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BEST PRACTICES **FOR REDUCING BYCATCH IN LONGLINE TUNA FISHERIES**

CONTENTS

PREFACE

LONGLINES HAVE BEEN IDENTIFIED AS HAVING ONE OF THE HIGHEST BYCATCH RATES FOR SPECIES SUCH AS SHARKS, SEA BIRDS, SEA TURTLES, AND MARINE MAMMALS. YET, THE FISHING INDUSTRY CAN DRIVE BYCATCH REDUCTION THROUGH THE ADOPTION OF PROVEN BEST PRACTICE TECHNIQUES RESULTING IN RAPID AND SIGNIFICANT IMPROVEMENTS.

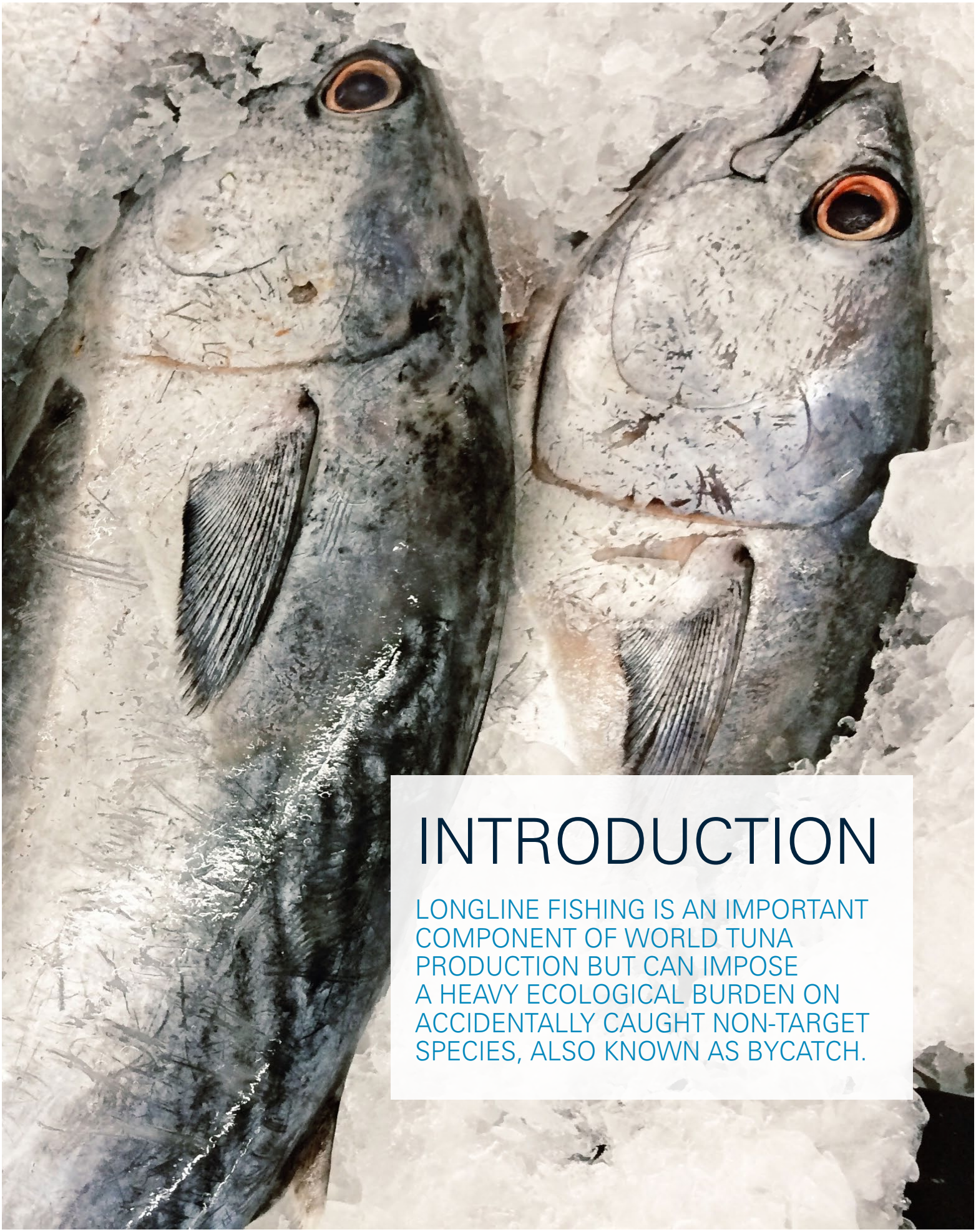
However, political will to achieve broad industry uptake of best practices has been lacking and the five Regional Fisheries Management Organizations (RFMOs) have achieved mixed progress mitigating bycatch.

Companies that source longline tuna can address this poor regulatory governance by incorporating bycatch reduction methods into their sourcing requirements and request that best practices are adopted by their suppliers while working with other businesses to see that these approaches are replicated across whole fleets and fisheries.

This report is aimed at supply chain members who wish to source responsibly-caught longline tuna and improve the environmental performance of the fisheries they source from. The report describes the bycatch impacts of longline tuna fisheries, the mitigations and measures that can substantially reduce catching non-target species and offers industry guidance on ways to insist that such practices are adopted when sourcing tuna.

Among the best practices identified in this report are: using suggested bait and catch methods, avoidance of areas with an abundance of wildlife, and following advice on gear use and placement. The report also illustrates examples of longline fisheries that have already adopted best practices including the Hawaii Longline Swordfish Fishery, the US Northeast Distant Fishery Experiment (NED), the Australian Eastern Tuna and Billfish Fishery, and Fiji Longline.

The report is not intended to be a technical resource for skippers, crew or vessel owners. For this audience we encourage the uptake of specific training and education materials, for example developed by the International Seafood Sustainability Foundation (ISSF) to further support the adoption of these best practices at the vessel/fleet level.



INTRODUCTION

LONGLINE FISHING IS AN IMPORTANT COMPONENT OF WORLD TUNA PRODUCTION BUT CAN IMPOSE A HEAVY ECOLOGICAL BURDEN ON ACCIDENTALLY CAUGHT NON-TARGET SPECIES, ALSO KNOWN AS BYCATCH.

The bycatch of large seabirds, especially albatross, marine turtles, sharks and other species in the tuna longline fishery, even though it does not constitute a problem in all fisheries, is clearly an issue of concern to many fisheries.

The bycatch of seabirds is problematic globally, primarily in higher latitudes. When gear is being set, seabirds can be hooked or entangled and drown as the gear sinks. Approximately one third of seabird species are currently threatened with an extinction, including 15 of 22 albatross species (Paleczny et al. 2015), IUCN.org).

Sea turtle bycatch is problematic in many longline fisheries throughout the world (Wallace et al. 2013, Lewison et al. 2014}. Hard-shelled turtles tending to get caught by biting baited hook and leatherbacks by foul-hooking on the body and through entanglement.

In addition to sea birds and sea turtles many shark species are also incidentally captured in longline fisheries throughout the world. The most commonly caught species is typically the blue shark but shortfin mako and other pelagic species are also common (ISC 2017, ATTC 2017).

