# Endangered, threatened, and protected (ETP) species analysis and recommendations for the Pacific Ocean tuna – longline (Thai Union) FIP based on electronic monitoring (EM) data

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# 1 Glossary

| Acronym | Definition |
|---|---|
| EM | Electronic Monitoring |
| EPO | Eastern Pacific Ocean |
| ETP | Endangered, threatened, and Protected (species) |
| FIP | Fishery Improvement Project |
| IATTC | Inter American Tropical Tuna Commission |
| WCPO | Western and Central Pacific Ocean |
| WCPFC | Western and Central Pacific Fisheries Commission |
| MSC | Marine Stewardship Council |

# 2 Introduction

This report presents the results of an analysis conducted on the Electronic Monitoring (EM) data from Thai Union fishing vessels within the Pacific Ocean longline tuna fishery improvement project (FIP). This analysis aims to provide critical information about the impact of the longline fishery on endangered, threatened, and protected (ETP) species.

The FIP is for Thai Union Pacific Ocean longline tuna fishery, targeting albacore (*Thunnus alalunga*) and catching bigeye (*Thunnus obesus*) and yellowfin (*Thunnus albacares*). The pelagic longline vessels are flagged to China and Vanuatu and operate on the high seas in the Pacific Ocean. The fishery is regionally managed by the Western and Central Pacific Fisheries Commission (WCPFC) in the Western and Central Pacific Ocean (WCPO), and the Inter American Tropical Tuna Commission (IATTC) in the Eastern Pacific Ocean (EPO). The entire FIP scope can be found in Table 1 of this report.

**Table 1: FIP Scope**

| | |
|---|---|
| **Species** | Albacore (*Thunnus alalunga*), bigeye (*Thunnus obesus*), and yellowfin (*Thunnus albacares*) |
| **Stocks** | Pacific Ocean albacore, bigeye, and yellowfin stocks. |
| **Fishing gear** | Longline |
| **Geographical area** | Pacific Ocean (Northwest, Northeast, Western Central, Eastern Central, Southwest, Southeast) |
| **Management** | Western Central Pacific Fisheries Commission (WCPFC), Inter American Tropical Tuna Commission (IATTC). |
| **Number of vessels used in this report** | 4 |
| **Name of vessels used in this report** | Tunago No. 31<br>Tunago No. 51<br>Tunago No. 61<br>and Fortuna No. 12 |
| **% coverage of entire fleet** | 12% |

## 2.1 Data collection

Electronic monitoring systems were installed on four vessels within the Tunago longline fishery and monitored 17 fishing trips between April 2019 and September 2020. Of these 17 trips, 11 trips were extracted and analysed by the Digital Observer Services (DOS), a fisheries consultancy company and EM service provider. In total, Key Traceability received the EM reports from nine of the 11 trips analysed, which accounts for 12% of total fishing trips across the entire Tunago fishing fleet. The 12% coverage was further analysed by Key Traceability and is presented in this report.

A 2019 study researched the optimum percentage coverage of EM that a fleet could use to represent the most-accurate total catch data, and this was 20% (Linden, 2019). To gain a catch estimate across the entire fishing fleet, we extrapolated the data to fulfil 100% of the vessels. It must be said that an extrapolation of this magnitude may not be totally accurate or provide entirely reliable data because of differences in fishing activity across the fleet. Seasonal fishing is prevalent in this fishery and different seasons can lead to interactions with varying numbers of species. As such, there is ambiguity in the scaled-up catch dataset. Considering that the optimal percentage coverage of EM catch data to represent true catch estimates is 20% (Linden, 2019), the data in this report may be underestimating the impact the fishery is having on bycatch ETP species. To increase the percentage coverage of EM data to meet 20%, five more fishing trips need to be analysed across the vessels installed with EM systems.

The EM data represented target catch and bycatch data, portraying more than 16,000 data points between May 2019 and July 2020. The video footage was received and initially processed by Digital Observer Services (DOS), a consulting company composed of scientific observers with specific knowledge on marine biology and species ID. A review of the videos was performed, and the species were identified, the records were supplemented with environmental data, including geographic location, start/end hauling date and time, and set number. The fate and condition of the individuals were recorded by the observer and included reference to whether the animal was caught dead or alive; whether it was retained or discarded; and if it was dead or alive upon discard. To the best of the ability of the observer, the length of the individual was also recorded, which can be helpful in determining the age of the animal and whether it is an adult or juvenile. The data was provided to Key Traceability in the form of separate spreadsheets per vessel, per fishing trip, and data analysis to determine the contribution to total catch was completed.

The EM data was unable to record the weights of the individuals caught by the four vessels. Key Traceability used online sources, including scientific research papers, to determine the average weights of each species that was caught, and then used this data across the entire species catch.

# 3 Overview of bycatch and ETP species in longline tuna fisheries

## 3.1 Bycatch in longline tuna fisheries

Longline fishing, targeting pelagic predators like tunas and tuna-like species, operates in the open ocean and can encounter other marine animals that occupy the same habitat. As a result, these non-target species interactions are recorded as bycatch. Some bycatch species can be landed and sold for profit, whereas others, including ETP species, cannot.

Sharks and rays are being globally exploited by both target and non-target fisheries. Catch rates of sharks from target fisheries, like those for blue sharks (*Prionace glauca*), are much easier to obtain because these are legal fisheries that require catch data. However, for the fisheries that do not target sharks but catch them incidentally, these data are harder to find (Gray & Kennelly, 2018). Only fisheries with employed observer coverage or electronic monitoring systems can provide catch rates of sharks. However, for some smaller fisheries, there is no observer coverage available, and the incidents of shark catch go unreported (Gray & Kennelly, 2018). Therefore, it is difficult to assess the stock status of sharks and the impacts that global fisheries are having on these keystone species (Gray & Kennelly, 2018).

Marine mammals, particularly those that are pelagic and migratory, including different whale and dolphin species, are also highly susceptible to open water longline fishing. Entanglement in lines or becoming hooked and drowning is a serious issue for smaller Cetacea like dolphins and has been seen across global fisheries (Hamer, et al., 2012). The attraction of longline vessels is thought to be due to the line of fish, suspended in the water column after being caught. This fast-food meal attracts dolphins and other toothed whales in what is known as depredation, which can lead to the whale becoming hooked on the line (Fader, et al., 2021).

A similar response occurs in marine turtles and seabirds, where the fish that become hooked on the longline gear is appetising to turtles, who either by investigation or consumption, can also become caught on the hooks (Gilman, et al., 2006). Albatross, gulls, and boobies are particularly attracted to longline fishing activities due to the supply of fish that become hooked on the gear. Albatross, specifically, travel thousands of miles when migrating and food supply on the open ocean can be scarce. Encountering a line of fish is appealing to these hunters and the birds will often swoop down to feast on the catch. However, this can also lead to the birds ingesting the hook as well as the fish that was attached to it (Brothers, et al., 2010); (Anderson, et al., 2011). Once hooked on the line, the bird risks drowning or predation unless a fisher can release the animal beforehand. Unfortunately, the very method of longlining often means that the line is not checked for several hours up to a few days, and oftentimes the discovery of a hooked bird is when it is already dead.

## 3.2 Importance of ETP species

Endangered, threatened and protected (ETP) species are those that are at critical risk of being overfished because of bycatch rates in non-target, industrial fisheries – including tuna longline fisheries (Gray & Kennelly, 2018). The majority of ETP species comprise four main types of animals: elasmobranchs, mammals, reptiles, and birds. Being mostly charismatic, species like turtles, whales, dolphins, and sharks, are prominent in global media when involved in entanglement or other bycatch incidents. Not only do they have a wide media presence, but the ecological impacts of catching these species are far-reaching. Larger marine animals are, generally, slow-growing and have a low reproductive rate, which means that excessive removal of individuals from a population could be devasting on species numbers (Heppel, et al., 1996); (Brothers, et al., 2010); (Mannocci, et al., 2012). Removal of apex predators including sharks has particularly intense cascading effects on other species, including target species like tunas, in their absence (Ferretti, et al., 2008).

