There are no new businesses. It could also be a result of climate change. Do you know for how long we have been waiting for the rain to come? And the big boats, the trawlers. Those can also be reasons that the catch has is declining”.
Boat owner at Waldring	Decrease	-	“19 years ago: 300 Bang-bang was normal, and then you would be at sea for less days and with a smaller net”. Now one of his boats caught 29 Bang-bang in a 17-day trip. “That just covers the costs, others also had around 40”.

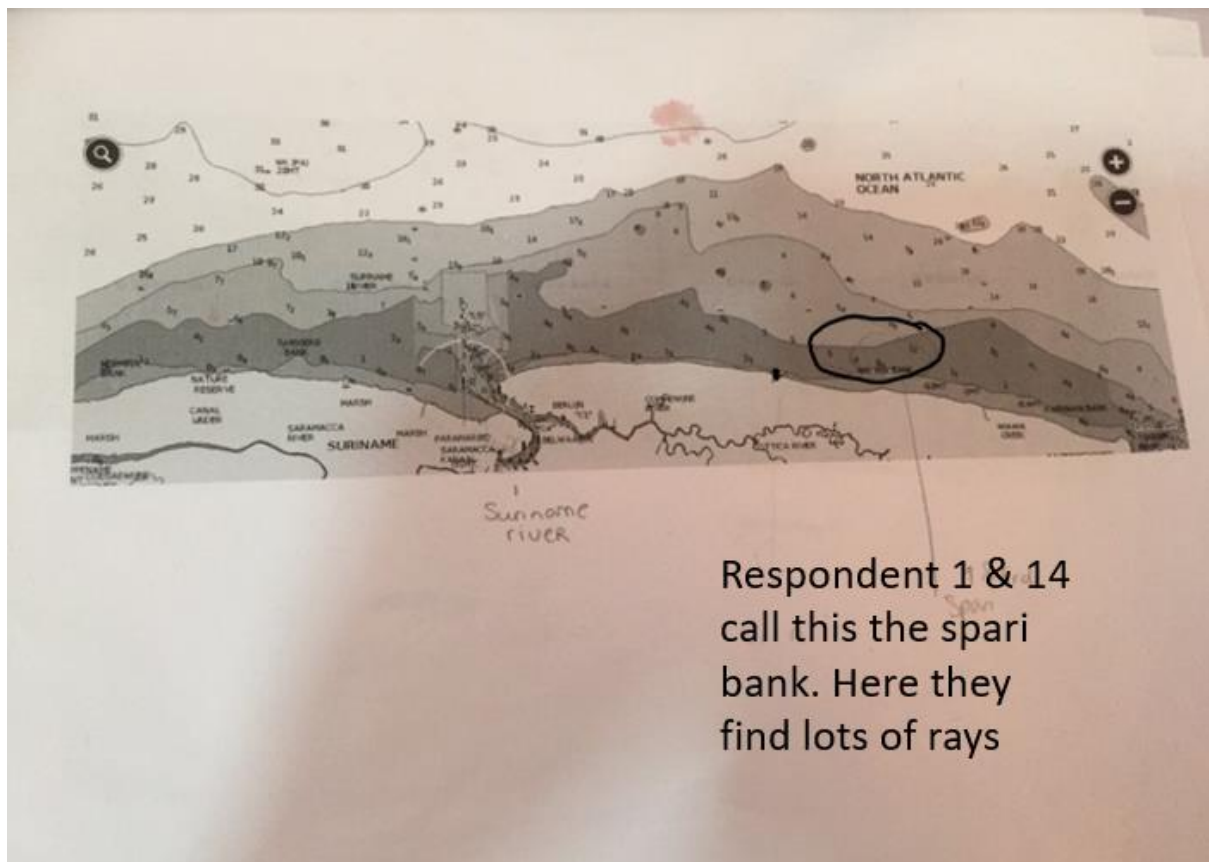
## Annex 5: Life cycle of Bang-bang and Kandratiki