Finally, marine mammals are occasionally entangled and hooked, which can lead to injury and subsequent death. Fishers may also harass and kill cetaceans (whales & dolphins) to try to avoid the removal of hooked fish and bait and gear damage (Werner et al. 2015).

It is possible to substantially reduce bycatch through adopting a range of mitigation measures that together constitute best practices. This document reviews the issue in longline tuna fisheries and identifies practices and mitigation measures that can be implemented either voluntarily or via mandated management to reduce the problem of bycatch in longline fisheries. Examples of fisheries where best practices have been adopted are provided.

We urge participants of the Global Tuna Supply Chain Roundtable to encourage the producers they source from to adopt these practices. In addition, we encourage the uptake of other training and education materials, for example developed by the International Seafood Sustainability Foundation (ISSF) to further support the adoption of these best practices at the vessel/fleet level.

The fishing industry can drive bycatch reduction and mitigation initiatives with implementation resulting in rapid and significant improvements. Companies that source longline tuna can request that best practices are adopted by their suppliers while working with other businesses to see that these approaches are replicated across whole fleets and fisheries.

TUNA FROM **LONGLINE FISHERIES**

Tuna are caught by a variety of fishing gears including purse seines, hook and line, troll, harpoon, traps, and longlines. Longlines caught on average 12 percent of all tuna worldwide between 2011 and 2015 (ISSF 2017). Longlines are used to target a variety of tuna species such as adult albacore, bigeye tuna, yellowfin tuna, and bluefin tunas (Pacific, Atlantic, and southern) and are the primary gear used to capture albacore tuna worldwide.

Longlines consist of a monofilament main line with branch lines attached (Figure 1). The branchline design can vary but typically is made up of the line, leader, and hook. The line is usually kept near the surface or at a specific depth range with regularly spaced branch lines in between pairs of floats (FAO 2003). Longlines can be configured differently to fish at different depths and target different species. Longlines set in the upper part of the water column, called shallow water sets, target swordfish.

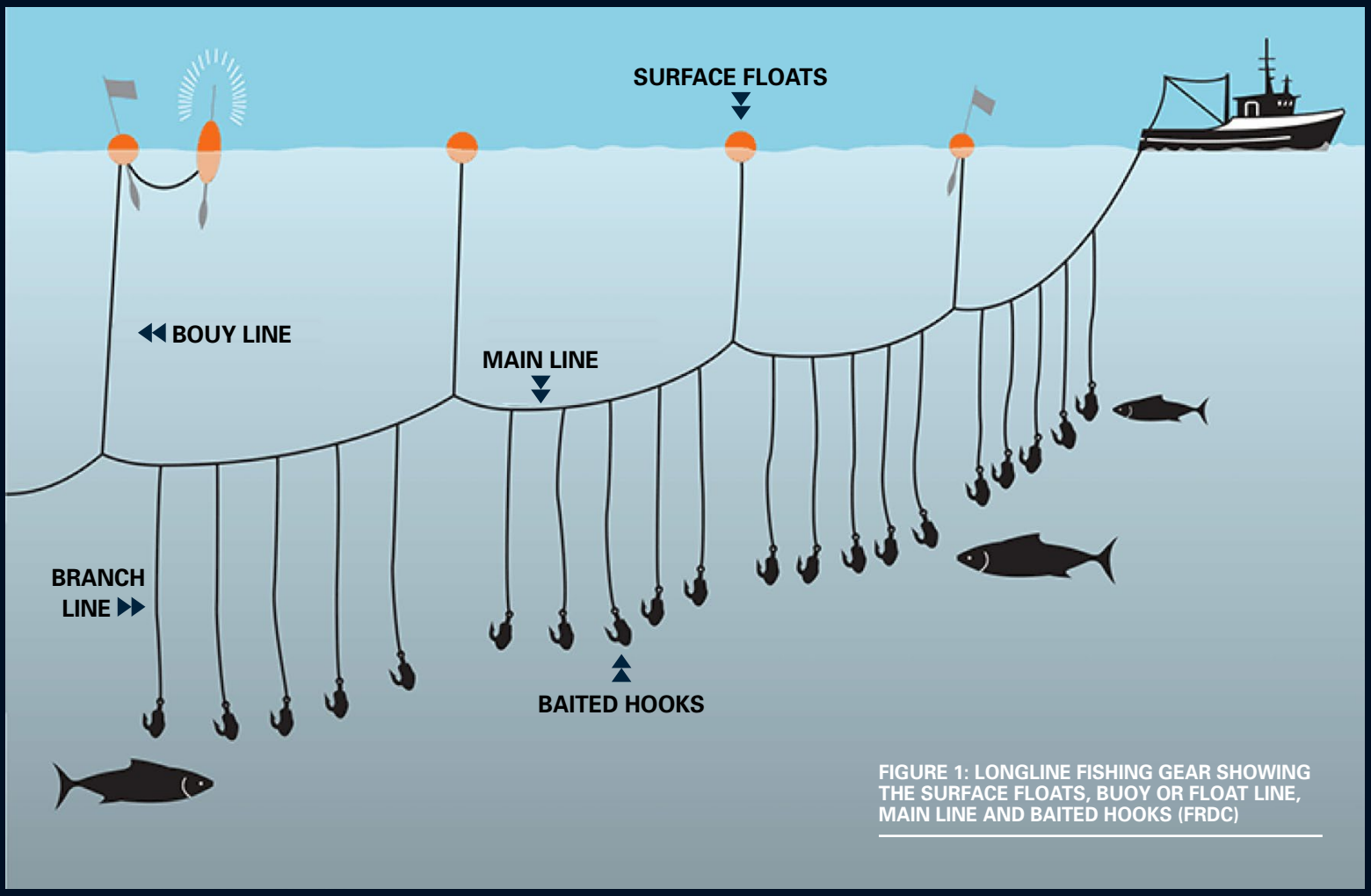


FIGURE 1: LONGLINE FISHING GEAR SHOWING THE SURFACE FLOATS, BUOY OR FLOAT LINE, MAIN LINE AND BAITED HOOKS (FRDC)

