



# Net loss or Net Gain?

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## Gillnet Use in Belizean Waters

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## Introduction

Belize's fishing sector is faced with declining fish stocks, increasing number of fishers, and environmental pressures such as pollution, impacts of tourism development and the now ever-present effects of climate change. At the same time, there is impressive growth in the natural resource dependent tourism industry. The sustainable use and management of Belize's marine resources is a constant challenge. Since 2013, Belizean conservation groups have been highlighting concerns about the sustainability of gillnet use in Belizean waters both legally and illegally and have called for a phase out and ban of the use of this particular fishing gear.

There is however limited information on the status of gillnet use, gillnet fishers and the environmental and economic impact gillnets are having. Gillnets are indiscriminate when it comes to fish species and as such many protected species are being affected by their continued use. Many of these protected species contribute significantly to Belize's economy largely through the tourism industry, which is now the largest employer and export earner for the country. In addition to this, other species such as large predators and grazers which are important to the reef are also affected. On the other hand, Belizean fishers have been using gillnets for decades. While some have willingly given up their use of gillnets others have been reluctant or completely opposed to the idea of permanently removing gillnets from Belizean waters.

The Ministry of Forest, Fisheries and Sustainable Development (MFFSD) under whose mandate the management of fisheries resources fall, has set up a Task Force to examine this issue more closely in order to make a determination on the future of gillnet use by Belizean fishers. In order to contribute to this important discussion, this report firstly examines the overarching policies and sustainable development goals of the country as these are what should circumscribe actions taken towards a national vision. The specific rules regarding the management of fisheries are then reviewed in order to determine their adequacy and implementation. This is followed by an in-depth look at the exact nature of gillnet fishing in Belize, who is involved and at what scale.

Two key areas in terms of the impacts of gillnet fishing are examined; these are its environmental and economic impacts. This analysis looks at what is at stake and its value to the Belizean economy and society. Some potential mitigation measures are then reviewed in order to determine what may be the best policy options moving forward. Specific recommendations are then made in regards to a phased-ban of gillnets and the process by which this should be done. The conclusion of the report highlights the main challenges identified and reiterates the need for timely action.

## Belize's Sustainable Development Policy

The discussion around marine conservation, fisheries management and fisheries regulations has to take place within Belize's overarching sustainable development policy. This is simply because Belize, both as a society and economy, is highly dependent on the natural environment and its accompanying ecosystems' goods and services. The largest sectors of the economy, namely agriculture and tourism are dependent on a viable natural environment and healthy ecosystems. Belize's Growth and Sustainable Development Strategy (GSDS) 2016 - 2019 recognizes this and features the environment as a critical component.

The GSDS is important in the context of addressing marine resources management and the livelihoods of thousands of Belizeans as it provides a system-wide view of supporting “the country in coping with resource constraints, and help it increase its resilience in the face of a volatile global economy and a changing global climate<sup>1</sup>.” Furthermore, the GSDS is the nation’s primary planning document, providing detailed guidance on priorities and on specific actions to be taken during the planning period, including actions that contribute to longer term development objectives beyond 2019.

Under the Critical Success Factor (CSF) 3 of the strategy, “*Sustained or Improved Health of Natural, Environmental, Historical and Cultural Assets*”, the extraordinary economic and social importance of Belize’s natural assets are fully recognized. The GSDS underscores the fact that “Belize’s ecosystems are under considerable anthropogenic and natural pressures, and some are being converted or degraded at a rapid pace (e.g. conversion from natural habitats to agricultural land; threats to coral reefs). The already evident adverse effects of climate change also threaten the health of ecosystems while introducing new dangers and risks for people as well as the economy.” Specifically, under Necessary Condition 3.1.5: *Marine and Aquatic Resources*, it states that Belize’s marine and aquatic resources are among its most valuable assets both for tourism and for the provision of fish (food) and other economic benefits.

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The anthropogenic and natural pressures are indeed real and the consequences have already started to manifest themselves. For instance, a consistent decline in reef health and fisheries has repeatedly been reported<sup>2</sup>. The decline in fish stocks was noticed as early as the 1980s and only a decade later, in the 1990s, major reef decline was noticed due to mass bleaching and hurricanes. A recent study of the Mesoamerican Reef found that only 5 percent of reefs within Belize waters were in good condition and 73 percent were in poor to critical condition<sup>3</sup>.

Under these circumstances, actions to protect, sustain, and sustainably use the marine resources are of the highest priority. While sustainable extraction of marine resources is important, even more critical is the protection of the ecosystems that provide those goods and services such as fish that are exploited

<sup>1</sup> Growth and Sustainable Development Strategy for Belize 2016-2019. Ministry of Economic Development, Petroleum, Investment, Trade and Commerce. Government of Belize

<sup>2</sup> Heyman, William, and Rachel Graham, eds. 2000. “The Voice of the Fishermen of Southern Belize.” Toledo Institute for Development and Environment and the Trinational Alliance for the Conservation of the Gulf of Honduras, September, 1-44.

<sup>3</sup> <http://www.force-project.eu/sites/default/files/FORCE%20Belize%20National%20Feedback%20Report.pdf> Accessed 3/6/2019

for food and providing livelihoods. The GSDS recognizes that maintaining the diversity of life has implications for the health of ecosystems, for securing access to biological resources, and for its social and cultural value – all of which have implications for economic development and the quality of life in general. It further underscores that the economic cost associated with biodiversity loss can be significant and issues a call to action for Belize to sustain its biodiversity. Belize’s National Biodiversity Strategy and Action Plan complements this call by setting up a target that by 2020 primary extractive natural resource use in terrestrial, freshwater and marine environments is guided by sustainable management plans, with improved biodiversity sustainability<sup>4</sup>.

## Fisheries Management

### Fisheries Act and Regulations

The fisheries sector is managed under the Fisheries Act 210 of the Laws of Belize. It specifies exactly how fishing is to be done. According to the Act, a person who wishes to engage in commercial fishing in Belize must apply to the Fisheries Administrator for a fisher folk license (Reg. 37, Sub-reg. (2:01) Fisheries Regulations). That person must be at least 18 years of age; be a Belizean by birth or naturalization (if applicable); be a permanent resident in Belize and is in possession of a Permanent Resident Card; and must have been residing in Belize for a continuous period of at least six months prior to the date of the application. A license issued by the Fisheries Administrator expires on 31st December of each year and is subject to renewal upon payment of the prescribed fee (Sub-reg. 3:02 Fisheries Regulations).

A person engaging in commercial fishing in Belize using a boat must have a valid commercial fisher folk license and a vessel license and a valid sea worthy certificate issued by the Belize Port Authority (Sec. 6 (1) Fisheries Act). Any person engaging in commercial fishing or engaged or employed in or on any boat while in use for commercial fishing must also hold a valid fisher folk license (sec. 7 Fisheries Act). Other activities requiring a license include where a person or entity wishing to export, attempting to export or purchasing with a view to export any fish, must be the holder of a valid fish exporter’s license (Sec. 9 (1) Fisheries Act). An export duty is to be paid by the exporter on all fish taken within the waters of and exported from Belize<sup>5</sup>.

There are rules that regulate the capture of specific protected species. Regulation 9 of the Fisheries Act prohibits the buying or selling of bonefish and Regulation 10 prohibits any person from fishing for in the water of Belize or buying, selling or having in possession any Hawksbill Turtle, Loggerhead Turtle, Green Turtle, Leatherback Turtle, Kemp Ridleys Turtle, or Olive Ridleys Turtle. These regulations protecting marine turtles are tied to the IUCN list of threatened species, as well as Appendix I and Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals (CMS).