Respondent	Spawning area	Spawning time	Time to reach maturity
1	River or near rocks	Mostly in August in the rainy season	Not asked
4	Anywhere in the sea	Not asked	Not asked
5	Not asked	Not asked	Not asked
6	Does not know	Not asked	Not asked
7	Does not know	April – August	Not asked
8	To shore	'at a certain time'	Not asked
12	In the Amazon	3-5 months in the summer, August September	4-5 months. "They grow quick and die quick"
13	At the shore he thinks	May June, he thinks	1-2 months
17	Seashore, near the coast	Does not know	Not asked
18	In the mud at shore	Jan – April +/-	Not asked
22 (someone else present answered, he did not know)	In de river	May- August/ September	+ - 6 weeks
22B	Does not know	Does not know	Does not know
25	Not asked	Does not know (each trip they find Kandra and Bang with ripe eggs)	Not asked
26	Not asked	Does not know (each trip they find Kandra and Bang with ripe eggs)	Not asked
28	Inshore	Does not know, but sees ripe eggs in the rainy season	3-4 years
29	Does not know	Rainy season	'You can't know that'
30	Not asked	Not asked	'You can't know that'
35	"To shore but don't know where"	Mostly in August he sees ripe eggs	6 weeks but not sure
37	"In the rocks or the river. Rocks are offshore the Nickerie, Coppename, Suriname and Marowijne river. At 12 fathom, 72 feet water"	Mostly in May-June he sees the ripe eggs. But throughout the year he sees the ripe eggs	Does not know
39	On the mudbanks	Does not know. "I do not keep track of the eggs I find"	Does not know
40	Does not know	Does not know, but "I guess the tides and rainy season play a role"	Does not know
41	Inshore, mostly at the Coppename river and Matapica	August and September	Does not know
42	Inshore, mostly at the Coppename river and Matapica	August and September	5 months
43	Inshore, but he finds them with eggs "anywhere"	Mostly in July	Does not know
44	Inshore	Rainy season	Does not know
45	Inshore	"I don't know, but I think in the same period as kwikwie, so April and may"	Does not know
BV boat owner Nickerie	In the sandbanks of the Nickerie river and Corantijn river mouth. They lay their eggs in brackish water	Not asked	Not asked

## Annex 6: Examples from the ETP and other key species guide used during the interviews



Annex 7: Example of map used with fathom numbers during the interviews



The bank drawn by the two fishers on the map is at 0 – 4 fathoms.

## Annex 8: Interview questions for fishers

1. How did you learn to fish?
2. What is your role during a fishing trip? (and before and after the trip?)
3. Approximately how many days do you fish per month (in the high season?)
4. For how long have you been fishing in this fishery (artisanal gillnet)?
5. With what kind of fishing gear do you fish? (inboard or outboard boat, net (length, mesh size), where in the water column, how long in the water, how long at sea, Winch, fish finder?)
6. Always same boat, captain, crew?
7. Boat owner Guyanese or Surinamese / man of woman?<sup>28</sup>
8. How do you keep a record of your catches?<sup>29</sup>
9. In your experience, how has the catch changed over the last 5 years? (increase, decrease, different sizes, difference in specie composition?)
10. If you think that the catch has changed, why do you think it has changed?<sup>30</sup>
11. Have there been any changes in fishing effort over the last 5 years (length of net, mesh size, days at sea, soaking time → hours they leave the net in the water, more fishing vessels/ licenses)?
12. Which fish do you catch? (Here I used the fish poster with the different types of fish)
13. Where can you catch the most in which season? (perhaps use a map so the respondent can point it out) (Do you go east or west from the Suriname river?, and how many fathom deep?, in which months do you catch most?, more catch with high or low tide?)
14. Do you know what the spawning areas are for Bang-bang and Kandratiki?
15. Do you know when they spawn? (in which months do you find the fish with the ripe eggs?, at a later stage, I used images of fish with ripe eggs to ask the question)
16. Do you know how long it takes for the fish to reach maturity?
17. What kind of bycatch / unwanted catch do you find in your nets? (Here I used the ETP and other key species identification guide)
18. If you throw them back at sea are they dead or alive?<sup>31</sup>
19. do you catch more, less or the same number of sharks now as 5 years ago?
20. do you catch more, less or the same number of rays now as 5 years ago?
21. do you catch more, less or the same number of turtles now as 5 years ago?
22. do you catch more, less or the same number of dolphins now as 5 years ago?
23. Where and when (which months) do you catch
  - Sharks
  - Rays
  - Turtles
24. When and where do they spawn / lay their eggs?
  - Sharks
  - Rays
25. Where in the net do you mostly encounter turtles (bottom, middle, upper part) and which turtles are these?
26. What do you do with the different unwanted species?
  - Discard from board? (throw it back into the sea, dead or alive)
  - Land the catch?
  - Cut out of the net and release?
27. How do you know where and when there is an abundance of certain types of fish?