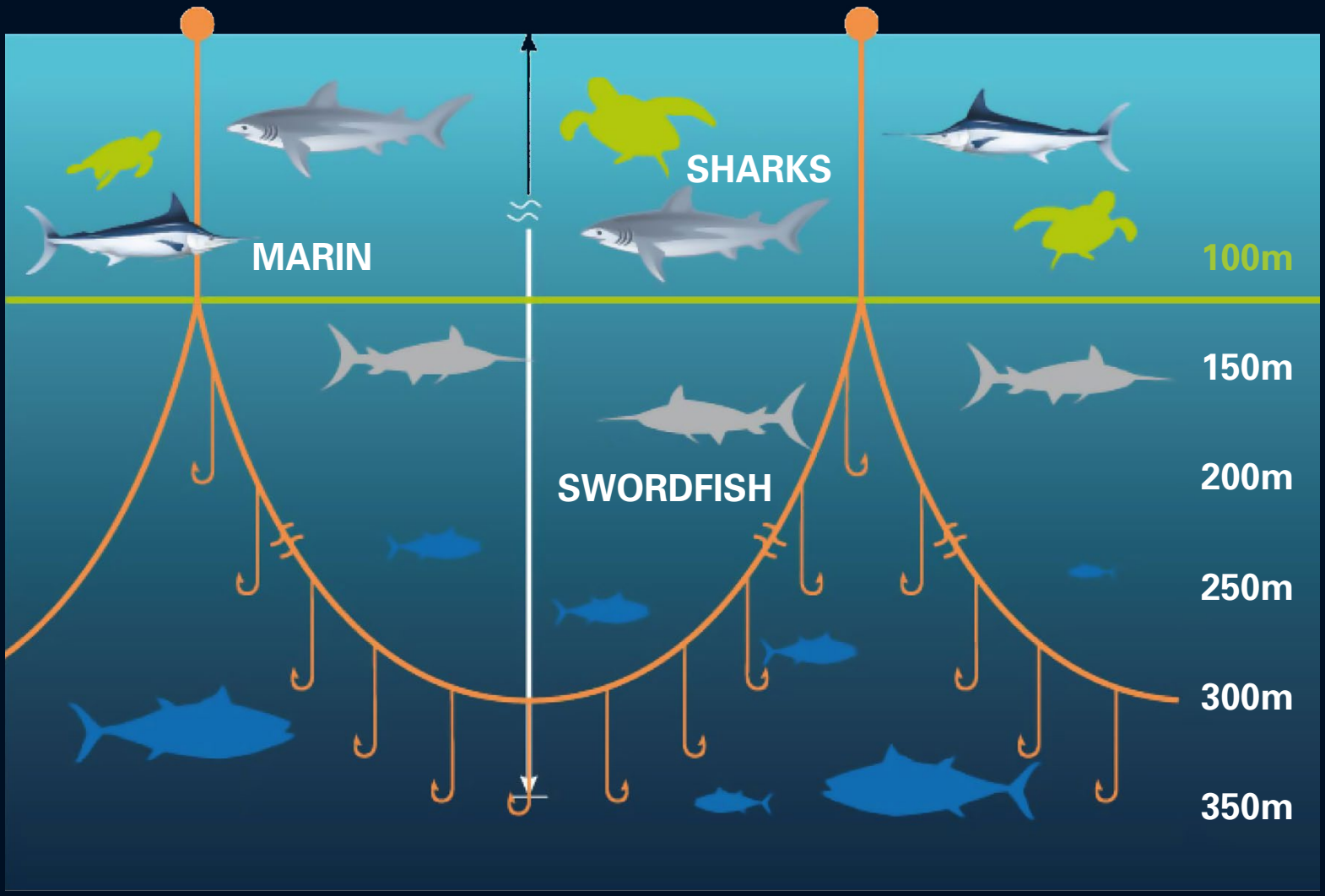


FIGURE 2: DEPTH DISTRIBUTION OF TARGET AND BYCATCH SPECIES IN PELAGIC LONGLINE FISHERIES (ISI-FISH 2017)

Longlines set at deeper depth, deep-water sets, target tuna (Figure 2).

Several different types of longline fisheries target tunas throughout the world. These include 1) industrial fisheries—typically large vessels with advanced mechanical and fish-finding navigation systems and high capital investment; 2) small-scale fisheries—small vessels with labor-intensive fishing and little capital cost, which can be for subsistence or commercial use; and 3) artisanal fisheries—traditional family or household fisheries with small capital investment and small vessels that make short trips, such as day trips (FAO 2005).

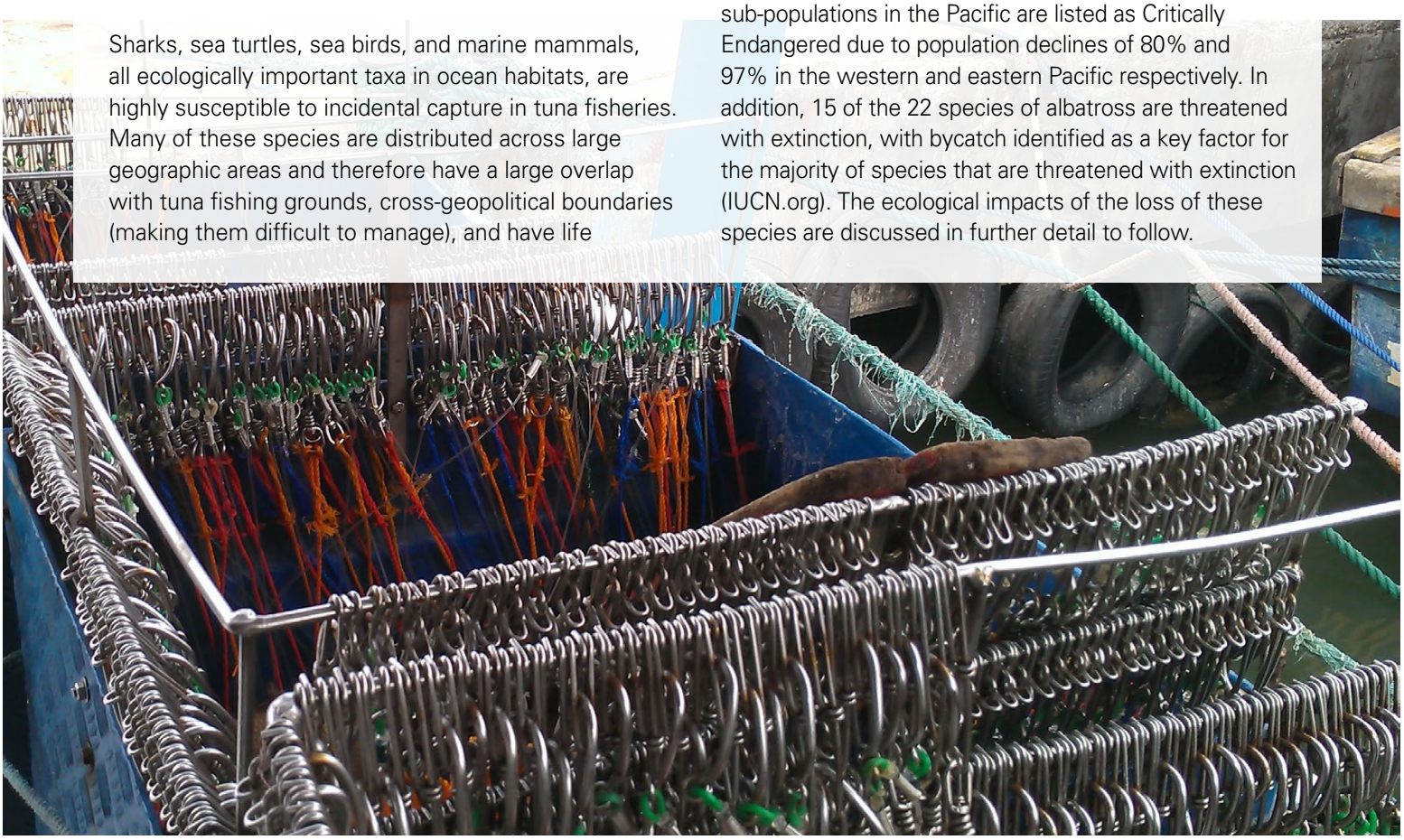
LONGLINE TUNA FISHING **& BYCATCH**

Bycatch, defined here as the incidental take of non-target species, including undersized tuna, marlin and swordfish, has been identified as one of the most significant issues affecting both the management and conservation of marine fisheries. The type and amount of bycatch associated with individual fisheries depends on several things, including gear design (e.g., hook type), fishing method (e.g., time of day of setting), and the spatial overlap between fishing effort and individual species' distribution. The supply chain has the ability to adopt voluntary bycatch mitigation measures (identified below) that can significantly reduce the impact of the fishery on the populations of bycatch species.