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<sup>4</sup> National Biodiversity Strategy and Action Plan, Belize. Ministry of Agriculture, Forestry, Fisheries, the Environment and Sustainable Development, Belmopan, Belize, 2016.

<sup>5</sup> Usher, M. A. (2018) The United Nations Convention on the Law of the Sea and Belize National Ocean Governance Framework: including legal and institutional requirements for sustainable marine fisheries, sustainable marine aquaculture, seafood processing, and marine and coastal tourism. UNCTAD in cooperation with DOALOS of the Office of Legal Affairs (OLA) of the United Nations and the Belize Fisheries Department.

## Gillnets

The permitting and use of gillnets is regulated by the Statutory Instrument No. 78 of the Belize Fisheries Act. On July 1, 2013 the Belize Fisheries Department enacted a policy requiring that all gill nets, must be registered before it is used. This regulation has been part of the law since 2011, but had never been enforced until 2013. The enforcement came after conservationists started lobbying for the outlawing of gillnet fishing in the early part of 2013. The Fisheries Department held registrations from May to June 2013 following the enactment of the regulation.

Once a gill net is registered, the owner is issued a certificate as proof of ownership and the net is tagged and labeled for proper identification by fisheries officers. The regulations state that a fine of \$500 or six months' imprisonment or both will be imposed for fishing without a registered net; in addition, the net will be confiscated. The certificate of registration for gill nets is valid for one year, after which it must be renewed. The specific stipulations regarding the use of gillnets are as follows:

### Netting

- No person shall set traps outside the reef or within 300 feet from the Barrier Reef
- No person shall use net for the capturing of hicattee
- No setting of nets, weirs, beach seines within a 2-mile radius of the mouth of the Haulover Creek, Sibun River, Belize River or half a mile from any city, town, village or inhabited locality in Belize.
- No person shall set any net 1 mile from any bridge or half mile from the mouth a tributary.
- No person shall close off a channel, passage, entrance, or small embayment of water with any fishing device in such manner as to restrict the free passage of boats or to wholly prevent the passage of fish.
- Minimum mesh size for nets (except cast nets) is 3 inches.
- Maximum length of net allow in the waters is 100 meters.
- No person shall have in his/her possession any net that exceed 300 meters.
- On board any vessel only 300 meters (at sea) or 200 meters (rivers, creeks) of nets are allowed at any given time.
- All nets must have a tag issued by the Fisheries Department upon registration of nets.
- No person shall place any nets in the following areas:
  - New River Lagoon
  - Lemonal Creek
  - Irish Creek
  - Dawson Creek
  - Ramgoat Creek
  - Crab Cather Lagoon
- No person shall use nets in front of Placencia or Monkey River.

### Nets in Lagoons, Rivers, Streams or Creeks

- Nets cannot be set across more than 1/10 of a lagoon but they cannot cover more than 300 meters across the lagoon.
- Nets cannot be set across more than ¼ of a river but they cannot cover more than 200 meters across the river.

## Marine Protected Areas

Since the mid-1980's, having realized that fisheries were collapsing worldwide due to over exploitation, bad management strategies, habitat destruction and climate change, the Fisheries Department decided that fisheries management in Belize should incorporate an ecosystems management approach. As a result, the Belize Fisheries Department started to declare marine reserves as fisheries management tools<sup>6</sup>. There are now a total of 26 marine protected areas in Belize with 21 sites directly under the mandate of the Fisheries Department. The Fisheries Department has developed partnership arrangements with local non-governmental organizations that now hold co-management agreements over some of the MPAs. The use of gillnets in MPAs are prohibited by regulations specified under the Fisheries Act Chapter 210, Revised Edition 2003.

## Gamefish and Protected Species

The Fisheries (Species Designation and Protection) Regulations contained in Statutory Instrument No. 114 of 2009, Gazetted on 26 September 2009, prohibits any person, save and except in the act of catch and release, or establishment from having in his possession any bonefish, permit fish or tarpon or any of its product forms (Reg. 3 (1) and (2)); as these species (others included in the Schedule) are designated for sport fishing (Reg. 4).

The Coastal Zone Management Authority (Sport Fishing) Regulations, 2009 contained in Statutory Instrument No. 115 of 2009, which was gazetted on 26th September 2009, prescribes the requirement for any person conducting sports fishing within Belizean territorial waters to obtain a license and further outlines the terms and conditions under which sport fishing licenses are issued, and fees are collected.

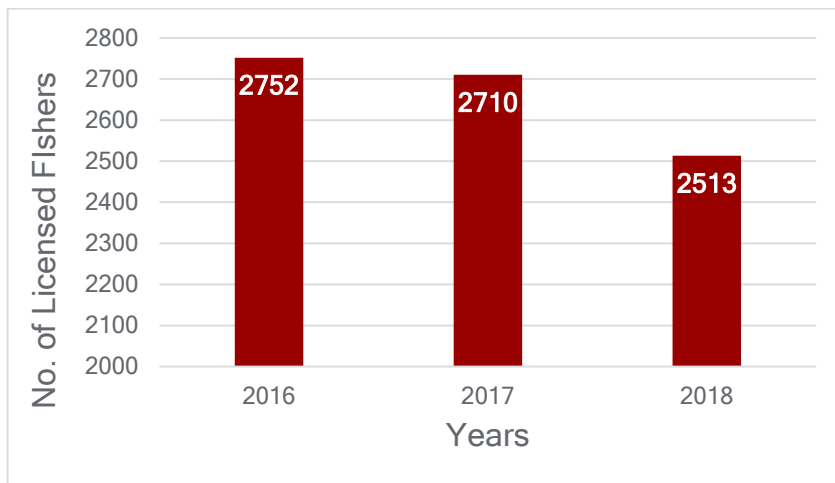
## Use of Gillnet in Belizean Waters

### Who are the gillnet fishers?

Overall, there are currently 2,513 licensed fishers in Belize. While there has been a slight decline in the total number of licensed fishers over the past three years as shown in Figure 1, it is still higher than the number in 2004 when there were approximately 1,731 licensed fishers. This represents a 45% increase over that 14-year period.

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<sup>6</sup> Usher, M. A. (2018) The United Nations Convention on the Law of the Sea and Belize National Ocean Governance Framework: including legal and institutional requirements for sustainable marine fisheries, sustainable marine aquaculture, seafood processing, and marine and coastal tourism. UNCTAD in cooperation with DOALOS of the Office of Legal Affairs (OLA) of the United Nations and the Belize Fisheries Department.