### 3.2.1 Elasmobranchs

Sharks are the top of many oceanic food webs and play an important role in the ecological regulation of lower trophic species. Studies have shown that the removal of sharks from an ecosystem because of overfishing, marine pollution, or other anthropogenic impacts can lead to detrimental consequences on the ecosystem (Stevens, et al., 2000; Ferretti, et al., 2008; Bornatowski, et al., 2014). Trophic cascades are prominent when an apex predator, like a shark, is removed from an ecosystem and has been seen all over the world, including the Gulf of Mexico (Shepherd & Myers, 2005), North-western Atlantic (Myers, et al., 2007), and the Caribbean (Bascompte, et al., 2005). Discarding caught sharks to avoid the penalties faced by illegal landing is also a significant issue in global fisheries and, coupled with the demand for shark fins, is prominent across some fisheries (Gray & Kennelly, 2018). Shortfin mako (*Isurus oxyrhinchus*), silky (*Carcharhinus falciformis*), and oceanic whitetip (*Carcharhinus longimanus*) are three of the most caught sharks that are finned on board before their carcasses are discarded back into the ocean (Gray & Kennelly, 2018), all of which are ETP species.

The life histories of sharks also make them vulnerable to overexploitation. Most sharks have long lifespans, late maturation rates, long gestation periods, and varying levels of fecundity. This combination of traits means that there could be a decrease in juvenile recruitment to adulthood because of overfishing smaller and younger sharks. Likewise, a decline in the number of sexually mature, adult sharks could also lead to fewer pups in the future (Molina & Cooke, 2012).

Mobula species (*Mobula* spp.) are also a commonly caught elasmobranch by pelagic longline fisheries, yet despite rays and skates speculated at being at higher risk of becoming bycatch than sharks, there is a paucity of data when it comes to assessing both fisheries and ray stocks (Gray & Kennelly, 2018). However, mobulid rays have life-history traits that are congruent with less resilience to over-fishing. They are slow-growing, late-maturing, produce one offspring at a time, and have a pregnancy interval of between 2-5 years (Rambahiniarison, et al., 2018).

### 3.2.1 Seabirds

Seabirds, particularly albatross and petrels have complex life histories that make these species susceptible to anthropogenic destruction of a population. Slow growing, late maturing, low fecundity, and long-lived species like albatross and petrels means that their reproductive capacity is limited, so the removal of even a small number of individuals can be devastating for a population (Brothers, et al., 2010). Likewise, these animals often mate for life, meaning that the death of one mate would not reproduce again. Due to their late maturation age, removal of juveniles from a population before they have been able to reproduce is also highly detrimental to populations, yet oftentimes the juveniles are caught because they are inexperienced. A study conducted off the coast of South Africa recorded the incidents of fishing-related mortality for seabirds and found that 73% of the seabirds that were killed were juveniles (Peterson, et al., 2010). Peterson, et al. also suggested that one of the reasons for this majority could be due to the inexperience of juveniles, where the adults would leave a productive fishing site each summer when fishing started, whereas the juveniles did not.

### 3.2.2 Reptiles

Turtles are another marine animal that encounters global fisheries because they are often pelagic and migratory. As a result, six out of seven recognised sea turtles have been declared endangered, with leatherback (*Dermochelys coriacea*) and loggerhead (*Caretta caretta*) turtles facing total extinction in the Pacific Ocean. Due to the complex life-history traits of Testudines, these animals are susceptible to overfishing. Turtles are highly fecund, producing hundreds of eggs in each reproductive cycle, however, the recruitment of juveniles to adulthood is low (Heppel, et al., 1996). Likewise, turtles are very long-lived animals and grow slowly, so the removal of juveniles from a population before they have reproduced is harmful to the wider population size.

Industrial fishing using longline gears poses a significant risk to sea turtles because if one becomes hooked, there is a high probability that it will drown before being retrieved, and even it if is released alive, the damage inflicted by the wound or swallowing a hook, could be fatal (Gilman, et al., 2006) (Swimmer, et al., 2017). Typically, turtle bycatch has been seen occurring in shallow set longlines and on lines that use squid as bait, which provides an insight into potential mitigation techniques that could be implemented to reduce the risk of turtle bycatch (Swimmer, et al., 2017).

### 3.2.1 Cetaceans

Due to their slow growth rates and late sexual maturation age, Cetacea populations are vulnerable to fisheries and high mortality could negatively impact their global populations. With a low fecundity and reproduction only once every one-to-three-years, dolphin populations would struggle to recover after bycatch incidents (Mannocci, et al., 2012). Historically used by fishers as an indicator of tuna schools, dolphins, and other smaller toothed whales hunt in similar locations as tuna, meaning that tuna fishing vessels are likely to encounter these mammals. As with sharks, cetaceans will be attracted to an animal hooked on the longline, becoming hooked themselves during depredation and drowning before they can be released (Gilman, et al., 2006). Efforts to mitigate these incidents of marine mammal bycatch are imperative across longline fisheries.

# 4 Overview of Electronic Monitoring (EM) in longline tuna fisheries

Electronic monitoring on longline tuna vessels is an important method used to assess the amount of bycatch that is encountered during a fishing trip. Unlike with human fisheries observers, EM systems are active throughout the duration of the fishing trip, continuously recording and leaves little room for mis or under-reporting catch (van Helmond, et al., 2018). The EM systems onboard fishing vessels conduct video imagery during a fishing trip and are analysed *ex-situ* to determine the number of species and individuals within a species that are caught by the vessel. This data is then used to inform fisheries management.

Throughout the years, onboard observers have been used to record landings of both target and non-target species (including bycatch) and the data collected is imperative in assessing stock health for a range of ETP species, particularly sharks and birds. With technological advancements in EM systems, video cameras and sensor devices can be installed onto vessels to record the entirety of a fishing trip, with minimal maintenance. This also reduces the need for onboard observers, potentially saving labour costs (van Helmond, et al., 2018). On longline vessels, each animal from the line is brought on board the vessel one by one, which makes species' recording easier than hauling fisheries.

The data retrieved from EM systems are beneficial for fisheries scientists in understanding more about the impact of longline fishing on marine species. Likewise, the data can be used by fishery mitigation companies that work towards finding innovative ways to reduce the amount of bycatch caught by this type of fishing gear. Currently, there are no minimum EM requirements set by most RFMOs, which reduces the desire of many fishing fleets to install on their vessels. Where the systems have been installed, it is a consideration of the flag state as to whether it is used or not. Under MSC guidelines, EM is not a requirement of every fishery, and they operate on a case-by-case basis as to whether it is appropriate for that fishery or not. However, the minimum EM coverage across a fleet and across total fishing trips is 20%, which should make it more manageable for fisheries to implement. Likewise, the 5 years' worth of catch data requirement for full certification means that many fisheries are preferring EM over observers due to the breadth of coverage it can provide.

There are limitations to EM systems, however, which can arise due to, inter alia, a dirty lens, poor weather, or poor lighting (Emery, et al., 2019). These external factors make collecting biological data, including species identification, length, weight, age, sex, condition, and fate tricky to ascertain. This is where a supplemented EM system to a fully-fledged observer program is favoured. However, there are advancements in EM technology constantly occurring, which makes factors like length determination much easier to assess.