Longlines have been identified as having one of the highest bycatch rates for many species, which is considered to be a global threat to long-lived animals such as sharks, sea birds, sea turtles, and marine mammals.

Sharks, sea turtles, sea birds, and marine mammals, all ecologically important taxa in ocean habitats, are highly susceptible to incidental capture in tuna fisheries. Many of these species are distributed across large geographic areas and therefore have a large overlap with tuna fishing grounds, cross-geopolitical boundaries (making them difficult to manage), and have life history characteristics (late age of sexual maturity, long reproductive cycles, produce small number of young) that make them especially vulnerable to the impact of fishing associated mortality.

The bycatch of these species in longline (and other) fisheries is of great concern, as many of their populations have declined greatly in recent years. For example, it is currently estimated that 1.1 percent of shark species assessed by the International Union for the Conservation of Nature (IUCN) are critically endangered, 1.4 percent are endangered, 4.6 percent are vulnerable, and 6.4 percent are near threatened (Dulvy et al. 2014). Green sea turtles and Kemp's ridley are currently listed as endangered or critically endangered by the IUCN respectively. Olive ridley and loggerhead sea turtles are all listed as vulnerable by the IUCN. While leatherback sea turtles are globally listed (IUCN) as Vulnerable, the sub-populations in the Pacific are listed as Critically Endangered due to population declines of 80% and 97% in the western and eastern Pacific respectively. In addition, 15 of the 22 species of albatross are threatened with extinction, with bycatch identified as a key factor for the majority of species that are threatened with extinction (IUCN.org). The ecological impacts of the loss of these species are discussed in further detail to follow.



ECOLOGICAL IMPACTS **OF LONGLINE FISHING**

Sharks, tuna, and billfish are considered to be top predators, playing a critical role in the structure and function (Stevens et al. 2000) (Libralato et al. 2005) (Morgan and Sulikowski 2015) of all marine ecosystems. The loss of sharks has been shown to negatively impact several ecosystems. For example, the loss of sharks can lead to changes in the abundance of their prey species, which can lead to a cascade of other trophic level impacts (i.e. abundance of predators can decrease or prey behavior can be altered, thereby releasing lower trophic level species from predation) in the ecosystem (Myers et al. 2007, Duffy 2003, Ferretti et al. 2010, Schindler et al. 2002, Ruppert et al. 2013). The reduction in biomass of tunas and billfish through fishing can result in similar changes to the ecosystem (Ward and Myers 2005). In addition, behavioral changes, such as changes to the activity level of prey species, their diet, and/or habitat utilization can be caused by the loss of sharks (Heithaus et al. 2007).

Sea turtle bycatch occurs primarily in the tropics and subtropics, particularly in the eastern Pacific Ocean, northwest and southwest Atlantic and Mediterranean regions where these species are commonly found (Wallace et al. 2013, Lewison et al. 2014). Sea turtles with hard shells tend to bite baited longline hooks resulting in their capture. Leatherback turtles, however, rather than ingesting baited hooks, tend to get caught by becoming foul-hooked on the body and entangled. Sea turtles can also become entangled in the float and/or branch lines, which could cause them to drown. Globally, tens of thousands to hundreds of thousands are estimated to be caught annually with about 25% dead when retrieved (Gilman, 2011).

Sea birds are most frequently caught during longline setting, primarily in fisheries that occur in higher latitudes (particularly south of 25oS), where albatrosses and petrels, the species most vulnerable to longline bycatch, are most abundant Seabirds become hooked or entangled while trying to scavenge the bait from the hook, and are dragged under water and drowned as the gear sinks. However, seabird bycatch can also occur during hauling. It has been estimated to one third of all seabirds are threatened with extinction and that 15 of 22 species of albatross alone are threatened with extinction (Paleczny et al. 2015, IUCN.org).

Marine mammals, including toothed whales and, less frequently, baleen whales are occasionally entangled in the float and/or branch lines or hooked, which can result in injury and mortality. Interactions with seals may also occur in coastal longline fisheries.

Up to a quarter of the total catch in some pelagic longline tuna fisheries are shark species. The most commonly caught shark species is typically the blue shark, which his healthy in most of its range (i.e. ISC 2017) but other commonly caught species such as shortfin mako (i.e. ICCAT 2017) and silky sharks (i.e. Rice and Harley 2012) are not and many species, such as thresher sp. (i.e. Reardon et al. 2009) and hammerhead species (i.e. Baum et al. 2007, NMFS 2014a) are listed as Vulnerable and Endangered (respectively) by the IUCN or other national measures.

In addition to the direct effects of fishing on bycatch species, lost fishing gear can also negatively impact marine species. Fishing gear can become lost through bad weather conditions, breakages, improper fishing techniques or by accident. Lost fishing gear can lead to the entanglement and injury of marine life including marine mammals, seabirds, sea turtles and other marine species. It is important that vessels have measures in place to avoid losing gear and to recover lost gear when practical. Resources such as the Responsible Fishing Scheme offer advice on the recovery of lost fishing gear.

BEST PRACTICES IN **REDUCING BYCATCH IN LONGLINE TUNA FISHERIES**

There has been good progress in identifying effective and commercially viable methods to mitigate problematic bycatch in longline fisheries. Changes in gear designs and fishing methods have been shown to reduce longline bycatch, and Table 1 summarizes best practices by taxonomic group to demonstrate the range of measures that can straightforwardly be implemented on board a vessel.

However, while the information on bycatch mitigation has been presented by taxonomic group, it is critical to holistically assess the relative effects of a change in gear or methods, recognizing that a method that mitigates problematic catch of one taxonomic group or species may exacerbate the catch of other vulnerable species of the same or different taxa. See the "Trade-Offs" section for more information.

TABLE 1: BEST PRACTICES BYCATCH MITIGATION MEASURES BY PRIMARY BYCATCH TAXA..