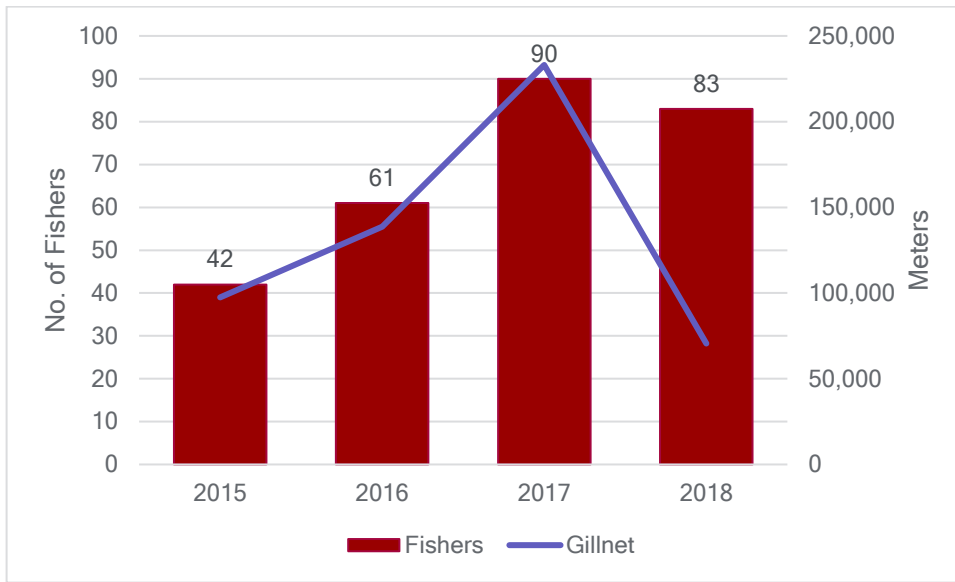
**FIGURE 1: TOTAL NUMBER OF LICENSED FISHERS, 2016 - 2018**

**SOURCE: BELIZE FISHERIES DEPARTMENT, 2019**

The use of gillnets is allowed with a permit obtained from the Belize Fisheries Department and gillnetting has been a long standing practice among Belizean fishers. Available data from the Belize Fisheries Department shows that there are currently 83 licensed gillnet fishers as shown in Figure 2. Due to the limited data available, it is difficult to say what exactly is the long term trend of gillnet use among fishers. There was nonetheless a more than doubling of licensed gillnet fishers from 2015 to present. The increase in licensed gillnet fishers was expectedly accompanied by an increased in gillnets registered as measured in meters. In 2018 however, the total length of gillnets in meters declined from a high of 233,077 meters (764,688 feet) to 70,550 meters (231,463 feet), which is equivalent to 44 miles of nets. This decline appears to be due to stricter compliance with allowable length of nets registered per fisher by the Fisheries Department.



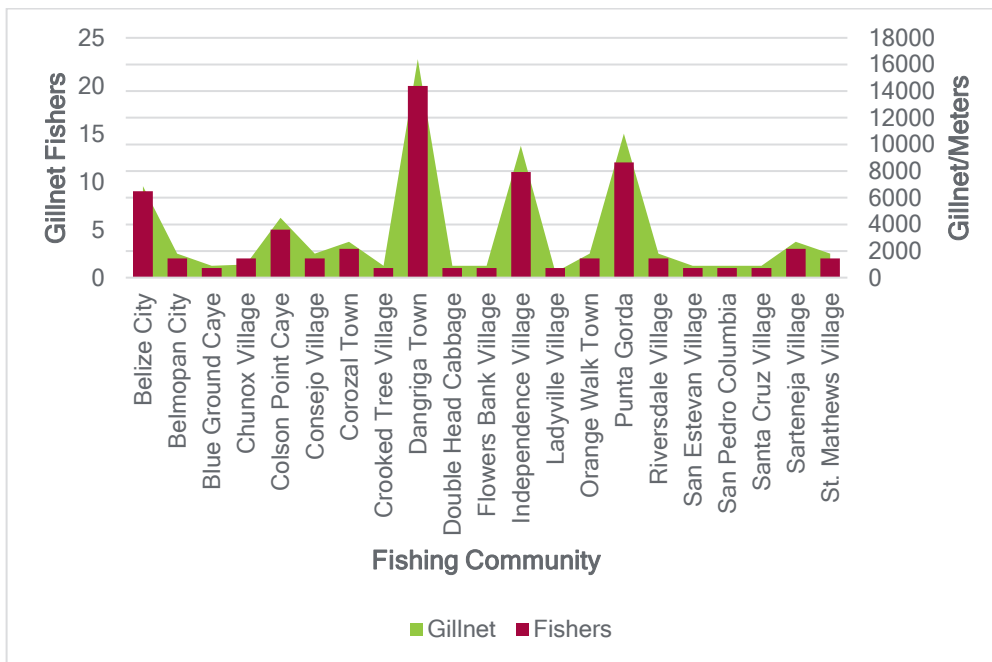
FIGURE 2: LICENSED GILLNET FISHERS AND GILLNETS, 2015- 2018



SOURCE: BELIZE FISHERIES DEPARTMENT, 2019

Majority of the gillnet fishers are based in Dangriga Town, Punta Gorda, Independence Village, and Belize City in order of magnitude. As can be expected, the number of licensed gillnet fishers are accompanied by the quantity of gillnets distributed around the fishing communities. Communities with the highest number of licensed gillnet fishers also have the largest quantity of gillnet availability as shown in Figure 3.

FIGURE 3: GILLNETS AND GILLNET FISHERS BY COMMUNITY, 2018



## Practice of Gillnet Fishing

Gillnet fishing occurs year round but is increased during closed conch and lobster season and during the Lenten season when there is higher demand for fin fish. Most gillnet users seem to use the nets as a supplementary gear with only a few completely dependent on it as their primary fishing gear. Gillnet fishers do not use their gillnets on a daily basis but may do so twice or thrice a week. Fishers often soak or deploy their gillnets overnight starting from 5:00pm to 5:00am when they are withdrawn. While most of those interviewed said that they would stay and watch their nets the reality is that many nets are left for extended hours without anybody checking them. Once nets are checked and fish are removed, the desired fishes are taken while bycatch is discarded there and then. Given the indiscriminate nature of gillnets in terms of species, protected fish species are being caught in gillnets<sup>7</sup> and these are simply taken or discarded as well. Gillnet fishing is not an easy task as it requires fishers to be on the sea at night and early morning as well as being constantly wet from diving to retrieve fish. Given the declining fish stocks, it is possible that fishers are turning to gillnets to make up for shortfalls. Fishermen report that they must travel farther and make longer trips to find fish, causing their fuel costs to skyrocket and decreasing their overall earnings. These are actually some of the reasons some fishers have given up their gillnets.

While there are specific stipulations on the placement of gillnets it does not appear that these are in fact being followed. Gillnets are being set regularly within one mile of settlements including Belize City (See

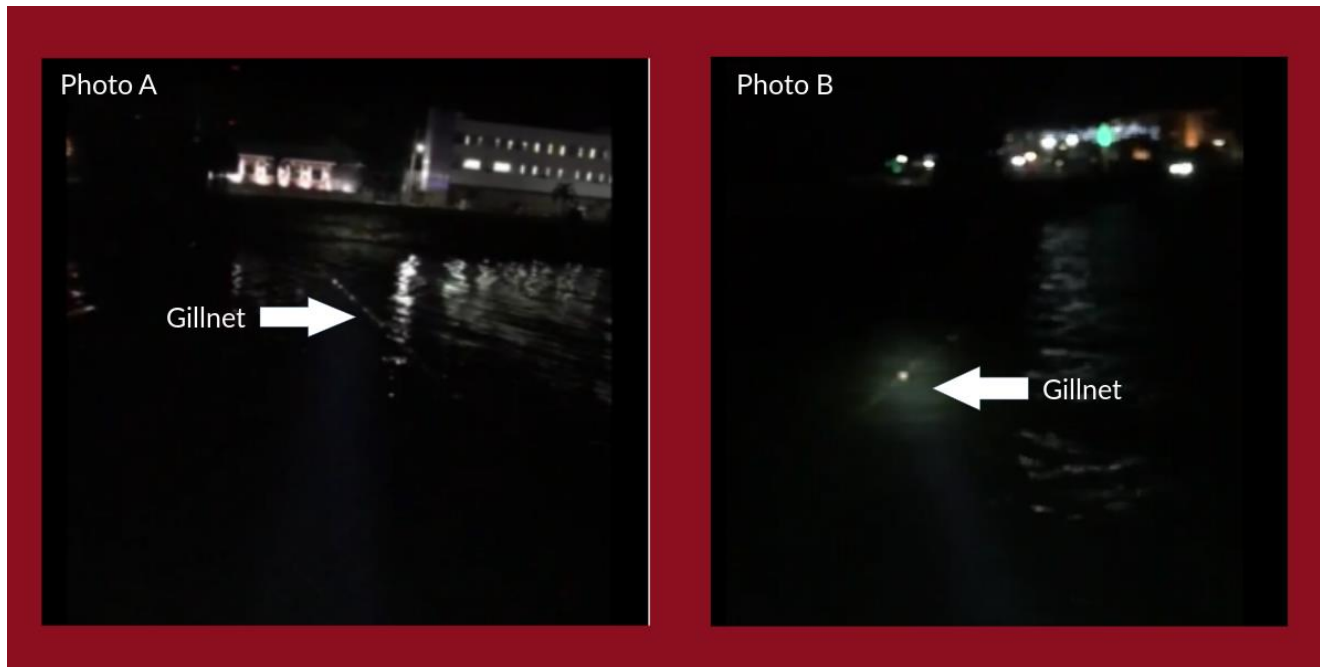
**Fishers are quick to point out that there is hardly any enforcement or surveillance on gillnet fishing by the responsible authorities.**