# 5 Analysis of ETP species interactions based on EM data

## 5.1 Initial analysis – MSC designation

A study was conducted using the EM data from systems on four Tunago fishing vessels operating over 15 months between May 2019 and July 2020. In total, there were 553 longline sets made across the vessels in this timeframe. The EM systems were present on all four of the vessels, but 20% of their recordings were analysed and used in this report, which has been shown to be fully representative of a fleet (Babcock, et al., 2011) (Linden, 2019). To understand the composition of the total catch, the EM data was scaled-up to estimate 100% coverage. As previously mentioned, scaling up the data from only 20% propagates reliability and accuracy issues with the data because it assumes every other fishing trip takes place at the same exact time and location, which is not true. Seasonality is not accounted for in this scaled data but should be considered in the future. In this report, the original EM data is always listed adjacent to the scaled data, to highlight the actual figures that were obtained from the systems.

The two tables below (**Table *1***Table 2 and Table 3) demonstrate the percentage composition of each species to the total ETP catch. Table 2 demonstrates the catch composition by the number of individuals within a species, whereas Table 3 highlights the catch composition by weight of species individuals. Both are useful tools to identify the discrepancies with the other. For instance, the number of boobies and gannets (Sulidae) contributed to 20% of the total ETP species caught (Table 2), but only 0.3% of the total weight of ETP species (Table 3). Due to the low weight of the animals and despite the high number of individuals caught (n=100), using the weight data alone would indicate that boobies and gannets are contributing one of the lowest to the total catch. For species that typically mate for life, including boobies and albatross in particular, weight data alone could be detrimental to their management because it is not indicative of the actual number of individuals affected by the fishery.

Table 2: MSC designation table for each species using their percentage composition to the total EM catch and scaled-catch numbers

| Scientific name | Common name | Designation | Justification | No. of individuals (EM) | No. of individuals (estimated total catch) | % Composition EM catch | % Composition ETP catch |
|---|---|---|---|---|---|---|---|
| Carcharhinidae | Requiem sharks | ETP | CMS Appendix I; CITES Appendix II; IUCN Red List as Vulnerable and Critical; Kiribati shark sanctuary | 128 | 1067 | 0.78 | 26% |
| Sulidae | Boobies and Gannets | ETP | CITES Appendix I; IUCN Red List as Least Concern and Endangered | 100 | 833 | 0.61 | 20% |
| Selachimorpha | Sharks | ETP | CMS Appendix I; CITES Appendix II; IUCN Red List as Vulnerable and Critical | 100 | 833 | 0.61 | 20% |
| *Isurus oxyrhinchus* | Shortfin Mako | ETP | CMS Appendix II; Endangered on IUCN Red List | 57 | 475 | 0.35 | 12% |
| *Carcharhinus falciformes* | Silky shark | ETP | CMM 2013-08; CMS Appendix II; CITES Appendix II; Vulnerable on IUCN Red List | 29 | 242 | 0.18 | 5.9% |
| Diomedeidae | Albatross | ETP | CMS Appendix II | 21 | 175 | 0.13 | 4.3% |
| *Isurus* spp. | Mako | ETP | CMS Appendix II; Endangered on the IUCN Red List | 18 | 150 | 0.11 | 3.7% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Laridae | Gulls | ETP | CITES Appendix I; IUCN Red List as Least Concern to Vulnerable | 13 | 108 | 0.08 | 2.7% |
| *Carcharhinus longimanus* | Oceanic whitetip | ETP | CMM 2011-03; CITES Appendix II; Critical on IUCN Red List | 4 | 33 | 0.02 | 0.82% |
| *Pseudocarcharias kamoharai* | Crocodile shark | Secondary but ETP in Kiribati | Kiribati shark sanctuary | 3 | 25 | 0.02 | 0.61% |
| *Alopias vulpinus* | Thresher shark | ETP | CITES Appendix II; CMS Appendix II; Vulnerable on IUCN Red List | 3 | 25 | 0.02 | 0.61% |
| *Isurus paucus* | Longfin mako shark | ETP | CMS Appendix II; Endangered on the IUCN Red List | 2 | 17 | 0.01 | 0.41% |
| *Testudinata* | Marine turtles | ETP | CMS Appendix I; CITES Appendix I and II; IUCN Red List as Vulnerable and Critical | 2 | 17 | 0.01 | 0.41% |
| *Lepidochelys olivacea* | Olive Ridley turtle | ETP | CMM 2008-03; CMS Appendix I; CITES Appendix I; Vulnerable on IUCN Red List | 2 | 17 | 0.01 | 0.41% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Phoebastria immutabilis* | Laysan albatross | ETP | CMS Appendix II; Near Threatened on IUCN Red List | 2 | 17 | 0.01 | 0.41% |
| *Alopias superciliosus* | Bigeye thresher | ETP | CMS Appendix II; CITES Appendix II; Vulnerable on IUCN Red List | 1 | 8 | 0.01 | 0.204% |
| *Dalatias licha* | Kitefin shark | Secondary but ETP in Kiribati | Kiribati shark sanctuary; Vulnerable on IUCN Red List | 1 | 8 | 0.01 | 0.204% |
| *Mobula* spp. | Mobula | ETP | CMS Appendix II; CITES Appendix II; Vulnerable on IUCN Red List | 1 | 8 | 0.01 | 0.204% |
| *Sphyrna zygaena* | Smooth hammerhead | ETP | CMS Appendix II; CITES Appendix II; Vulnerable on IUCN Red List | 1 | 8 | 0.01 | 0.204% |
| *Sphyrna lewini* | Scalloped hammerhead | ETP | CMS Appendix II; CITES Appendix II; Critical on IUCN Red List | 1 | 8 | 0.01 | 0.204% |

Table 3: MSC designation table for each species using their percentage weight composition to the total EM catch and scaled-catch (kg)

| Species | Common name | Designation | Justification | EM total weight (kg) | Total scaled weight (kg) | % EM composition (by weight) | % ETP composition (by weight) |
|---|---|---|---|---|---|---|---|
| *Selachimorpha* | Sharks | ETP | CMS Appendix I; CITES Appendix II; IUCN Red List as Vulnerable and Critical | 13730 | 114,417 | 2.46% | 30.6% |
| *Carcharhinidae* | Requiem sharks | ETP | CMS Appendix I; CITES Appendix II; IUCN Red List as Vulnerable and Critical; Kiribati shark sanctuary | 13696 | 114,133 | 2.46% | 30.5% |
| *Isurus oxyrhinchus* | Shortfin Mako | ETP | CMS Appendix II; Endangered on IUCN Red List | 7239 | 60,325 | 1.30% | 16.1% |
| *Carcharhinus falciformes* | Silky shark | ETP | CMM 2013-08; CMS Appendix II; CITES Appendix II; Vulnerable on IUCN Red List | 5524.79 | 46,040 | 0.99% | 12.3% |
| *Mobula spp.* | Mobula | ETP | CMS Appendix II; CITES Appendix II; Vulnerable on IUCN Red List | 1315 | 10,958 | 0.24% | 2.9% |
| *Isurus spp.* | Mako | ETP | CMS Appendix II; Endangered on the IUCN Red List | 1260 | 10,500 | 0.23% | 2.8% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Alopias vulpinus* | Thresher shark | ETP | CITES Appendix II; CMS Appendix II; Vulnerable on IUCN Red List | 690 | 5,750 | 0.12% | 1.5% |
| *Carcharhinus longimanus* | Oceanic whitetip | ETP | CMM 2011-03; CITES Appendix II; Critical on IUCN Red List | 360 | 3,000 | 0.06% | 0.8% |
| *Sphyrna zygaena* | Smooth hammerhead | ETP | CMS Appendix II; CITES Appendix II; Vulnerable on IUCN Red List | 340.2 | 2,835 | 0.06% | 0.8% |
| *Alopias superciliosus* | Bigeye thresher | ETP | CMS Appendix II; CITES Appendix II; Vulnerable on IUCN Red List | 160 | 1,333 | 0.03% | 0.4% |
| *Isurus paucus* | Longfin mako shark | ETP | CMS Appendix II; Endangered on the IUCN Red List | 140 | 1,167 | 0.025% | 0.3% |
| *Sulidae* | Boobies and Gannets | ETP | CITES Appendix I; IUCN Red List as Least Concern and Endangered | 135 | 1,125 | 0.02% | 0.3% |
| *Testudinata* | Marine turtles | ETP | CMS Appendix I; CITES Appendix I and II; IUCN Red List as Vulnerable and Critical | 68.46 | 570 | 0.01% | 0.2% |
| *Lepidochelys olivacea* | Olive Ridley turtle | ETP | CMM 2008-03; CMS Appendix I; CITES | 68.46 | 570 | 0.01% | 0.2% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Appendix I; Vulnerable on IUCN Red List | | | | |
| *Diomedeidae* | Albatross | ETP | CMS Appendix II | 57.75 | 481 | 0.01% | 0.1% |
| *Sphyrna lewini* | Scalloped hammerhead | ETP | CMS Appendix II; CITES Appendix II; Critical on IUCN Red List | 54.5 | 454 | 0.01% | 0.1% |
| *Pseudocarcharias kamoharai* | Crocodile shark | Secondary but ETP in Kiribati | Kiribati shark sanctuary | 15 | 125 | 0.003% | 0.03% |
| *Laridae* | Gulls | ETP | CITES Appendix I; IUCN Red List as Least Concern to Vulnerable | 11.7 | 97 | 0.002% | 0.03% |
| *Dalatias licha* | Kitefin shark | Secondary but ETP in Kiribati | Kiribati shark sanctuary; Vulnerable on IUCN Red List | 8 | 67 | 0.001% | 0.02% |
| *Phoebastria immutabilis* | Laysan albatross | ETP | CMS Appendix II; Near Threatened on IUCN Red List | 5.5 | 46 | 0.001% | 0.01% |