SHARKS/RAYS	SEA TURTLES	SEA BIRDS**	MARINE MAMMALS	JUVENILE BILLFISH (SWORDFISH, SAILFISH, MARLINS ETC.)
Avoid hotspots (i.e., areas where sharks are commonly caught in large numbers) There is currently no quantification of what constitutes a hot spot. This would be left up to the captain to determine if they are fishing in an area that is resulting in the incidental capture of large numbers of unwanted sharks.	**Use circle hooks with offset** Circle hooks* have a rounded shape with a point oriented toward the shank, which is different than the J hook that has a point oriented parallel to the shaft. Circle hooks are wider and therefore more difficult for sea turtles to become hooked on. The offset creates a larger gap between the point and the shank.	**Line weighting** Weights are added to the branch line so hooks are quickly deployed to the target fishing depths. This reduces bycatch of seabirds by moving the baited hooks out of the diving range of seabirds. The effectiveness of line weighting depends on the distance between the weight and the hook (a short distance accelerates the initial sink rate) and the amount of weight added (greater weight accelerates the subsequent sink rate). This mitigation measure must be used in conjunction with properly deployed streamer lines or night setting. For detailed description please see this resource.	**Avoid fishing in known hotspots** This would lessen any potential interactions between longline fisheries and marine mammals.	**Avoid fishing in known hotspots** Avoid fishing in areas with large amounts of juvenile and small billfish species.
Set longline gear and hooks deeper (see Figure 2). This may prevent the incidental capture of shark species that remain in the upper water column.	**Use of finfish bait** Using finfish instead of squid for bait has been shown to reduce sea turtle interactions. This may be more effective for leatherback sea turtles compared to other species.	**Night setting** Night setting is the practice of setting and hauling fishing gear between dusk and dawn. No modifications to fishing gear are needed. For detailed description please see this resource.	**Use circle hooks** Similar to other species, circle hooks are wider and more difficult for some marine mammals to bite and become hooked on.	**Use circle hooks** Similar to other species, circle hooks are wider and more difficult for some billfish to bite and become hooked.
Shorter soak times Adequate soak time reductions would be species/ fishery specific and require studies to be conducted.	**Shorter soak times** This reduces the amount of time the gear is in the water, reducing potential interactions. It also may reduce mortality in incidentally captured turtles because they remain hooked for a shorter period of time.	**Streamer line (tori or bird scaring line)** This is a line with streamers that is towed from a high point as the baited hooks are deployed (usually near the stern). An aerial segment with streamers suspended at regular intervals is formed as the vessel moves forward, creating drag on the streamer line. The mitigation measure works by maintaining the streamer line over the sinking baited hooks, therefore preventing seabirds from attacking the bait and becoming hooked. For detailed description please see these resources: vessels >35m or vessels <35m.	**Conduct fleet communications** This will allow you to determine where marine mammal sightings may have occurred and move fishing locations when interactions occur	**Set gear in water deeper than 100m** This will reduce interactions with billfish species that reside in the upper water column.

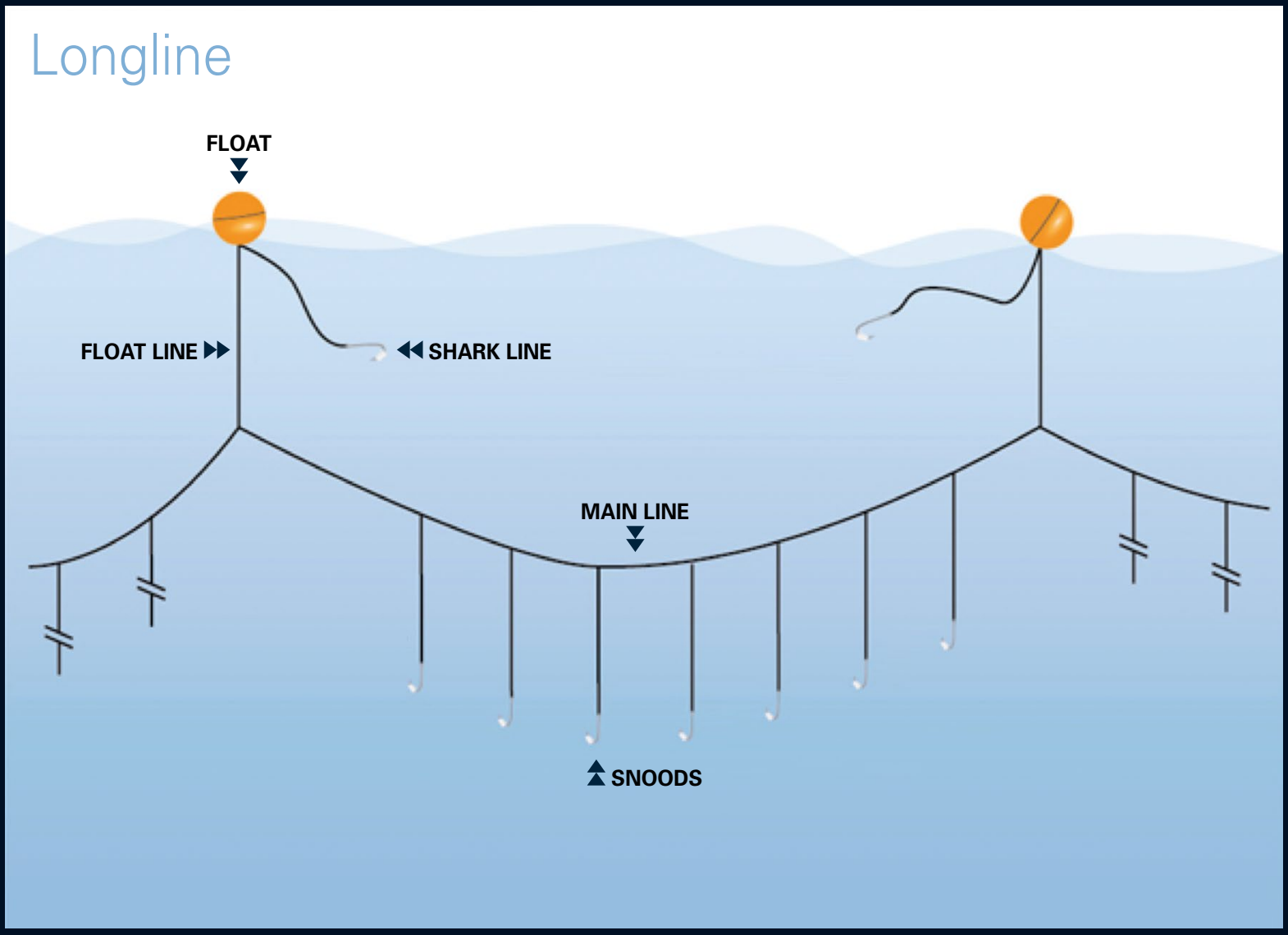
TABLE 1: BEST PRACTICES BYCATCH MITIGATION MEASURES BY PRIMARY BYCATCH TAXA.. cont.