Figure 4) and well inside the radius prohibited for rivers in contravention of the established regulations. While there is an official process to obtain license for gillnet fishing, there are many Belizean fishermen who are using gillnets without having the requisite licenses or having registered their gillnets<sup>8</sup>. Fishers are quick to point out that there is hardly any enforcement or surveillance on gillnet fishing by the responsible authorities.

<sup>7</sup> <https://www.ambergristoday.com/news/2017/09/12/tiger-shark-killed-illegal-gill-nets>. Accessed 7/3/2019

<sup>8</sup> <https://www.sanpedrosun.com/environment/2013/12/20/belize-fisheries-department-enforcing-gill-net-registration-policy/>. Accessed 3/7/2019.

FIGURE 4: GILLNETS PLACED NEAR BELIZE CITY SHORELINE



SOURCE: BELIZE GAMEFISH ASSOCIATION, 2019

The Belize Coast Guard and conservation agencies have retrieved multiple illegal nets that have caused damages to protected fish species<sup>9</sup>. The total number of illegal Belizean gillnet fishers and quantity of illegal gillnets are unknown.

### Target Species

The top three species targeted by gillnet fishers are snook, snapper and mackerel, followed by cobia, jack, shark and drum. Other species caught include barracuda grunts, mullet, stone bass, catfish, and mojarra<sup>10</sup>. A significant portion of gillnets fishers are dedicated to shark fishing. Shark meat and fins are generally exported to Guatemala under licenses obtained for finfish and salted fish. Shark meat and fins are also exported or taken to Guatemala illegally. This is discussed in further details below.

### Source of Nets

Most gillnet fishers purchase their nets from Guatemala, where they are relatively inexpensive and readily available. The total cost for a net is approximately \$250 and accessories such as rope, floats and weights account for another \$400 bring the total cost for a fully equipped net to about BZD\$650. A fisherman having three nets will likely have invested approximately BZD\$1,950 for his legal gear.

<sup>9</sup> <https://www.sanpedrosun.com/environment/2015/02/25/coast-guard-confiscate-gill-net-lighthouse-reef-atoll/>. Accessed 7/3/2019.

<sup>10</sup> Biery, L. The Status of Gillnet Fisheries in Belize Waters. OCEANA. 2013

## Dependence on Gillnets

Studies on gillnet use in Belize are extremely rare and therefore establishing the dependence of fishers on gillnets is a difficult task. In one pilot study carried out in southern Belize by Mayhew (2016), surveys were conducted in five fishing communities namely: Dangriga; Hopkins; Riversdale; Placencia; and Independence and Mango Creek. Of the 60 survey participants in that study, 11 (18%) identified themselves as gill net users - 9 from Dangriga; 1 from Independence and Mango Creek; and, 1 from Hopkins<sup>11</sup>.

The results of that study showed that of the 60 fishers surveyed, 57% reported having additional sources of income, including a range of economic activities. In comparison, regional study carried out to determine levels of development and poverty in fishing communities in CARICOM, about 47% of the income of fishing households in Belize is derived from sources other than fishing. Based on this, we can conclude that that most fishing households have additional income sources and approximately half of their income is derived from non-fishing activities. It should be noted that there are households that are entirely dependent on fishing but this is likely to be a smaller number. The income of fishermen generally ranges from US\$1,000 to US\$15,000 per annum with the average income per capita being around US\$8,000 per annum<sup>12</sup>.

Among the 11 gillnet fishers in the study, just over half stated fishing as their only source of income, three of whom stated gill nets provide more than half of their total annual catch. Among net users with additional sources of income, three reported that gill nets still provide over half of their total annual catch<sup>13</sup>.

Without readily available and detailed data, it is difficult to estimate the overall value of gillnet fishing especially since many of the shark fishers' gear of choice is also gillnets. Shark fishers extract more value than fishers who harvest only finfish. In 2007, Graham estimated the seasonal value of shark products harvested and exported to be around US\$1,984,842<sup>14</sup>. For the purpose of the estimate presented here, shark fishers are excluded and only fishers dependent on gillnet fishing are considered. Using the data that is available we can assume the following:

Total Number of Gillnet Fishers	83
Percent of fully dependent gillnet fishers	50%
Percent of income derived from gillnet	53%
Total fisher income per annum	BZD\$16,000

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<sup>11</sup> Mayhew, J. 2016. Perceptions of Fisheries Management, Gill Net Use and Income Diversification Among Small-Scale Fishers in Belize. Master's Thesis. Nicholas School of the Environment, Duke University

<sup>12</sup> CRFM. 2012. Diagnostic Study to Determine Poverty Levels in CARICOM Fishing Communities-Policy Document. CRFM Technical & Advisory Document, Number 2012 / 3, Volume II. 25p.

<sup>13</sup> Mayhew, J. 2016. Perceptions of Fisheries Management, Gill Net Use and Income Diversification Among Small-Scale Fishers in Belize. Master's Thesis. Nicholas School of the Environment, Duke University

<sup>14</sup> Graham, Rachel, T. 2007. Technical Report: Vulnerability Assessment of Sharks and Rays in Belize: Captures and Trade. Wildlife Conservation Society.

Annual Value of Gillnet Fishing = *Total Number of Gillnet Fishers X Percent of Dependent Gillnet Fishers X Total Fisher Income Per Annum X Percent of Income derived from Gillnet.*

$$= 83 \times 50\% \times \$16,000 \times 53\%$$

$$= 42 \times 16,000 \times 53\%$$

$$= 672,000 \times 53\%$$

$$= \text{BZD}\$356,160$$

The total estimated value of gillnet fishing for those fishers who are dependent on gillnets is BZD\$356,160, assuming that only half of the gillnet fishers are indeed fully dependent and that only 53% of their income is derived from gillnet fishing.

## Illegal, Unreported and Unregulated Fishing

### Illegal Gillnet Use by Belizean Fishers

In March 2014, two fishermen were busted by TIDE officers in Toledo with shark meat and fins amongst other items as they attempted to export the products to Guatemala. The fishermen had valid Belizean fishing licenses but were in possession of two gill nets longer than 100 meters, 542 pieces of salted shark, 439 pieces of mackerel and catfish and 73 shark fins. Police in Punta Gorda Town eventually charged the fishermen for the crimes of shark fining, possession of gill nets longer than hundred meters, and attempting to export fish without an exporter's license<sup>15</sup>. This incident highlights the fact that there are Belizean fishermen involved in the shark and shark fin trade with Guatemala using illegal gillnets and also exporting harvested marine products illegally.