Across the entire data set, it was found that ETP species constituted 8% of the total catch (Figure 1). The fate of each of the ETP species was also recorded by the EM systems onboard. The fates were recorded as either retained, or discarded and supplementing this information, was the specific condition of the animal, either dead or alive. There was a total of 24 codes used to describe the fate of the individuals (see

Appendix 1), and for ease of data analysis, these fates were grouped into retained, discarded dead, discarded alive, and unknown. The data analysis determined that 52% of the weight from ETP species was discarded alive, 32% was discarded alive, 13% was retained, and 2% was discarded with an unknown fate (Figure 2**Error! Reference source not found.**).

The analysis determined the majority weight of the ETP species was comprised of elasmobranchs (99%), which comprise of a variety of shark species, and mobulid species. Seabirds and turtles represented only 0.5% and 0.3% of the weight for ETP species, respectively.

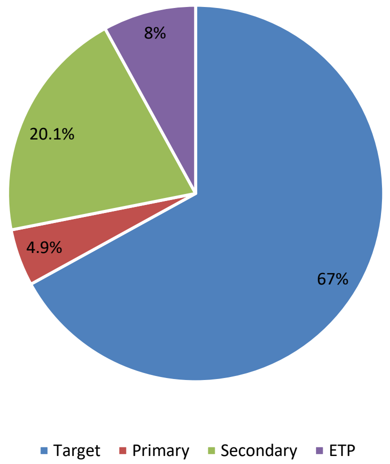


Figure 1: Percentage composition of the target, secondary, and ETP species to the total catch, using the average weights from the EM data

The fate of individuals may also be correlated with their species. As mentioned, species of turtles are often caught dead due to drowning or predation that occurs in the time between being hooked on the line and being brought to the vessel. In the data from this report, turtles only constituted 0.3% of the total weight of ETP species (Figure 2), but of the four individuals that were caught, three were dead upon line retrieval. All dead individuals were discarded back into the ocean and the final turtle escaped the line, alive. There was no indication as to the cause of death of any of the turtles, however, the data supports previous research about turtles often dying on the line, before crew can release them.

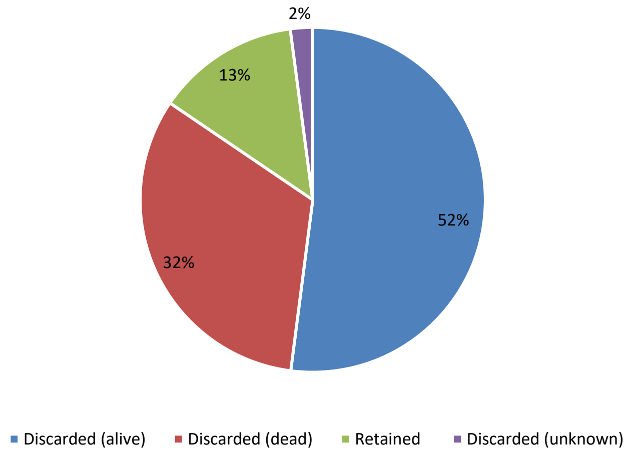


Figure 2: Percentage composition of ETP species by weight (kg) that were discarded (alive), discarded (dead), retained, and discarded (unknown)

There was no reference to poor crew handling on board the vessel as a reason for the number of dead discards mentioned in the fishing report. However, 14,167 kg of animals were alive when they were hauled on board the vessel but dead upon discard, which infers a possibility that these animals may have been mis-handled between capture and discard. Of this weight of discarded animals, 55% of them were ETP species, consisting of eight silky sharks, six mako sharks, one crocodile shark, and 48 unidentified sharks.

## 5.2 Elasmobranchs

Sharks and rays were amongst the highest number of animals caught across the ETP-only dataset. The highest number of elasmobranch bycatch were two types of sharks labelled: requiem sharks (Carcharhinidae), and various sharks (Selachimorpha), each contributing 30% to the total ETP catch weight. The ambiguity in shark bycatch identification to the species level is indicative of either poorly maintained EM equipment, or bad weather conditions restricting the full view of the animal. The DOS report indicated that where some ambiguity lay, the explanation provided stated that it was due to a "Dirty lens." However, not all unspecified or unknown individuals were given this reason as an explanation and could be indicative of a lack of knowledge from the observer. Shortfin mako (*Isurus oxyrhinchus*), silky shark (*Carcharhinus falciformis*), and mobula (*Mobula* spp.) were the following highest contributors of bycatch at 16%, 12.3% and 2.9%, respectively. The remaining elasmobranch species contributed minimally to the total weight of ETP species (Figure 3).

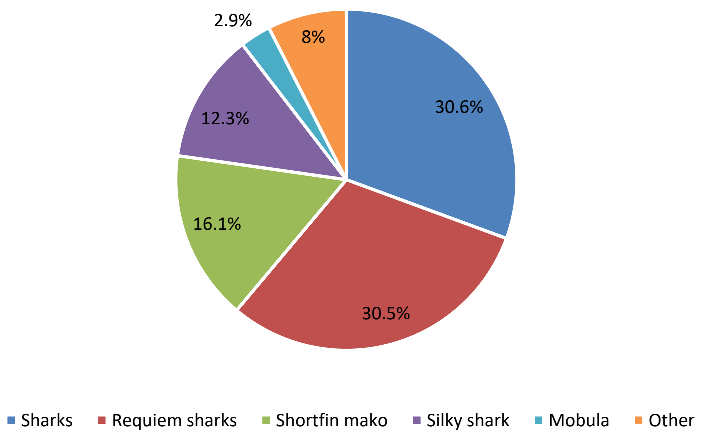


Figure 3: Percentage composition of individuals ETP species' weights to the total ETP species bycatch weight (kg)

The majority of ETP elasmobranchs caught were discarded alive (53%), and 32% of those caught were dead upon discard. Most discards were made because the species caught was listed as “undesirable” if it was dead, and “protected” if the animal was still alive upon discovery. As mentioned, there were many elasmobranchs that were brought onboard the vessel alive but discarded dead.

There were 49 ETP shark individuals retained upon capture, consisting of 45 mako sharks (shortfin and unspecified mako), and four sharks of unspecified identity. There was no explanation provided as to why the individuals were retained, however, they were all headed, gilled, tailed, and gutted or retained whole (see Appendix 1 for fate codes). Of the 49 individuals that were retained, 33 of them were alive when caught meaning there was no attempt, or the attempt was unsuccessful at releasing the animal before they were stored onboard.