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<sup>28</sup> This question was added at a later stage

<sup>29</sup> This question was added at a later stage

<sup>30</sup> This question was added at a later stage

<sup>31</sup> This question was added at a later stage



28. From which species do you sell the bladder?<sup>32</sup>
29. How often do you see trawlers in the artisanal fishing area? (below 10 fathom)<sup>33</sup>
30. Which type of trawlers do you see in the artisanal fishing area? (Below 10 fathom)<sup>34</sup>
31. What do you think about the future of this fishery? Do you have any concerns about this?
32. According to you, what should the role of the government be in relation to the artisanal fisheries?<sup>35</sup>
33. In which fishing related groups are you organized?
34. (crew, cooperative, ...?)
35. Through what channels can you share your ideas or concerns about this fishery?
36. In what way are you involved in decision making about this fishery? (decisions about fishing practices and rules)?
37. Have you ever been invited to discussions/ presentations/ debates about the fishery? If so, by whom? (which organization)?
38. Would you like to be invited if there are fishery related meetings in Paramaribo?<sup>36</sup>
39. Where are you from?
40. Do you have a Surinamese or Guyanese nationality?<sup>37</sup>
41. For how long have you been living here?
42. What other sources of income do you have?
43. If respondent has another source: what part of your total income comes from fishing approximately? (in % or less than half/ half/ more than half)
44. Do you have a family? Do they live in Guyana or Suriname?
45. If respondent has a partner: does he or she also earn an income?
46. If respondent has children: do they also earn an income?
47. Are any family members (parents, siblings, cousins, partner, children) involved in fishing?
48. Do you own fishing boats / license/ gear?
49. Until what age did you go to school? / study?

Other:

50. Do you sell the whole sharks, or just the fins?
51. What languages do you speak?

Do you think I missed anything important about your work or the fishery?  
Do you have any questions for me?

Thank you!

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<sup>32</sup> This question was added at a later stage

<sup>33</sup> This question was added at a later stage

<sup>34</sup> This question was added at a later stage

<sup>35</sup> Questions that are not in bold were only asked if there was time left, which was usually not the case.

<sup>36</sup> This question was added at a later stage

<sup>37</sup> This question was added at a later stage

## Annex 9: Interview questions for members of the fishers' cooperative

1. **For how long have you been involved in this particular fishery?**
2. **What are your activities related to this cooperative? / what does your job involve?**
3. What are your goals for this fishery? **(for board members)**
4. What are the main challenges for this fishery?
5. How do you feel the collaboration is going with **(for board members)**
  - Fishers
  - NGO's
  - Government
  - Other stakeholders?
6. **How many fishing boats do you own?**
7. **How many licenses do you own?**
8. **How do you come in contact with captains?/ how do you find a fishing crew?**
9. How are the profits of a fishing trip shared?
10. **In your experience, how has the catch changed over the last 5 years? (increase, decrease, different sizes, difference in specie composition)**
11. **Has there been any changes in fishing effort over the last 5 years (length of net, mesh size, days at sea, soaking time→ hours they leave the net in the water)**
12. **Where can you catch the most in which season?**
13. Do you know what the spawning areas are for Bang-bang, Kandratiki, Koepila ..., ...
14. Do you know when they spawn?
15. Do you know how long it takes for the fish to reach maturity?
16. **What kind of bycatch / unwanted catch do you find in this fishery?**
17. **In your experience, how has the amount and species of unwanted catch changed over the last 5 years? (increase, decrease, different sizes, difference in specie composition)**
18. **How did you learn about the fishing business?**
19. **How do you know where and when there is an abundance of certain types of fish?**
20. **What do you think about the future of this fishery? Do you have any concerns about this?**
21. **In what kind of conservation efforts has this cooperative been involved?**
22. **and in which are you involved currently?**
23. **Would you be willing to test other fishing gear with which you catch less turtles, rays and sharks (especially endangered, threatened and protected species).**
24. **How often do you have meetings with the fishers to discuss certain topics about the fishery?**
25. If you organize meetings: **How do you reach out to the fishers? How many show up?**
26. **Through what channels can you share your ideas or concerns about this fishery?**
27. **In what way are you involved in decision making about this fishery? (decisions about fishing practices and rules)**
28. What would you think of a closed fishing season? (this is one of the plans from the ministry of agriculture, livestock and fisheries)
29. **Where are you from?**
30. **How are the profits of a fishing trip shared?**
31. **Until what age did you go to school? / study?**

Do you think I missed anything important about your work or the fishery?