As reflected in other reports, fishers interviewed for this report also voiced frustration over unmonitored Guatemalans fishing in nearby Belizean waters. Local fishermen claim that there are many Guatemalan fishers with legitimate fishing licenses operating in Belizean waters. Obtaining a Belizean fishing license requires someone to present proof of nationality or residency and so it is difficult to say whether indeed Guatemalan fishers have obtained Belizean fishing licenses. Theoretically, this can only occur if those Guatemalan nationals have obtained Belizean nationality documents in which case it would be within their rights and privileges as naturalized citizens or residents. The only other way is if the Belize Fisheries Department is waiving the legal requirements for obtaining a fishing license.

What has been established though is that there are indeed persons of Guatemalan origin who have been naturalized and have obtained Belizean fishing licenses but actually live in Guatemala. They circumvent the proof of residence/domicile requirements by obtaining utility bills from other persons and presenting it to the Fisheries Department as though they meet the residency criteria. Having obtained legitimate fishing licenses, they are then free to operate within Belizean waters but most if not all of their products are exported to Guatemala, facilitated by their Guatemalan counterparts.

Most of the products these fishers extract using gillnets are shark meat and shark fins. There is a high demand for shark meat and shark fins in Guatemala and these are being taken over to Guatemala both

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<sup>15</sup> <https://www.ambergristoday.com/news/2017/09/12/tiger-shark-killed-illegal-gill-nets>. Accessed 7/3/2019.

legally and illegally. The exact quantity of shark meat exported to Guatemala is unknown as these are exported as “salted fish” and fishers who go through the formal process self-report to the Customs officials. The number of species and exact quantity are not counted or measured. Also, once an export license is obtained, it is often photocopied and used by multiple fishers. This lack of verification was recorded by Graham<sup>16</sup> in 2007 and it seems the practice has not changed.

There is a high demand for shark meat and shark fins in Guatemala and these are being taken over to Guatemala both legally and illegally.

In 2007, according to Graham<sup>17</sup>, the estimated total seasonal value of shark products exported to Guatemala was approximately US\$1,984,842 with US\$701,930 being shark meat and US\$1,282,912 being dried fins. This value however is not brought back to Belize but rather stays in Guatemala. The fishers restock and refuel in their country of residence, Guatemala, bringing no economic benefit to the Belizean economy<sup>18</sup>. This mode of operation was confirmed in interviews held with fishers from Punta Gorda Town.

### Illegal Gillnet Use by Guatemalan Fishers

Another similar issue with illegal gillnetting that is echoed constantly when interviewing fisheries stakeholders is that of Guatemalans fishers who come into Belizean waters illegally to fish. There are some reports of Honduran fishermen operating in similar fashion but the greatest challenge comes from Guatemala fishers originating from Sarstoon and Livingston. There are indications that this illegal fishing in Belizean waters is a serious problem and could be causing significant damage to local fish stocks. Local fishers from various fishing communities report that Guatemalans especially, come into Belizean waters under the cover of darkness to set extremely long gillnets and long lines and retrieve them and leave by daybreak making it difficult to intercept them.

Large fishing boats leave harbour in Livingston, Guatemala at around 5:30 pm and return around 6:00 am with their catch, all originating from Belizean waters. The difficulty faced by Belizean authorities to patrol such a large area of sea at night makes it easy for these fishermen to operate with impunity. Considering the immense benefits of illegally shark fishing provides, there is a strong incentive for these Guatemalan fishers to undertake this risky venture.

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<sup>16</sup> Graham, Rachel, T. 2007. Technical Report: Vulnerability Assessment of Sharks and Rays in Belize: Captures and Trade. Wildlife Conservation Society.

<sup>17</sup> Ibid.

<sup>18</sup> Biery, L. The Status of Gillnet Fisheries in Belize Waters. OCEANA. 2013

FIGURE 5: TYPES OF GUATEMALA FISHING BOATS THAT ENTER BELIZEAN WATERS



SOURCE: GARY AYUSO, THE REPORTER NEWSPAPER

While Guatemalan fishers take whatever is caught in the gillnets, they are primarily after sharks and shark fins. Shark fins in Guatemala are currently selling for US\$100 per pound. Just one shark can easily produce up to 12 lbs. of fins which has an equivalent value of US\$1,200. The price for shark fin

Shark fins in Guatemala are currently selling for US\$100 per pound.

has gone up by 100% from 2007 when the average price was at US\$50 per pound<sup>19</sup>. The shark meat is salted and placed in 50 gal. containers and delivered to one of the 3 main buyers in Livingston. While shark fishing in the past occurred mainly from January to April, this activity has now been extended throughout the year. One fisherman reported that one large boat extracts around 1,500 lbs. of shark meat per month. With such significant financial

incentives, illegal gillnet fishing by Guatemalans is unlikely to subside anytime soon.

It is important to note that the Belize government currently regulates trade in certain shark species under the CITES convention. Oceanic whitetip sharks, the scalloped, smooth and great hammerheads, the porbeagle shark, whale, basking, white sharks two species of manta rays are managed under Appendix II of the convention. These CITES listings the prohibition of Hammerhead exports under an agreement with the International Commission for the Conservation of Atlantic Tuna (ICCAT)<sup>20</sup>.

<sup>19</sup> Graham, Rachel, T. 2007. Technical Report: Vulnerability Assessment of Sharks and Rays in Belize: Captures and Trade. Wildlife Conservation Society.

<sup>20</sup> Ibid.

FIGURE 6: SALTED FISH IN 50 GALLON DRUMS DELIVERED IN LIVINGSTON



SOURCE: GARY AYUSO, THE REPORTER NEWSPAPER

The penalties prescribe in the laws for violating fisheries and gillnet regulations are hardly significant to act as some sort of deterrence for both illegal Belizean and Guatemala fishers. Fines for illegal fishing are only up to BZD\$500 or six months' imprisonment or both. Compared to value of fish that can be harvested illegally, this is a minor cost. These penalties urgently need to be upgraded.

## Environmental Impacts of Gillnet Use

While gillnets offer size selectivity, where fish that are smaller than the mesh size can escape the nets and fish with heads larger than the mesh size are not entangled<sup>21</sup>, species selectivity is quite poor, catching various species and sometimes entangling marine megafauna and protected species<sup>22</sup>.

### Bycatch

One of the biggest environmental impact of gillnet comes from bycatch. While there is a paucity of data on bycatch of gillnets in Belize, experiences elsewhere point to some serious implications. Seabirds and marine mammals are known to become entangled in gillnets, especially those set near the surface, adjacent to bird colonies and in shallow waters<sup>23</sup>. Bycatch of marine mammals by largescale driftnets,

<sup>21</sup> Gill Nets in Belize. Coastal Zone Management Authority and Institute (CZMAI), November 2018.

<sup>22</sup> Pingguo, H. Gillnets: Gear Design, Fishing Performance and Conservation Challenges, University of New Hampshire, Institute for the Study of Earth, Oceans and Space and New Hampshire Sea Grant

<sup>23</sup> Ibid.



which is similar to gillnets, resulted in a ban of driftnet fishing in the high seas with United Nation's Resolution 44/225 passed in 1989.