There was an incident of shark finning onboard a vessel within the Tunago FIP that was recorded by a crew member. The incident showed a member of the crew removing a singular fin from the shark, and it is assumed that the fin would have been used by the crew, post-landing. The video footage received from the EM vessels did not catch this incident and infers that, while the 20% coverage across the vessels may be efficient enough for providing catch rates, its effectiveness fails monitoring compliance issues, like shark finning.

## 5.3 Seabirds

Seabirds contributed only 0.47% of the total weight of ETP species caught in this dataset yet contributed 133 individuals to the total catch number. A significant factor in the seabird data is that most of the seabirds caught could not be identified to specific species. This is particularly problematic when estimating the impact that bycatch could be having on specific populations of these ETP species. The 100 boobies and gannets recorded, contributed the greatest weight to the total seabird bycatch (64%) (Figure 4). However, specific species were not recorded, and like the elasmobranch ambiguity, this could be a result of poor weather conditions or a dirty camera lens, or it could be due to human error/misidentification.

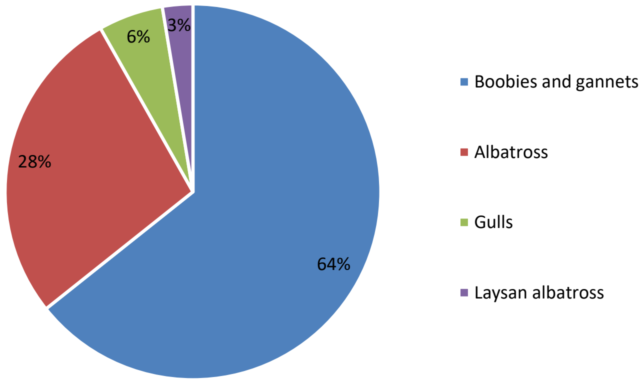


Figure 4: The percentage of seabirds recorded in the EM catch data

All individual birds were reported to be dead upon discard. This is due to the length of time between becoming hooked on the line and discarded, wherein the bird had already drowned upon discovery by the fishers. The main reason for discarding the birds were listed as "undesirable species" since there is no demand for seabird sale on the land.

Only two individual albatrosses were able to be identified after the EM video footage was released to Key Traceability. Both incidents involved the Laysan albatross (*Phoebastria immutabilis*) identified by the distinctive dark eye patch, black posterior and wings, and the fact that these birds were caught in the Northern Pacific Ocean (see Figure 5a). Currently, the Laysan albatross is listed as Near Threatened on the IUCN redlist, last assessed in 2018 and is on the CMS Appendix II. A study conducted in 2020 highlighted that the Laysan albatross has a stable global population with an estimated 1.6 million individuals. Despite this, they are still at risk of anthropogenic interference from longline fisheries (Albores-Barajas, et al., 2020).

One of the techniques used to reduce seabird bycatch, which are employed by the longline vessels in this fleet, is to implement mitigation techniques in certain areas of the Pacific that overlap with albatross and other seabird migration routes. The WCPFC CMM (18-03) states that longline vessels operating North of 23$^{o}$ North in the Pacific Ocean to use at least two mitigation measures from their selection (see

Appendix 1). The vessel that caught the two Laysan albatross is Tunago51 was stated in the vessel report that they were using Tori-lines to mitigate the interaction with seabirds. However, it was not made clear that other mitigation techniques were used during this fishing event. Another technique is to set the longlines during the night, to avoid attracting birds over in the daylight. However, the video footage used to identify the Laysan albatross individuals showed that the line hauling was taking place during the day, inferring that night-setting was not employed by this vessel.

The remaining 21 albatross incidents have been mapped below (Figure 5Figure 5) to show where, in the Pacific Ocean, these events took place. There are four more incidents that took place North of 23° North, from one other vessel. The final incidents of albatross catch took place South of 30° South, in which the WCPFC CMM (18-03) also states that there are specific requirements for longline vessels, including the use either two measures from: Tori lines, weighted branch lines, or night setting, or implementing hook-shielding devices to their lines.

**Commented [AR4]:** Figure 5?

**Commented [AR5]:** Is there footage of the vessels not complying to RFMO bycatch mitigation measures?

**Commented [ew6R5]:** The only footage we have access to is when the animals were brought onto the vessel, so of just the deck. Unfortunately, this means that the tori lines or other mitigation techniques are not visible. However, the videos are captured during the day, which means the lines were most likely set during the day as well. This is a breach of one of the mitigation techniques (to only set the lines at night).

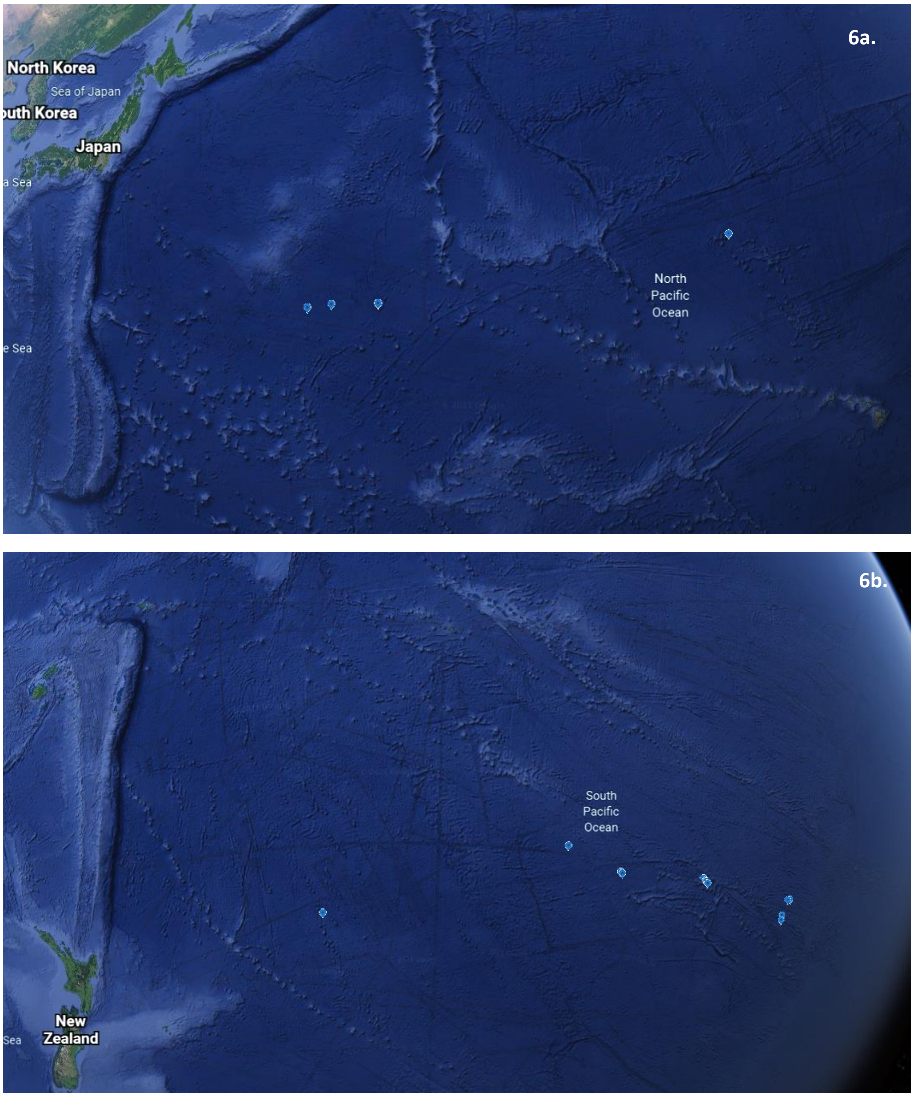


Figure 5: Map depicting the location of the albatross incidents that occurred across the Tunago longline fishery fleet. 6a. North Pacific incidents, which took place on Tunago31, Tunago51, and Fortuna12 vessels between 27/11/2019 – 22/02/2020. 6b. South Pacific incidents took place on Tunago51 and Tunago61 vessels between 26/08/2019 – 27/06/2020. (Google Earth, 2021).