SHARKS/RAYS	SEA TURTLES	SEA BIRDS**	MARINE MAMMALS	JUVENILE BILLFISH (SWORDFISH, SAILFISH, MARLINS ETC.)
Prohibit the use of wire leaders (or trace) and/or shark lines (Figure 3). Wire leaders prevent sharks from being able to bite through and escape after accidental capture. Shark lines may attract more sharks to the fishing gear.	**Removing the first and/or second hooks closest to the float in each basket** The hooks closest to the float fish in shallower water and therefore have a higher likelihood of incidentally capturing sea turtles.	**Hook-shielding devices** Devices that encase the point and barb of baited hooks. This prevents seabird attacks during the setting process. Hooks are released after the hook has reached a minimum of 10m depth or has been in the water for a minimum of 10 minutes. The Hook Pod and Smart Tuna Hook are two devices assessed as having met ACAP performance requirements. Please see this resource.	**Use "weak" hooks** These are specially designed hooks that break or bend when certain amount of pressure is applied, allowing incidentally captured species the ability to escape.	**Restrict the use of light sticks** This may reduce billfish interactions by lessening the ability to see baited hooks.
Prompt and safe release of any incidentally captured sharks Guidance on how to releasing a shark or ray to reduce stress and injury and minimize your safety risk can be found here.	**Use of monofilament for the mainline and branch line** Monofilament lines reduces the risk of entanglement compared to multifilament lines. Monofilament is less flexible, making it easier to release entangled sea turtles (i.e. reduces knotting of the line).	**Time/area closures** Time-area closures and restrictions on the timing of setting could further reduce seabird bycatch as these factors have been observed to have significant effects on seabird catch rates.		
Use fish instead of squid for bait Using finfish instead of squid for bait has been shown to reduce interactions with some but not all shark species.	**Set in water deeper than 100m** This may reduce the incidental capture of shallow bycatch species such as sea turtles by targeting fish at deeper depths.			
	Cover the point of the hook This will reduce the ability of sea turtles to bite and become hooked.			
	Avoid using light sources (deep-sets) This may reduce sea turtle interactions by lessening the ability to see baited hooks.			
	Use weighted/leaded swivels (minimum weight of 45g within 1m of the hook) This will keep the baited hook weighted down and may reduce the ability of sea turtles to become incidentally hooked.			

* There is a conflict between sea turtles and sharks with regards to the effect of hook types (see 'Trade-Offs' section below).

** The Agreement on the Conservation of Albatrosses and Petrels (ACAP), a multilateral agreement which seeks to conserve albatrosses and petrels by coordinating international activity to mitigate known threats to their population, recommends a combination of the first three mitigation measures. ACAP also recognizes the use of hook-shielding devices or time/area closures as best practice.

FIGURE 3: SHARK "LINE" SHOWN ATTACHED TO THE FLOAT AND FISHING ABOVE THE MAINLINE (SPC 2014)



TRADE-OFFS

It must be appreciated that conflicts regarding which taxa are most protected can arise through the implementation of some bycatch mitigation methods. For example, in some regions, setting longlines at night to protect albatrosses and other diurnal foraging seabirds has led to higher bycatch of nocturnal foraging seabirds. Prohibiting wire leaders in longline gear to reduce shark catch rates could exacerbate seabird bycatch problems: fishers may be less likely to attach weights close to hooks on branchlines lacking a wire leader due to safety concerns thus reducing the baited hook sink rate and increasing seabird catch rates (Gilman 2011). Similarly, the use of wider circle hooks to reduce sea turtle bycatch, can result in increased captures of some shark species (Gilman et al. 2016).

Conversely, unintended benefits can also occur; use of wider circle hooks in place of narrower J and tuna hooks to reduce turtle bycatch rates and mortality in longline fisheries has also been found to reduce seabird bycatch rates by about 80% (Gilman 2011).

Other trade-offs include mitigation methods that may reduce the bycatch of one species in a taxa but increase other species catch rates in the same taxa (Gilman et al. 2016). For example, the use of small fish instead of bait reduces the catch rate of blue sharks but increases the catch rates of shortfin mako sharks (Gilman et al. 2016).

However, the risk of conflicts should not result in inertia regarding the implementation of bycatch mitigation methods and instead we advocate communication with producers to determine the most appropriate mitigations through collection and interpretation of bycatch data. For example, if the adoption of a mitigation technique results in increased bycatch of another species then review the original mitigation.

EXAMPLES OF BEST PRACTICES FOR **REDUCING BYCATCH IN LONGLINE FISHERIES**

HAWAII LONGLINE SWORDFISH FISHERY

Hawaii has one of the highest observer coverage rates in longline fisheries operating in the western and central Pacific Ocean. For longline fisheries operating in the region and belonging to the Western and Central Pacific Fisheries Commission the required observer coverage rate is 5 percent (WCPFC 2007). The Hawaii deep-set fishery (targeting tuna) has a 20 percent observer coverage rate and the shallow-set fishery (targeting swordfish) has 100 percent observer coverage (WPRFMC 2009). The required use of suites of bycatch mitigation methods has reduced both seabird and sea turtle catch rates by 90 percent in the shallow-set fishery and the seabird catch rate in the deep-set fishery has seen a 65 percent reduction. Concerns over false killer whale captures in the deep-set fishery have resulted in the required use of weak hooks, area closures and required training and certification for vessel captains in safe handling/release techniques. *(http://www.fpir.noaa.gov/PRD/prd_FKW_take_reduction_team.html)*.

US NED ATLANTIC FISHERY EXPERIMENT

The US National Marine Fisheries Service conducted the Northeast Distant Fishery Experiment (NED) between 2001 and 2003. The NED tested a variety of techniques to determine their effectiveness in reducing bycatch of sea turtles in the US pelagic longline fishery. The researchers developed a technique that included the use of 18/0 circle hooks and mackerel bait, which reduced bycatch rates of leatherback and loggerhead sea turtles by 65–90 percent *(http://www.nrcresearchpress.com/doi/pdf/10.1139/f05-004)*. Based on this research, the US adopted new regulations requiring the use of 18/0 circle hooks or larger, the use of only mackerel bait in the NED, and 100 percent observer coverage (NMFS 2014b). In addition, outside of the NED region, longline vessels targeting tunas are only allowed to use 18/0 or larger circle hooks and whole finfish and/or squid bait and observer coverage rates outside the NED region have ranged from 7–17 percent since 2004—much higher than WCPFC required observer coverage rates (NMFS 2014b).

AUSTRALIAN EASTERN TUNA AND BILLFISH FISHERY

The Australian Eastern Tuna and Billfish Fishery (ETBF) has a Bycatch and Discarding Workplan. The workplan is a collaborative effort between the government, industry, and scientists and aims to focus on "high risk" bycatch species. Current plan objectives (covering 2014–2016) are to be addressed by the Australian Fisheries Management Authority (AFMA) and include: 1) develop bycatch mitigation devices for seabirds, 2) reduce interactions with protected seabirds, 3) improve post-release survival of captured sharks, and 4) improve the understanding of shark catch composition. The end goal is a more tactical approach to managing bycatch in this fishery. In addition to this workplan, the Australian ETBF already requires the use of circle hooks to reduce sea turtle capture and de-hooking devices and line cutters to release incidentally captured sea turtles. The plan also requires tori lines, line weighting requirements, and prohibiting the discharge of offal during setting and hauling to reduce incidental sea bird captures. There are limits on the number of sharks that can be captured, and other shark specific management measures including prohibiting the use of wire/trace leaders (AFMA 2014a)(AFMA 2017). The Australian ETBF aims to observe 8.5 percent of the fishery, higher than the 5 percent WCPFC-mandated coverage rate (AFMA 2014b), and has recently moved to using electronic monitoring (AFMA 2017).