A high quantity of gillnet bycatch has been widely acknowledged by local fishermen in Belize. In order of frequency, catch and release species (permit, tarpon, bonefish), manatees, turtles, sharks (hammerheads, tiger sharks, nurse sharks), and unspecified juvenile fish were listed as the most commonly observed gillnet bycatch<sup>24</sup>. Follow up interviews conducted with local fishers for this study confirmed this list of species that ended up as bycatch except for manatees. Fishers have reported indeed seeing protected tarpon and bonefish in gillnets, as well as many juvenile fish, and have expressed concern that gillnets kill the

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majority of creatures that become entangled in them. Some fishers agree that gillnet fishing kills many juvenile fish before they can be released. However, they think that fishermen would widely ignore new laws until enforcement is significantly improved<sup>25</sup>.

In a review of cetaceans and gillnet fisheries in Mexico, Central America and the Wider Caribbean carried out by Vidal et. al (1994)<sup>26</sup> at least 14 species of cetaceans were found to have been caught in gillnets in the study area. These included: vaquitas, common dolphins, bottlenose dolphins, tucuxis, Atlantic spotted dolphins, spinner dolphins, clymcne dolphins, Risso's dolphins, killer whales, pygmy sperm whales, botos, and gray whales.

There has been no specific study done in Belize to determine the rate and scale of bycatch by gillnets. This however is not only a problem in Belize but also globally. In the absence of legal and governance regimes that require and enable regular monitoring, bycatch documentation in much of the world is likely to remain patchy, far from complete, and largely idiosyncratic. Sufficient data requirements are rarely met, even in highly developed countries with strong legal and institutional foundations<sup>27</sup>.

Nonetheless, the threat of bycatch in passive fishing gear is far from resolved and is likely growing rather than receding. Even as other significant threats to marine mammal populations have become better documented and understood over the past 2 decades – underwater noise, ship strikes, reductions in prey populations, toxic algal blooms, epizootic disease, and various environmental changes related to

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<sup>24</sup> Ibid.

<sup>25</sup> Biery, L. The Status of Gillnet Fisheries in Belize Waters. OCEANA. 2013

<sup>26</sup> Vidal, et al, 1994. Cetaceans and Gillnet Fisheries in Mexico, Central America and the Wider Caribbean: A Preliminary Review

<sup>27</sup> McClellan, K. et. al. (2013) Marine mammal bycatch in gillnet and other entangling net fisheries, 1990 to 2011. Endangered Species Research. Vol. 20: 71-97, 2013

global climate change – bycatch has retained its prominence as a critical issue demanding urgent attention if there is to be any hope of preventing further losses of marine mammal diversity and abundance and protecting (or restoring) ecological health<sup>28</sup>.

## Ghostfishing

Gillnets too can become lost due to adverse weather or sea conditions, or by conflict with other fishing gears or marine vessel traffic. Some derelict gear may continue to fish after being lost at sea. This phenomenon is referred to as “ghost fishing.” Fishing gear intentionally abandoned or otherwise disposed at sea, has a similar effect on animals and the environment. When lost gillnets are retrieved, they often contain large amounts of fish and shellfish. Direct observations on lost gillnets or simulated “lost” gillnets confirm that these nets did continue to fish. Gillnets deliberately set over wrecks in UK coastal waters and were found to have continued fisher for at least two years<sup>29</sup>.

Local fishermen have reported encountering lost or abandoned gillnets in Belizean waters though not very frequently. With the introduction of synthetic materials in gear construction of nets now in use, these lost fishing gears can continue to fish for several years before they become inactive.

## Economic Impacts of Gillnet Use

### Tourism Industry

Gillnetting has implications for the tourism industry through its effect on Belize product offerings. The main tourism activities that visitors engage in when visiting Belize are marine activities and jungle based activities. It is undoubtedly the natural environment that gives Belize’s tourism product its competitive advantage. According to the Belize Tourism Board’s (BTB) Visitor’s Satisfaction Survey in 2016, approximately 70% of visitors reported that they “snorkelled” and 21% reported that they went “diving”. Other activities that most reported engaging in were fishing, kayaking, and sailing. The survey also tracked the places where visitors claimed to have visited, and overwhelmingly, these were the marine areas of the country. Forty-two percent (42%) reported going to offshore islands, and 55% visited the Barrier Reef while 43% reported visiting marine protected areas.

Tourism is Belize’s number one export income earner, and in 2018 it was forecasted to account for about 17.2% of Belize’s GDP directly, and with its broader (direct and indirect) economic impact, account for 45% of GDP. In 2017, the GDP direct contribution to the economy of tourism was 15% (BZ\$555m) with a broader contribution of 41.3% (BZ\$1.5b). These figures illustrate a consistent growth in contribution from the tourism industry and confirms it a vital pillar of the Belizean economy. However, it is entirely dependent on healthy and functioning terrestrial and marine ecosystems.

The total number of persons employed directly in tourism in 2015 was approximately 18,500 or 34.8% of total employment (48,500), a figure representing some 1 in 7 persons. In 2017, persons directly

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<sup>28</sup> Ibid.

<sup>29</sup> McClelan, K. et. al. (2013) Marine mammal bycatch in gillnet and other entangling net fisheries, 1990 to 2011. *Endangered Species Research*. Vol. 20: 71-97, 2013

employed in tourism was 20,186 or 37.3% of total employment (59,000). The number of employed persons in the tourism industry is expected to rise to 90,000 jobs by 2028<sup>30</sup>.

### Sports Fishing and Gamefish Sector

The subsector of the tourism industry that is most at risk from the negative effects of gillnetting is sports fishing. Sports fishing is differentiated from game fishing in this report even though both are considered recreational forms of fishing. Sports fishing in this instance is used to describe the activities of guests who are guided by local tour operators and guides as part of the tourism industry. Game fishers are local fishers who fish in the same catch and release fashion but do so independently for recreational purposes only.

Belize is renowned throughout the fly fishing world for its exceptional sport fishing opportunities for Bonefish, Permit and Tarpon. Belize is, in fact, one of the few places in the world where fishermen (anglers) have a chance for the “Grand Slam” of flats fishing - a Bonefish, Permit and Tarpon all caught in a single day<sup>31</sup>. Sport fishing for Bonefish, Permit and Tarpon is not concentrated in any one area of Belize, but rather extends the entire length of the country, from Ambergris Caye to Punta Gorda Town. Fishing for Bonefish and Permit is primarily done in the shallows or back reef flats throughout Belize, whereas Tarpon are mostly caught in creeks, channels and rivers. Belize sports fishery sector supports numerous independent fishing guides, fishing lodges and hotels throughout Belize. Over the past several years, many Belizean hotels have become much more aggressive in marketing to sport fishermen by featuring fishing in their electronic and print advertising. This expanded focus on sport fishing has resulted from universal recognition that Belize offers world-class sport fishing.<sup>32</sup>

Fishermen (anglers) traveling to Belize to fish for Bonefish, Permit and Tarpon contribute to the Belizean economy in two important ways. Some fishermen hire independent guides and purchase lodging, meals, equipment, supplies, transportation, and other items separately. Others pay a “package price” to a fishing lodge which normally includes guided fishing, lodging, meals, and transportation in Belize. These packages generally do not include gratuities, bar or gift shop expenditures. Both independent fishing guides and fishing lodges generate income and jobs for Belize<sup>33</sup>.