## 5.4 Reptiles

The turtle catch contributed to 0.3% of the total ETP catch, which, despite there being four individuals, was a similar contribution to the total ETP weight as the seabirds. Of the four individuals, two were olive ridley turtles (*Lepidochelys olivacea*) and two were unidentified turtles (Testudinata). Of the four that were caught, three were discarded dead and only one was discarded alive, supporting previous research which highlighted that, marine turtles are rarely discovered in time to be rescued before drowning after being hooked on the line. The three dead turtles were discarded because they are "protected species" and therefore cannot be landed by the vessel.

## 5.5 Cetaceans

There were no records of Cetacea bycatch across any of the four vessels in the EM sample size. Therefore, there was no data analysis conducted on this group. However, the absence of the Cetacea from these bycatch data could be indicative of successful mitigation techniques.

# 6 Fishery management practices

## 6.1 Regional Fisheries Management Organisation (RFMO)

In the Pacific, the Western and Central Pacific Fisheries Commission (WCPFC) is the governing body that implements fishery management policies across the ocean. For each ETP species, different policies aim to conserve and protect the species, including mitigation techniques that should be employed by all fishing vessels.

## 6.2 Fishery-specific management

Within the Tunago FIP, the fishery has an ETP management strategy for elasmobranchs, turtles, seabirds, and cetaceans. Within the strategy, there are mitigation techniques that should be used and implemented across all the vessels within the fleet to reduce the number of bycatch incidents. For seabirds, in particular, several different mechanisms are implemented by the fisheries to reduce these encounters, including tori lines, night setting, and mainline set shooter during setting.

There is also a specific policy regarding shark finning within the Tunago fishery to highlight the importance of shark conservation and protection. This policy is signed by all fishers before a trip to agree that no shark finning will take place onboard the vessel. Any sharks caught and retained will remain whole and will not be finned on board the vessel.

## 6.3 Issues with management practices

Despite the number of policies, both RFMO mandated and FIP specific, that describe and outline the appropriate procedures for ETP mitigation and bycatch, there are some limitations to them and their effectiveness. As seen in the example of seabirds, despite the fishery obligated to comply with WCPFC management requirements about using tori lines, night-setting, and mainline set shooters during line setting, there were still 23 bycatch incidents of albatross and 100 bycatch incidents of boobies and gannets.

**Commented [AR7]:** Is there clear evidence that these methods were being used?
This infers that all methods were being used, but in an above section it says that only tori lines were used.

**Commented [ew8R7]:** Good point. I meant that based on the requirements of the fishery, these mitigation techniques should be in use - but you're right, there was no evidence that the techniques were actually operating. I have changed the sentence structure accordingly.

Similarly, the number of elasmobranchs, specifically sharks that were caught alive but were dead upon discard is concerning because there are clear management measures in place, set by the IATTC and WCPFC about best practice when handling these animals. There was no evidence to show that crew were mis-handling the animals, however, this does not mean it didn't happen. Further skipper training and regular updates on handling best practice, specifically for sharks but also for other ETP species is imperative for all vessels. Under both WCPFC and IATTC management measures, any alive sharks must be attempted to be released when captured. The report showed that of the 49 individual ETP sharks that were retained, 33 of them were alive when brought onboard. The ambiguity of the language used in the IATTC management measures, which state "especially juveniles and pregnant" may be being used as a loophole for this action and should be considered when advocating for change (See Appendix 1 for a full breakdown of the RFMO conservation management measures for sharks, mobulids, turtles and seabirds).

Similarly, despite the shark finning policy that is signed by fishers across the Tunago fleet, an incident of shark finning was featured on the EM video recordings. Further work is required here to ensure that incidents like this do not happen in the future.

**Commented [AR9]:** Is this the same incident that has already been dealt with or is this a new one?

**Commented [ew10R9]:** Same incident - to my knowledge, there was no further evidence of more shark finning activities.

**Commented [TE11R9]:** Correct

# 7 EM review and next steps

## 7.1 MSC requirements

This report is a step in the right direction for understanding bycatch and catch rates for the Tunago longline tuna fishery, a mandatory requirement for the FIP's succession to MSC certification. Listed under Principle 2, impacts of the FIP on ETP species is of great importance and requires that management policies are made to improve the health of the impacted species, and improve the scoring for the Principle. Understanding the interactions with Primary, Secondary, and ETP species are imperative for the Principle 2 scoring, especially for those that there are current management policies and practices in place for.

It would currently fail on Principle 2 based on the shark finning requirements of the MSC and the shark finning event that took place on the vessel. Since the incident, it has been a mandatory requirement of every crew member to sign a new shark finning policy before embarking on a fishing trip. This policy not only reminds the crew of the prohibition to shark fin, but it also holds them accountable if an event occurs.

Likewise, for the ETP management section of the Principle 2 scoring, the retention of ETP sharks with potential intent to sell to the market would fail the scoring. All efforts need to be made to release the individuals either alive or dead.

## 7.2 Next steps

To conclude, the EM systems implemented across Tunago fishing vessels in the Pacific Ocean longline FIP (Thai Union) are effective at highlighting the interactions that the FIP has with ETP species. Using this data, we have been able to assess the effectiveness of bycatch mitigation technologies in place on the vessels.

Advocacy for tighter management measures from the RFMOs, regarding ETP species is a clear step in the improvement of the results found in this report. The IATTC has already prohibited the retention of silky sharks on board vessels operating under their jurisdiction (Resolution C-19-05), which has been upheld by vessels in this report. However, the number of mako sharks that were retained by the four Tunago vessels in this report is alarming. Shortfin mako are currently listed as endangered by the IUCN Red List, last assessed in 2018 so are vulnerable to being overfished because of bycatch.

There are also some improvements to the EM systems themselves that would vastly increase the data output, and these will be the focus of the next steps in the workplan:

1. Increase the number of trips that are analysed from nine, to 14.

The data presented in this report represents only 12% of the total number of fishing trips from the entire Tunago fleet. In order to increase this percentage representation to meet the optimal 20% minimum (Linden, 2019), five more fishing trips need to be analysed by DOS. To obtain sufficient catch data to enter MSC Certification, it is recommended that this change is made.

2. The ability for the weights of the animals to be measured and recorded.

The ability to record weights will vastly improve the reliability and accuracy of the data presented in this report. For this report, average weights of each species had to be found using online sources, however, this is not representative of different age or size of individuals. Likewise, weight is an important indicator of maturity in different marine species and is particularly crucial when retaining commercial and managed species. If an individual has not yet reached sexual maturity, this means that it has not been able to reproduce and replenish the species before its removal, potentially leading to a decrease in population size.

3. Ensuring that there is an allocated crew member responsible for the maintenance of the equipment, cleaning the lens regularly, and ensuring that the image on the video is clear. This will enhance species identification.

As seen in this report, there were 305 individuals that could not be identified, even to a group of species, and were thus listed as "unknown". The analysers that worked through the EM video footage are trained observers and therefore, it can be assumed that the reason for these "unknown" individuals is potentially due to a bad picture. If this is due to the camera lens being dirty, then this is something that the crew need to be aware of and ensure is cleaned and maintained.

4. Training on species identification, particularly with seabirds, is imperative for the future of the project.

Like the previous step, further species identification training, especially for ETP species, should be implemented across the EM video analysers. For species like albatross, of which there are several different species with varying degrees of vulnerability, it is critical to know how fisheries are impacting their populations. In this report, Key Traceability obtained the video files for some of the albatross incidents to conduct independent identification on the individuals and were able to identify the Laysan albatross in two incidents. Further training of the video analysers would reduce the need for this to occur and enhance the efficiency of the data analysis process.