FIJI LONGLINE

The Fiji longline fishery, which targets albacore tuna in the South Pacific Ocean, is certified as sustainably fished by the Marine Stewardship Council (MSC). This longline fishery reported an observer coverage rate of 19 percent during 2015 (Fiji 2016). The Fiji longline fishery does not target sharks; prohibits the use of shark gear and wire traces; and requires the use of circle hooks, recording and reporting of captured sharks by species, and fishing in waters deeper than those inhabited by pelagic shark species. In addition, Fiji has a government decree in place to prohibit targeted shark fishing. There are also large marine reserves where fishing is banned. Interactions with endangered, threatened, and protected species are very low in this fishery. Sea turtles are protected in Fijian waters. Vessels are provided with and trained to use de-hooking devices (and other tools), which aid in the release of incidentally captured sea turtles. (Akroyd et al. 2012).

RECOMMENDATIONS **TO THE SUPPLY CHAIN**

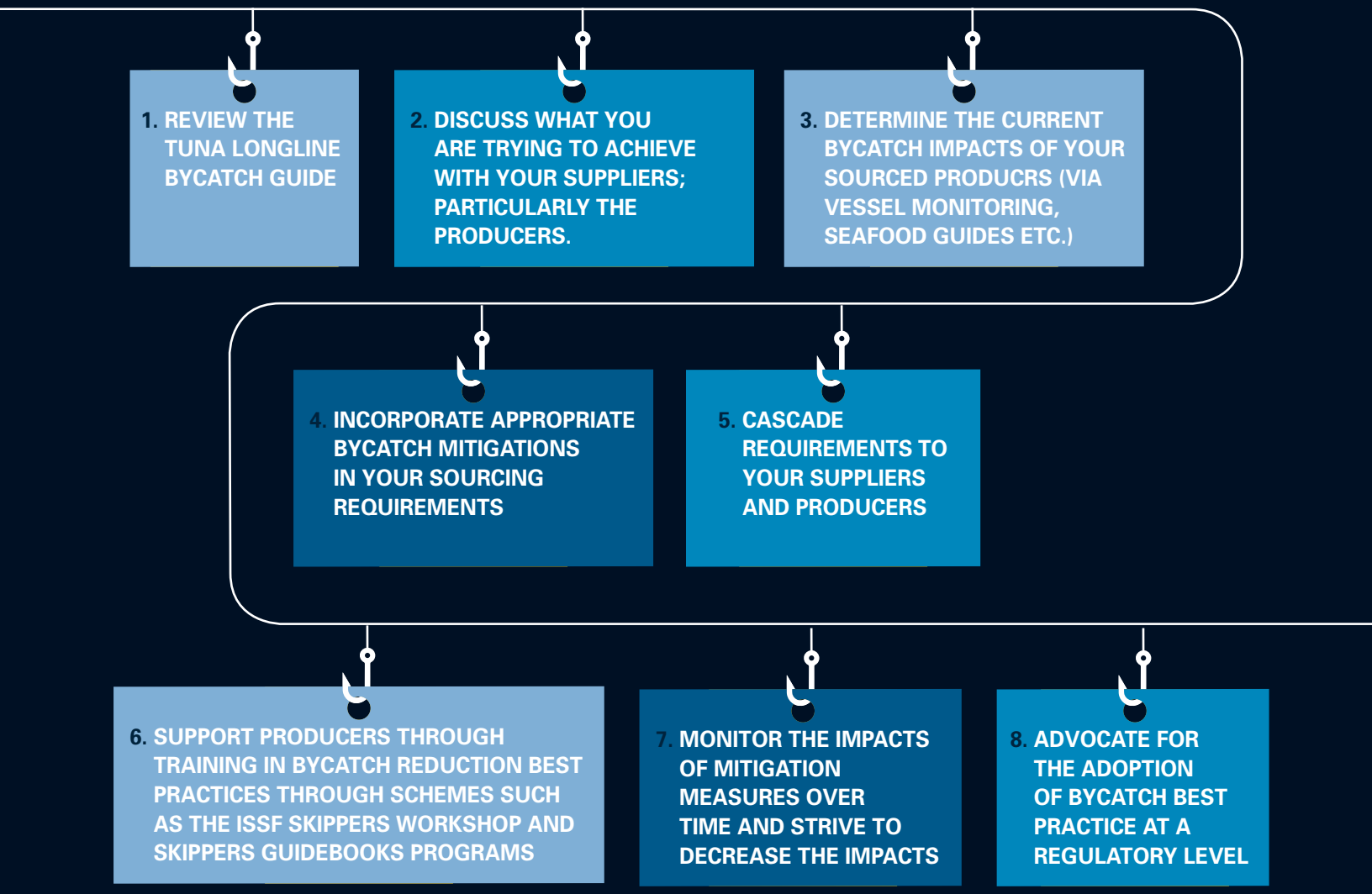
Buyers of tuna are best placed to encourage the adoption by producers of the voluntary improvements described in this document. In Appendix 1, we have provided a bycatch matrix which identifies key bycatch species by fleet (represented in SFP's FishSource tool) to help buyers identify which bycatch taxa are common in the fleets they source from. This should assist buyers identify some bycatch mitigation measures (table 1) that could immediately be implemented. Figure 4 outlines the steps that buyers can take to achieve this. Such measures may go beyond regulatory requirements but can make a significant difference to environmental performance including maintaining species within the natural marine food web, thus increasing the viability of the target fishery and protecting endangered and vulnerable species such as turtles and albatrosses. Furthermore, increased environmental performance can be reflected in increased ratings in sustainable seafood schemes (such as Seafood Watch) of interest to customers.

Bycatch is under the control of the fishing companies and implementing these best practices can be achieved directly onboard vessels. It is recommended that buyers require best practices in reducing bycatch as a minimum requirement of purchasing longline tuna. It is further recommended that buyers ask companies to monitor the impacts of mitigation measures (interaction rates and mortality rates) over time and strive to decrease the impacts. Skippers and crews should be trained in bycatch reduction best practices (including safe handling and release techniques and species identification) through schemes such as the ISSF Skippers Workshop and Skippers Guidebooks programs.

The supply chain can begin implementing improvements in bycatch mitigation through simple measures such as starting a basic Fishery Improvement Project or through the voluntary adoption of bycatch mitigation measures by a fleet.

Buyers should also advocate for the adoption of bycatch best practice at a regulatory level, including at the Regional Fishery Management Organizations (RFMOs). This can be achieved through companies making public declarations in support of the adoption of best practices in bycatch reduction; encouraging fishing companies to commit to publicly disclose data regarding the nature and volume of bycatch (set-by-set) for each vessel; and contacting fishery managers/RFMO delegations directly to request regulatory improvements.

FIGURE 4: OUTLINE OF STEPS THAT SUPPLY CHAIN STAKEHOLDERS CAN TAKE REDUCE LONGLINE BYCATCH.



In conclusion, we have outlined key bycatch mitigation measures that should be implemented within your supply chain. We do note that the success of certain bycatch mitigation measures depends heavily on the fishery they are used in. Fishery improvement projects that look at the impact of bycatch mitigation measures in fisheries over time would be welcome and beneficial to tuna longline fishing as a whole.