According to Fedler (2008), the combined direct expenditures (BZD\$25.2 million) and value added expenditures (BZD\$31.3 million) of fishing for Bonefish, Permit and Tarpon in Belize in 2007 provided a total economic impact of around BZD\$56.5 million annually. Furthermore, fishing activity associated with Bonefish, Permit and Tarpon generated slightly less than \$30 million in wages and salaries and supported 1,864 full-time equivalent jobs<sup>34</sup>. Tax revenues generated by sport fishing industry in Belize are also substantial. Hotel Tax, Business Tax, Property Tax, Employment Taxes, GST, Fuel Tax and Departure Tax. Considering all this, independent fishing guides and fishing lodges paid an estimated BZD\$2.3 million in taxes during 2007 in Belize.

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<sup>30</sup> 2018 Belize Economic Impact Report, WTTC

<sup>31</sup> Fedler, A, J. 2008. Economic Impact of Recreational Fishing for Bonefish, Permit and Tarpon in Belize for 2007

<sup>32</sup> Ibid.

<sup>33</sup> Ibid.

<sup>34</sup> Ibid.

In a follow up study carried out in 2014, Fedler found an even larger economic contribution of sports fishing to the overall economy. The total economic effect of flats fishing in Belize in 2013 was slightly more than BZD\$112 million annually. Wages and salaries derived from sports fishing totaled around BZD\$34.5 million which represents around 2,100 jobs. Fedler rightly points out in the conclusion of his report that the challenge is for Belize to maintain these highly regarded fisheries if the industry is to continue to grow and flourish. He further points out that netting, mineral mining, development, water pollution and fisheries habitat destruction all have the potential to degraded the quality of fishing over time<sup>35</sup>. To maintain the robust contribution of the sports fishing sector of the tourism industry, both the marine ecosystem and target species must be protected and maintained.

Continued decline in protected species critical to the sport fishing sector from the use of gillnets will undermine a BZD\$34.5-million-dollar sector and the tourism sector overall. Thousands of jobs are being placed at risk and the value of protected fish species are greater through the sport fishing sector than when caught for consumption.

### Commercial Fisheries

While Belizean gillnet fishers are harvesting mainly fin fish and shark, illegal gillnet fishers who come from Guatemala are harvesting indiscriminately taking not only fin fish normally caught by Belizean fishers but also shellfish. The large boats that come into Belizean waters from Guatemala illegal use nets similar to trawlers which pick up juvenile conchs from the seafloor. These juvenile conchs are sold in Guatemala as delicacies called “pango.” This indiscriminate and illegal exploitation is putting Belize’s commercial fisheries at risk of further decline. The total value of Belize exports in capture fisheries in 2017 was approximately BZD\$30,579,789.09, according to the Belize Fisheries Department. This includes major commercial species such as conch and lobster being primary earners with finfish a distant third.

### Mitigation Methods

There are a few mitigation measures that have been developed to reduce the impact of gillnet fishing. In reality however, there is no single solution that can be applied globally to solve gillnet bycatch issues especially for migratory species. Whether gear technology alone or in combination with other methods can be used as an effective solution is still in its infancy<sup>36</sup>. Solutions to gillnet bycatch problems are extremely complex and need to be addressed on a case by case basis. There are many factors that contribute to the efficacy of a

The total economic effect of flats fishing in Belize in 2013 was slightly more than BZD\$112 million annually.

<sup>35</sup> Fedler, A. J. 2014. 2013 Economic Impacts of Flats Fishing in Belize. Bone and Tarpon Trust. Vero Beach. Florida, USA.

<sup>36</sup> Blyth, R. et. al. 2011. Report to the Convention on Migratory Species: Assessment of Bycatch in Gill Net Fisheries. Convention On Migratory Species. Tenth Meeting of the Conference of the Parties. Bergen, 20-25 November 2011

particular measure including the gillnet fishery type, catch per unit effort, the area fished and size and behavior of non-target species. Some techniques that are very effective at reducing bycatch are also linked to reductions in fishing efficiency and are costly.

### Gear Technology

Some of the mitigation measures trialled elsewhere to reduce bycatch in gillnets include visual alerts, acoustic alerts (pingers) and passive reflectors. Use of material with high reflectivity is reported to reduce bycatch of harbor porpoises (*Phocoena phocoena*) and seabirds (shearwater *Puffinus* spp.) without reduction in target species (cod, haddock and pollock)<sup>37</sup>. Prevention of ghost fishing may include prevention of gear loss, lost gear retrieval and de-ghosting technologies. The use of degradable material which causes the lost gillnet to lose floatation could reduce the vertical profile of the net.

### Surveillance and Enforcement

Surveillance and enforcement of regulations is one step in reducing the negative impacts of gillnetting. For regulations to work, the monitoring and enforcement has to be consistent and effective. In Belize, this responsibility is currently shared among the Fisheries Department, the Belize Coast Guard and co-managers of MPAs. Co-managers however have limited jurisdiction to the specific MPA they co-manage. This is a major challenge for the authorities currently as it requires large financial resources which are not available. It is precisely poor monitoring and enforcement that are among the biggest challenges in the regulation and management of gillnet fishing.

### Time/Area Closures

Time/area closure is another mitigation measure which involves closing an area to fishing for a specific period of time when levels of entanglement for potential bycatch species are considered to be too high. For this method to be effective however, an extensive knowledge of temporal patterns of both potential bycatch species and target fish is required. Variations in spatial and temporal occurrence in some species from year to year makes this difficult to determine the appropriate time and area that are suitable for closure<sup>38</sup>.

### Buy-back Program

One way of decommissioning some gillnet fishers would be to institute a buy-back programme. Most buyback programmes include purchase of vessel, and/or licenses and permits, and gear. For example, in Mexico a buyback scheme was employed to help address the problem of porpoise bycatch from gillnets. To avoid extinction of this species of porpoise the government made the decision to enforce a gillnet ban and then followed up with arrangement for buyback of licenses and finding alternatives for fishers while also enforcing the ban.

It is important to consider that if an alternative for fishers leaving or reducing their capacity in a fishery is unavailable or offers lower net benefits, then a one-time payment of compensation could be used but may be insufficient because fishers will be incurring ongoing net costs. Buybacks too can create adverse spillover effects. Without sufficient long term measures fishers may re-enter the fishery, or remaining

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<sup>37</sup> Ibid.

<sup>38</sup> Blyth, R. et. al. 2011. Report to the Convention on Migratory Species: Assessment of Bycatch in Gill Net Fisheries. Convention On Migratory Species. Tenth Meeting of the Conference of the Parties. Bergen, 20-25 November 2011

fishers will continue to invest, new technology will be adopted, nets may get longer or fishers may simply fish for longer. If these things happen, the result of reduced fishing capacity that was achieved from the buyback will be lost<sup>39</sup>

## Conclusion and Recommendations

### Gillnets – A Door to Illegal and Unregulated Fishing

Ultimately, this study found that there is widespread concern among fishers regarding the scale of illegal fishing activity, especially by foreigners, at night and during closed seasons. This same issue was reflected in the pilot study done by Mayhew (2016)<sup>40</sup>. Guatemalan fishers are illegally extracting valuable marine resources using gillnets at levels far beyond what Belizean fishermen are harvesting. At the same time, there are Belizean fishermen who are participating in illegal gillnet fishing and supplying illegal Guatemalan fishers. The exact scale of the illegal fishing is unknown but what has been identified indicates it to be on a huge scale. Partly because of the illegal nature of their fishing and the high demand for seafood in Guatemala, illegal fishers are taking every fish they can to increase their profits and meet the demand. All this exploitation of national resource occurs with little to no benefit to Belize's economy. Beyond that, all this unsustainable exploitation is putting Belize's very own fisheries and tourism sector at risk of losing millions of dollars and thousands of jobs. The value gained from tourism and sport fishing greatly outweighs the cost of a phased ban on gillnets.