5. Improvements to be made in the ETP species mitigation technologies and techniques onboard vessels to reduce the number of potential negative interactions.

More bird mitigation techniques to be used onboard the vessels to supplement the techniques already in place. Currently, in the southern and northern Pacific oceans, longline vessels must use two of the following seabird bycatch mitigation measures:

- Bird-scaring lines (also known as bird curtains, streamer, or tori lines)
- Weighted branch lines
- Night setting

And vessels must also use two seabird bycatch mitigation measures from a wider selection that includes:

- Side-setting with bird curtains
- Blue-dyed bait
- Offal management
- Underwater setting chute and line shooter

Enforcing the use of more, or all these techniques is a way to ensure that bird mitigation is robust and efficient.

6. Prohibit the retention of ETP species onboard the vessel, even if they are dead upon capture.

Making every effort to return the ETP animal, particularly sharks, to the ocean rather than retaining them onboard the vessel. These ETP species should not be landed or sent to the market to make a profit. If catches keep happening, then more effort is required to implement ruthless mitigation techniques to prevent future incidents.

7. Access to logbook data

Encouraging the disclosure of skipper logbooks to supplement EM catch data is important to ensure that the data is being correlated across reporting mediums. This is a method to ensure the validity and reliability of the data.

KEY TRACEABILITY

# 8 ETP workplan

| | |
|---|---|
| **Action Number and Name** | 1) Electronic monitoring improvements |
| **Action Goal** | Develop a more efficient electronic monitoring system to be used onboard fishing vessels |
| **Action Description** | Currently, there are some general issues with the EM systems that could be improved on to increase their reliability and efficiency, including:<br>a) Increase the number of trips that are analysed;<br>b) The ability to measure animal weights;<br>c) Enlisting a crew member to maintain the system by regularly cleaning the lens;<br>d) The ability to take stills of the video when an ETP species is recorded;<br>e) Improve species ID across the EM system review. |
| **Expected Completion Date** | March 2022 |
| **Priority** | Medium |
| **Estimated Cost** | $20,000USD |
| **Responsible Parties** | Satlink, FIP Participant, FIP Coordinator |
| **MSC PI Addressed by the Action** | 2.3.3, 2.3.2, 2.3.1 |
| **Replacing Action** | Action 2.1 – ETP Species Outcome, Management, and Information |

| **Tasks/ Milestones** | **Responsible (lead)** | **Responsible (supporting role)** | **Starting date** | **Proposed completion date** | **Evidence of completion / results** |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 1a. Increase the number of trips that are analysed from nine to 14, in order to provide sufficient data that represents at least 20% of the entire fishing fleet and trips. | DOS | FIP Coordinator,<br><br>FIP Participant | January 2022 | June 2022 | |
| 1b. Improve the ability of the EM systems to record specific animal weights and to take photo stills from the video to improve ETP species identification. | Satlink | FIP Coordinator.<br><br>FIP Participant | January 2022 | June 2022 | |
| 1c. Provide training for EM system reviews to be able to conduct comprehensive ETP species ID. | Satlink | FIP Coordinator, FIP Participant | January 2022 | June 2022 | |
| 1d. Encourage one crew member to be responsible for the maintenance of the EM systems on board to prevent the lens from becoming too dirty to successfully record the catch. | FIP Participant | FIP Coordinator | January 2022 | June 2022 | |

| | |
|---|---|
| **Action Number and Name** | 2) ETP mitigation technologies |
| **Action Goal** | Improve current mitigation technologies to further reduce ETP bycatch incidents, specifically regarding seabirds. |
| **Action Description** | Determine the improvements that should be made to the mitigation technologies and implement these changes or new additions to the vessels. Conduct analysis on similar catch data to assess the success of the new mitigation technologies. |
| **Expected Completion Date** | May 2022 |
| **Priority** | Medium |
| **Estimated Cost** | $30,000USD |

| | |
|---|---|
| **Responsible Parties** | FIP Participant, FIP Coordinator |
| **MSC PI Addressed by the Action** | 2.3.3, 2.3.2, 2.3.1 |
| **Adjoining Action** | Action 2.1 – ETP Species Outcome, Management, and Information |

| **Tasks/ Milestones** | **Responsible (lead)** | **Responsible (supporting role)** | **Starting date** | **Proposed completion date** | **Evidence of completion / results** |
|---|---|---|---|---|---|
| 2a. Identify the main ETP species mitigation technologies that need to be improved | FIP Coordinator | FIP Participant | January 2022 | June 2022 | |
| 2b. Supply improvement mitigation technologies to the FIP and fishing vessels | FIP Participant | FIP Coordinator | January 2022 | June 2022 | |
| 2c. Monitor the progress of the FIP and mitigation technologies and collect data from the EM systems on board. | FIP Coordinator | FIP Participant | January 2022 | June 2022 | |
| 2d. Assess the effectiveness of the new bycatch mitigation technologies by following up with another report on ETP species bycatch rates. | FIP Coordinator | FIP Participant | January 2023 | June 2023 | |

| | |
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| **Action Number and Name** | 3) Reporting improvements |
| **Action Goal** | Improve the current reporting techniques used by the observers from DOS and Skippers to make sure they correlate and are accurately reporting species. |
| **Action Description** | Training to be provided to both Skippers and observers to ensure that specific species are being accurately reported, to show the true number of species that are being impacted by the fishery. |
| **Expected Completion Date** | May 2022 |

| | |
|---|---|
| **Priority** | Medium |
| **Estimated Cost** | $30,000USD |
| **Responsible Parties** | FIP Participant, FIP Coordinator |
| **MSC PI Addressed by the Action** | 2.3.3, 2.3.2, 2.3.1 |
| **Adjoining Action** | Action 2.1 – ETP Species Outcome, Management, and Information |

| **Tasks/ Milestones** | **Responsible (lead)** | **Responsible (supporting role)** | **Starting date** | **Proposed completion date** | **Evidence of completion / results** |
|---|---|---|---|---|---|
| 2a. Provide training to Skippers and observers on important ETP species and non-commercial species. | FIP Coordinator | FIP Participant | January 2022 | June 2022 | |
| 2b. Use future EM reports and Skipper logbooks to analyse the catch data and identify if the training has reduced the number of unspecified species, and unknown species. | FIP Participant | FIP Coordinator | January 2022 | June 2022 | |
| 2c. Write a subsequent report on the changes made in the reporting of species to identify if this training has been successful. | FIP Coordinator | FIP Participant | January 2023 | June 2023 | |

| | |
|---|---|
| **Action Number and Name** | 4) Improve awareness of ETP species |
| **Action Goal** | Reduce the amount of ETP species that are retained by the vessel. |
| **Action Description** | Posters and training to be provided to the crew and Skippers to reduce the amount of ETP species, specifically sharks, which are retained by the vessels. |

| | |
|---|---|
| **Expected Completion Date** | May 2022 |
| **Priority** | Medium |
| **Estimated Cost** | $30,000USD |
| **Responsible Parties** | FIP Participant, FIP Coordinator |
| **MSC PI Addressed by the Action** | 2.3.3, 2.3.2, 2.3.1 |
| **Adjoining Action** | Action 2.1 – ETP Species Outcome, Management, and Information |

| **Tasks/ Milestones** | **Responsible (lead)** | **Responsible (supporting role)** | **Starting date** | **Proposed completion date** | **Evidence of completion / results** |
|---|---|---|---|---|---|
| 2a. Create ETP species posters to be used on board the vessel to highlight the species that should not be added to the retained catch. | FIP Coordinator | FIP Participant | January 2022 | June 2022 | |
| 2b. Organise training for crew and Skippers to educate about the specific species that should not be added to the retained catch and inform them as to why this is an issue. | FIP Participant | FIP Coordinator | January 2022 | June 2022 | |
| 2c. Create a policy for the crew to sign before each trip to ensure that ETP species will not become part of the retained catch. | FIP Coordinator | FIP Participant | January 2022 | June 2022 | |
| 2d. Conduct a subsequent review of the EM catch data and logbook data to ensure that these ETP species are not still being retained as part of the catch. | FIP Coordinator | FIP Participant | January 2023 | June 2023 | |