Do you have any questions for me?

Thank you!

## Annex 10: Interview questions for the Fisheries Department

1. For how long have you been involved in this fishery?
2. What are your goals for this fishery?
3. What are the main challenges for this fishery?
4. How is the cooperation going with:
  - Fishers
  - Fishers' cooperations
  - NGO's
  - Other stakeholders?
5. What do the data collectors do exactly?
6. Is a record kept of the bycatch (sharks, rays, turtles, dolphins)?
7. How much is caught by the SK and SKB fleet?
8. How many closed and open boats have a license? (only the total of 380 is mentioned, so it is unclear how many licenses there are for closed and open boats)
9. What has changed in fishing effort in the last five years? (length of net, mesh size, days at sea, soaking time → hours they leave the net in the water, winches, more fishing vessels/licenses).
10. How do you think the knowledge and experience of fishers can be used to reduce bycatch?
11. How do you think the knowledge and experience of fishers can be used to manage the target species?
12. Through what channels can fishers share their concerns?
13. In what way does the government involve fishers in fishery related policy?
14. How can fishers influence decision making?
15. Why has the maximum allowed length of the net increased?
16. Why does it say: "not applicable" about the target species for the SK and SKB gillnet in the license conditions?
17. Why is VMS not used yet in the SK fishery? Would the costs be for the boat owners?
18. If someone makes a report about a trawler fishing too close to shore, with a photo with the GPS location, time and name of the boat, could you then check this information with the VMS system of the trawler?
19. Is it still the case that when a VMS is defect, the ship has to give its geographical position every four hours to the VMS coordinator?
20. Why are there 35 licenses for bottom trawlers for demersal fisheries, as opposed to 23 in 2012 when it was stated in the fishery management plan that fishers and managers insisted that the fish trawl fleet should not grow anymore?
21. Why has the SK fleet grown while it was stated in the fishery management plan that fishers and managers insisted that the SK fleet should not grow anymore?
22. Why are there now 50 licenses for Bangamary fishery (SKB) while it was stated in the fishery management plan that fishers and managers insisted that the Bangamary fleet should not grow anymore?
23. What will happen with the Chinese trawlers that are waiting for the coast?
24. Will there be a new Fishery Management Plan?

Do you think I missed anything important about your work or the fishery?

Do you have any questions for me?

Thank you!

## Annex 11: Planning and agreements

General agreements between university supervisor and student	<ul style="list-style-type: none"> <li>• Supervisor and student respond to each other's emails within 5 working days, unless one is on vacation or if the supervisor is on fieldwork herself</li> <li>• The student and supervisor have contact at least once every three weeks once the student is conducting fieldwork.</li> <li>• One week of holiday and 7 days of working at a part-time job throughout the weeks before and after the fieldwork are included in this planning. Which in total adds 2 weeks to the 21.5 full-time weeks for a 30 EC thesis</li> </ul>
Time planning	
First week of February	Discuss research questions with both university supervisor and WWF Guianas staff
21 February	Hand in proposal to supervisor
22 February – 3 March	Receive feedback on final research proposal
5 March	Hand in final version of the research proposal
End March, beginning of April	Go to the research area
April	Fieldwork  1 <sup>st</sup> week: acclimatize and get to know the physical and social setting of the field site, finding accommodation  10 interviews
May	Fieldwork  15 interviews
June	Fieldwork  10 interviews
In May or June (week to be determined)	One-week holiday
End of June, beginning of July	Return to the Netherlands
2-5 July	Hand in first version
15 July	Kei and Sophie decided to postpone deadline due to personal circumstances.
22 July	Hand in second version
11 August	Hand in third version
12-16 August	Kei reads third version
27 August	New deadline final thesis
17 September	Thesis presentation

## Annex 12: Pictures



Witwitie landed by the SK gillnet fishery



Part of the landed catch of the SK gillnet fishery. Mostly Mackerel on this picture



Part of the landed catch of the SK gillnet fishery. Some sharks in front



Several fishermen joined the interview in Nieuw Nickerie



Poster announcing a meeting for members of VC



Part of the landed catch of the SK gillnet fishery

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