### Regulations Are Ineffective

Corollary to the illegal fishing is the extremely lax enforcement of Belize's fishing laws and regulations.

Considering the overall decline of the fishing sector and the environmental damage gillnets pose to fish and other wildlife, it is likely that continued use of gillnets, especially illegally, will further degrade this important resource.

Fishers are quick to point out that there is hardly any monitoring of gillnet fishing and that the authorities simply do not have the resources to effectively patrol and interdict illegal gillnet fishing both by Belizeans and Guatemalans. Permitting, net size, no take areas, protected species bycatch, are all violated frequently in the face of poor enforcement. When asked, some gillnet fishers readily admitted that fisheries officers or any relevant authorities have not once monitored their gillnet fishing activity. Considering the overall decline of the fishing sector and the environmental damage gillnets pose to fish and other wildlife, it is likely that continued use of

<sup>39</sup> Coastal Resources Center. (2013) Global lessons and information to assist with monofilament gill net management in Ghana. USAID Integrated Coastal and Fisheries Governance Program for the Western Region of Ghana. Narragansett, RI: Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island. 14 pp.

<sup>40</sup> Ibid.

gillnets, especially illegally, will further degrade this important resource.

## Recommendations

### Phased Ban of Gillnets

There should be a phased ban of gillnets. A phased approach will help to ensure that there are adequate plans and measures to support all fishermen who will be adversely affected. It is recommended that such a plan must first be developed and already be under implementation before any ban is instituted. This is to ensure fishers experience minimal adverse effects and also build trust between the fisheries managers and local fishers. There is widespread interest among local fishers in income diversification among small-scale fishers, especially in opportunities related to marine tourism, aquaculture, mariculture and seaweed farming.

Experience with gillnet bans elsewhere shows that they can be effective in restoring stocks. In the US state of Florida, a gillnet ban was implemented in 1995 in response to a rapid decline of mullet stocks, and significant increases in spawning stock biomass was observed for both mullet and mackerel post-ban. All of these species were in decline, crashed, or absent before gillnet closures, demonstrating a positive impact on marine fisheries on multiple trophic levels<sup>41</sup>.

Gillnet bans have been undertaken in different countries across the world. A ban was instituted in the west coast of South Africa as far back as 1984. Similarly, a gillnet moratorium was put in place Virginia's (USA) river fisheries in 1994 in response to declining harvest and catch rates<sup>42</sup>. To avoid the extinction of a cetacean species due to bycatch, the Mexican government also took the politically unpopular step of instituting a limited ban on the use of gillnets to protect the vaquita in the Gulf of California<sup>43</sup>.

Instituting a ban, however, will still require increased surveillance and enforcement to ensure that fishers do not develop novel and more damaging fishing methods or continue to use gillnets illegally. A specific plan to address the illegal gillnet poaching by Guatemalan fishers will need to be developed and implemented.

### Socio-economic Implications of a Phased Gillnet Ban

It is important to note that there can be political, social and economic impacts of a decision to institute a phased gillnet ban. If not managed well, it could even result in little or no overall reduction in fishing pressure and increased conflict between fishers and managers. There can be shifts if other areas where other fishers are already operating which can lead to inter-fisher and inter-community conflicts. Any ban cannot be seen or perceived to disregard the interests of the socio-economic wellbeing of gillnet fishers. This is especially true for older fishers who may be reluctant to be re-trained for other livelihood options. Some gillnet fishermen are uncomfortable with the idea of a total gillnet ban, as they fear it might be hard for them to make a living without the nets. Nonetheless, the gillnet bans in Monkey River and

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<sup>41</sup> Biery, L. The Status of Gillnet Fisheries in Belize Waters. OCEANA. 2013

<sup>42</sup> Coastal Resources Center. (2013) Global lessons and information to assist with monofilament gill net management in Ghana. USAID Integrated Coastal and Fisheries Governance Program for the Western Region of Ghana. Narragansett, RI: Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island. 14 pp.

<sup>43</sup> <https://edition.cnn.com/2017/07/02/americas/mexico-bans-gill-nets-vaquita-porpoise/index.html>. Accessed 7/3/2019.

Placencia currently in place were as a result of fishers' requests. This indicates that some level of support already exists in some areas for a gillnet ban. Fishers who are members of the Belize Fishers Federation (BFF) are in full support of instituting a ban on gillnets as they believe that the nets are further risking their livelihoods by degrading the fisheries stocks.

### Tradition and Identity

Perhaps unsurprisingly, fishers interested in diversifying their income showed the most interest in opportunities that would keep them working on the water, such as seaweed farming, tourism, aquaculture and other fisheries. Almost half of the fishers already derive a part of their income from non-fishing activities. Survey respondents in Mayhew's study expressed the importance of remaining on the water, whether fishing or doing something else, due to their cultural and historical ties to the ocean and fishing<sup>44</sup>. This is important and must not be disregarded. Fishers from coastal communities have their tradition and identity tied to the sea. Their sense of belonging and identity is partly formed and reinforced by their vocation and its practice. Removing this completely is unnecessary and could be injurious as this contributes to the fisher's sense of wellbeing whether he or she is a traditional fisher or a recreational fisher. Transitioning for fishers is not only about incomes but recognizing that culture, social institutions and community health are associated with access to resources<sup>45</sup>. Appreciating this aspect of the life of fishers apart from the livelihood needs will be critical in helping them to transition to less harmful gear and diversified livelihood portfolios.

### Address Other Threats to Marine Resource

While the trajectory of economic development appears to privilege the interest of some stakeholders over others, it is important that stakeholders such as fishers who have less resources and capital are not made invisible and their concerns and inputs disregarded. Fishers must be given the space to participate in the management of resources they are primarily dependent on. Fishers have consistently appealed for increased community participation and involvement in fisheries management<sup>46</sup>. There are indeed socio-environmental relations that are unchallenged, treated as invisible, natural or inevitable are automatically granted legitimacy<sup>47</sup>. Some of the concerns of fishermen including, unsustainable tourism developments, dredging, destruction of mangroves, habitat loss, agricultural run-offs and perceived corruption within management authorities must not only be acknowledged but also addressed. If these are not addressed as they should, to the fishers it will seem that they are being unfairly singled out and targeted to bear the brunt of the cost of the degradations to the marine ecosystems. It is imperative that other threats to marine resources that all stakeholders depend on are identified and addressed given how vital it is for major sectors of the society and economy.

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<sup>44</sup> Mayhew, J. 2016. Perceptions of Fisheries Management, Gill Net Use and Income Diversification Among Small-Scale Fishers in Belize. Master's Thesis. Nicholas School of the Environment, Duke University

<sup>45</sup> Martin, I, E. 2008. Resilience in Lower Columbia River Salmon Communities. Ecology and Society.

<sup>46</sup> Ibid.

<sup>47</sup> May, C.K. 2015. "Politics of Visibility: Competing for Legitimacy in North Carolina Fisheries Governance." Environment & Planning C:33(6):1484-500. DOI: <https://doi.org/10.1177/0263774X15614180>



## Annex 1 – Methodology

Several sources of information were used to establish the context and status of gillnet fishing in Belize. These included examination of data obtained from the Belize Fisheries Department in regards to gillnet fishers. This data yielded important information regarding the pattern of gillnet use among local fishers. Fishermen, both gillnet and non-gill net users, were interviewed in Belize City, and Punta Gorda. Interviews were also carried out with heads and members of NGOs, fisher associations and other groups who had a direct interest in the subject matter. An extensive literature review of Belize's policies, national plans, laws and regulations, experience of gillnet fishery in other parts of the world, and in Belize, was also carried out.