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|---|---|
| **Action Number and Name** | 5) Improve ETP species conservation measures |

| | |
|---|---|
| **Action Goal** | Tighten the conservation measures for ETP species handling and bycatch |
| **Action Description** | Advocate RFMOs for tighter conservation measures |
| **Expected Completion Date** | May 2022 |
| **Priority** | Medium |
| **Estimated Cost** | $30,000USD |
| **Responsible Parties** | FIP Participant, FIP Coordinator |
| **MSC PI Addressed by the Action** | 2.3.3, 2.3.2, 2.3.1 |
| **Adjoining Action** | Action 2.1 – ETP Species Outcome, Management, and Information |

| **Tasks/ Milestones** | **Responsible (lead)** | **Responsible (supporting role)** | **Starting date** | **Proposed completion date** | **Evidence of completion / results** |
|---|---|---|---|---|---|
| 2a. Lobby RFMOs for tighter restrictions on ETP species bycatch, including prohibiting the retention of endangered shark species. | FIP Coordinator | FIP Participant | January 2022 | June 2022 | |
| 2b. Lobby RFMOs for a change of language in the conservation measures that permit shark retention. | FIP Participant | FIP Coordinator | January 2022 | June 2022 | |
| 2c. Implement the changes made to RFMO conservation management measures to the vessels. | FIP Coordinator | FIP Participant | January 2022 | June 2022 | |
| 2d. Review and report on the catch data from the Tunago vessels based on the amendments to the conservation management measures. | FIP Coordinator | FIP Participant | January 2023 | June 2026 | |

# Appendix 1

Table 4: Fate codes and descriptions used across the EM catch data

| Acronym | Description |
|---|---|
| DCF | Discarded - cut free |
| DFR | Discarded - fins removed and trunk discarded |
| DPA | Discarded - protected species - alive |
| DSO | Discarded - struck off |
| DTS | Discarded - too small |
| DUS | Discarded - undesirable species |
| DOR | Discarded - other reason |
| DPU | Discarded - protected species - condition unknown |
| DPQ | Discarded - poor quality |
| DPD | Discarded - protected species - dead |
| DSD | Discarded - shark damage |
| DWD | Discarded - whale damage |
| RFL | Retained - filleted |
| RFR | Retained - fins and trunk |
| RGO | Retained - gutted only |
| RGT | Retained - gilled, gutted, and tailed |
| RHG | Retained - headed, gilled, and gutted |
| RHT | Retained - headed, gutted, and tailed |
| RPT | Retained - partial |
| RSD | Retained - shark damage |
| RTL | Retained - tailed |
| RWD | Retained - whale damage |
| RWW | Retained - whole |
| ESC | Escaped |

*North of 23° North*

6. CCMs shall require their large-scale longline vessels of 24 meters or more in overall length fishing north of 23°N, to use at least two of the mitigation measures in Table 1, including at least one from Column A. CCMs also shall require their small-scale longline vessels less than 24 meters in overall length fishing north of 23°N, to use at least one of the mitigation measures from Column A in Table 1. See Annex 1 for specifications of these measures.

**Table 1: Mitigation measures**

| *Column A* | *Column B* |
|---|---|
| *Side setting with a bird curtain and weighted branch lines*[1] | *Tori line*[2] |
| *Night setting with minimum deck lighting* | *Blue-dyed bait* |
| *Tori line* | *Deep setting line shooter* |
| *Weighted branch lines* | *Management of offal discharge* |
| *Hook-shielding devices*[3] | |

Figure 6: WCPFC CMM (18-03) seabird mitigation techniques to be employed by longline vessels in the Pacific

Table 5: RFMO conservation management measures for the WCPFC and IATTC for the different type of species in this ETP report: Elasmobranchs (sharks and mobulids), turtles, and seabirds.

| | | WCPFC | IATTC | Description | WCPFC specific | IATTC specific |
|---|---|---|---|---|---|---|
| **Elasmobranch** | Shark | CMM 2019-04 | Res. C-16-05 | 1. All sharks retained on the vessel must be fully utilised. I.e., everything but the head, tail, guts, and skins.<br><br>2. Shark finning is prohibited onboard the vessel.<br><br>3. Any shark fins that are removed cannot be retained by the vessel, transhipped, or sold after landing. The vessel must also not accept the sale of shark fins.<br><br>4. Alive sharks should be discarded in a safe manner, which does not harm the crew or animal. Especially pregnant and juvenile sharks.<br><br>5. All shark catches are to be reported. | n/a | IATTC: Silky sharks are not to be retained by the vessel but discarded alive, where possible. |
| | Mobulid | CMM 2019-05 | Res. C-15-04 | 1. Mobulids are prohibited from being retained and stored onboard the vessel. There is to be no transshipment, landing, selling, or purchasing of mobulids from the vessel.<br><br>2. All caught mobulids should be released alive, where possible, following best practice handling techniques.<br><br>3. Incidents of accidental storage of mobulids must be declared to governing authority and the individual be surrendered without receiving monetary profit.<br><br>4. All mobulid incidents will be reported in the Skipper logbooks and declared. | n/a | n/a |

| | | | | | |
|---|---|---|---|---|---|
| Turtle | CMM 2018-04 | Res. C-19-04 | 1. All caught turtles must be released, alive where possible, following best practice handling techniques to reduce harm to crew and the animal.<br><br>2. Investigate the effect that temporary fishery closures will have on turtle bycatch rates in areas that are known nesting sites or feeding areas.<br><br>3. For longline vessels:<br>Require shallow set longlines and employ at least one of the below:<br>i. Only use large circle hooks;<br>ii. Only use finfish as bait; Or<br>iii. Another mitigation measure approved by the commission.<br><br>5. Report on all turtle incidents on each vessel within the fleet. | n/a | n/a |

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| Seabird | CMM 2018-03 | Res. C-11-02 | 1. Further research is required to learn more about mitigation techniques, and to develop more ways to prevent seabird interactions with the longline fishing vessels in the future.<br><br>2. Any seabird captured alive, must be discarded in a safe way without inflicting harm on the animal, following the best practice handling techniques from the respective RFMOs. | 1. Longline vessels fishing south of 30o south require two of the three measures below:<br>i. Weighted branch lines;<br>ii. Night setting;<br>iii. Tori Lines; or<br>Hook-shielding devices.<br><br>Longline vessels that fish South of -30o South are required to use one of the three below:<br>i. Weighted branch lines;<br>ii. Tori lines<br>iii. hook-shielding devices.<br><br>2. North of 23o North, longline vessels require at least two mitigation techniques from (at least one from A.)<br>A.<br>Side-setting with bird curtains and weighted branch lines;<br>Night setting with minimum deck lighting;<br>Tori lines;<br>Weighted branch lines;<br>Hook-shielding devices.<br>B.<br>Tori line;<br>Blue-dyed bait;<br>Deep setting line shooter;<br>Management of offal discharge. | Longline vessels that fish between north of 23o and south of 30o must use two mitigation measures from: (one from A., and one from B.)<br>A.<br>Side-setting with bird curtains and weighted branch lines;<br>Night setting with minimum deck lighting;<br>Tori lines;<br>Weighted branch lines.<br>B.<br>Tori lines;<br>Weighted branch lines;<br>Blue-dyed bait;<br>Deep-setting line shooter;<br>Underwater setting chute;<br>Management of offal discharge. |