NOTE TO US COMPANIES:
During the 17th Meeting of the Conference of the Parties to the Convention on International Trade in Endangered Species, devil rays, thresher sharks and silky sharks were added to Appendix II of CITES (includes species that are not necessarily threatened with extinction but in which trade must be controlled to avoid over utilization that may impede the species survival). These are in addition to the already listed shark species (basking shark, shale shark, great white shark, oceanic whitetip shark, hammerhead sharks (scalloped, great and smooth), porbeagle shark and manta rays). Appendix II of CITES impacts the trade of these species and require special permits to be used by US fishers and dealers engaging in international trade. Detailed information on these requirements can be found here.

APPENDIX 1

Bycatch matrices of key bycatch taxa by tuna species and fleet's represented in SFP's FishSource database. Interactions with bycatch taxa were identified through country reports to the RFMO's, bycatch databases and other published literature. It should be noted that due to low observer coverage rates in tuna longline fisheries, bycatch interactions may not be fully reported and therefore may not be represented in these matrices.

YELLOWFIN TUNA

				BYCATCH IMPACT			
OCEAN	MANAGEMENT UNIT	FLAG COUNTRY	GEAR TYPE	SHARKS	TURTLES	SEA BIRDS	MAMMALS
EASTERN PACIFIC	IATTC	Costa Rica	Drifting longlines	X	X		
		Ecuador	Drifting longlines	X	X		
		Nicaragua	Drifting longlines	X	X		
		Panama	Drifting longlines	X	X		
WESTERN CENTRAL PACIFIC	Parties to the Nauru Agreement (PNA)	United States	Drifting longlines	X	X	X	
	Vietnam	Vietnam	Drifting longlines	X	X		
			Longlines	X	X		
	WCPFC	Australia	Longlines	X	X	X	
		China	Longlines	X	X	X	
		Cook Islands	Drifting longlines	X	X	X	
			Longlines	X	X	X	
		Fiji	Longlines	X	X	X	
		French Polynesia	Longlines	X	X	X	
		Indonesia	Drifting longlines	X	X		
			Longlines	X	X		
		Japan	Longlines	X	X	X	
		Korea, Republic of	Longlines	X	X	X	
		Marshall Islands	Drifting longlines	X	X		
			Longlines	X	X		
		Micronesia, Federated States of	Longlines	X	X	X	
		New Zealand	Drifting longlines	X	X	X	
		Spain	Longlines	X	X	X	
		Taiwan, Province of China	Longlines	X	X	X	
		United States	Longlines	X	X	X	X
ATLANTIC OCEAN	Grenada	Grenada	Drifting longlines	X	X		
	ICCAT	Brazil	Drifting longlines	X	X	X	
		Canada	Drifting longlines	X	X	X	
		Senegal	Longlines	X	X		
		South Africa	Drifting longlines	X	X	X	
		Trinidad and Tobago	Drifting longlines	X	X		
		United States	Longlines	X	X	X	
	Suriname	Suriname	Drifting longlines	X	X		
INDIAN OCEAN	IOTC	India	Longlines	X	X		
		Korea, Republic of	Longlines	X	X	X	
		Spain	Longlines	X	X	X	
		Sri Lanka	Drifting longlines	X	X		
		Thailand	Longlines	X	X		

BIGEYE TUNA

OCEAN	MANAGEMENT UNIT	FLAG COUNTRY	GEAR TYPE	BYCATCH IMPACT			
				SHARKS	TURTLES	SEA BIRDS	MAMMALS
EASTERN PACIFIC	IATTC	Ecuador	Drifting longlines	X	X		
		Spain	Drifting longlines	X	X		
		United States	Drifting longlines	X	X		
WESTERN CENTRAL PACIFIC	Parties to the Nauru Agreement (PNA)	United States	Drifting longlines	X	X	X	
	Vietnam	Vietnam	Drifting longlines	X	X		
			Longlines	X	X		
	WCPFC	Australia	Longlines	X	X	X	
		China	Longlines	X	X	X	
		Cook Islands	Drifting longlines	X	X	X	
			Longlines	X	X	X	
		Fiji	Longlines	X	X	X	
		French Polynesia	Longlines	X	X	X	
		Indonesia	Drifting longlines	X	X		
			Longlines	X	X		
		Japan	Longlines	X	X	X	
		Korea, Republic of	Longlines	X	X	X	
		Marshall Islands	Drifting longlines	X	X		
			Longlines	X	X		
		Micronesia, Federated States of	Longlines	X	X	X	
		New Zealand	Drifting longlines	X	X	X	
		Solomon Islands	Longlines	X	X	X	
		Spain	Longlines	X	X	X	
		Taiwan, Province of China	Longlines	X	X	X	
		United States	Longlines	X	X	X	X
ATLANTIC OCEAN	Grenada	Grenada	Drifting longlines	X	X		
	ICCAT	Canada	Drifting longlines	X	X	X	
		South Africa	Drifting longlines	X	X	X	
		United States	Longlines	X	X	X	
	Suriname	Suriname	Drifting longlines	X	X		
INDIAN OCEAN	IOTC	China	Longlines	X	X	X	
		Indonesia	Longlines	X	X	X	
		Korea, Republic of	Longlines	X	X	X	
		Maldives	Longlines	X	X		
		South Africa	Longlines	X	X	X	
		Spain	Longlines	X	X	X	
		Sri Lanka	Drifting longlines	X	X		

ALBACORE TUNA

OCEAN	MANAGEMENT UNIT	FLAG COUNTRY	GEAR TYPE	BYCATCH IMPACT			
				SHARKS	TURTLES	SEA BIRDS	MAMMALS
EASTERN PACIFIC	IATTC	Taiwan, Province of China	Longlines	X	X	X	
		China	Longlines	X	X	X	
WESTERN PACIFIC	WCPFC	Australia	Longlines	X	X	X	
		China	Longlines	X	X	X	
		Cook Islands	Drifting longlines	X	X	X	
			Longlines	X	X	X	
		Fiji	Longlines	X	X	X	
		Solomon Islands	Longlines	X	X	X	
		Taiwan, Province of China	Longlines	X	X	X	
		Vanuatu	Longlines	X	X	X	
ATLANTIC OCEAN	ICCAT	Canada	Longlines	X	X	X	
		Liberia	Longlines	X	X		
		Panama	Longlines	X	X		
		Suriname	Longlines	X	X		
		Spain	Longlines	X	X	X	
		Saint Vincent and The Grenadines	Longlines	X	X		
		South Africa	Longlines	X	X	X	
		United States	Longlines	X	X	X	
	Taiwan	Taiwan, Province of China	Longlines	X	X	X	
INDIAN OCEAN	IOTC	China	Longlines	X	X	X	
		Indonesia	Longlines	X	X	X	
		Korea, Republic of	Longlines	X	X	X	
		Mauritius	Longlines	X	X		
		South Africa	Drifting longlines	X	X	X	
	Taiwan	Taiwan, Province of China	Longlines	X	X	X	

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