PROGRESS ON THE CODE OF GOOD PRACTICES ON THE TROPICAL TUNA PURSE SEINE FISHERY IN THE INDIAN OCEAN

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SUMMARY

The two Spanish tuna purse seiner associations, ANABAC and OPAGAC, established a voluntary agreement for the application of good practices to minimize the ecosystem impacts of purse seine fishing, by reducing mortality of incidental catch of sensitive species and the use of non-entangling FADs. This paper presents results on the use of FADs and sensitive fauna release for the period 2015 and 2017 in the Indian Ocean. More than 500 trips were monitored in 25 purse seiners and 17 support vessels by human observers onboard or by electronic monitoring system. Results show that the percentage of entangling FADs has been reduced significantly since 2015, being in 2017 the 78% of the FADs left at sea non-entangling FADs (i.e. totally constructed with not meshed material or ≤7 cm mesh size if open net is present). Overall, 56,504 vulnerable specimens were registered using the specific data collection protocol on Good Practices in 2015-2017 period on 10,019 sets, and a predominance of sharks was observed (98% of the interactions). Sharks (other than whale sharks), mantas, rays and turtles are mainly released by hand from the deck. For mantas specific releasing tools are also used. Bycatch release time has been reduced since 2015, which is an indicator of the increased commitment of the crew and could contribute to higher post-release survival rates.

KEYWORDS: Purse Seiner, mitigation measures, bycatch, Indian Ocean

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1 Introduction

The use of man-made drifting fish aggregating devices (FADs) in tropical tuna (i.e. skipjack tuna, *Katsuwonus pelamis*; yellowfin tuna, *Thunnus albacares*, and bigeye tuna, *Thunnus obesus*) purse seine (PS) fisheries has been significantly increasing since their introduction in the early 90s, improving fishing efficiency, reducing searching time and increasing successful catch rates (Dagorn et al., 2012a; Fonteneau et al., 2013) and becoming the principal fishing mode for the purse seine fleet in all oceans. Nowadays, over half of the tropical tuna caught worldwide is fished by PS on FADs (Fonteneau et al., 2013; Scott and Lopez 2014, ISSF, 2019). For example, during last years tuna catches associated to FADs by the Spanish tropical purse seine fleet have accounted for around 80% of the yearly catches in the Indian Ocean for Spanish tropical tuna purse seine fishery (Báez et al., 2018).

The increasing use of FADs in the past decades [i.e., about 100,000 FADs are estimated to be deployed annually worldwide (Scott and Lopez 2014)], and their impact on the marine ecosystem, have received much attention (Dagorn et al. 2012a). The main concerns over FAD fishing are common for all tuna regional fisheries management organizations (Regional Fisheries Management Organizations, RFMOs, International Commission for the Conservation of Atlantic Tuna, ICCAT, in the Atlantic Ocean, Indian Ocean Tuna Commission, IOTC, in the Indian Ocean, Inter American Tropical Tuna Commission, IATTC, in the Eastern Pacific Ocean, and the Western Central Pacific Fishery Commission, WCPFC, in the Western Pacific Ocean): (1) reduction in yield per recruit of some target species (i.e. yellowfin and bigeye tuna); (2) increased by-catch and perturbation of pelagic ecosystem balance, including ghost fishing of sensitive species (e.g. sharks, turtles); (3) source of marine debris and impacts on coastal habitats as a result of beaching events; and (4) alteration of the tuna behavior (Bromhead et al. 2003; Hallier and Gaertner, 2008; Dagorn et al. 2012a; Filmalter et al., 2013).

Among others, fishing mortality of non-target species is commonly used to measure the environmental impacts of a fishery, which is a direct driver of change and loss of global marine biodiversity (Pauly et al., 2005; Worm et al., 2006). Recent studies have shown that tropical tuna purse seine fisheries have an overall bycatch rate for non-target fish species (including minor tuna as bycatch) of 1.40% relative to target tuna caught. These estimates decreased to 0.92% of non-tuna species when minor tunas are excluded from bycatch (Justel-Rubio and Restrepo, 2017). These minor tunas can comprise 80% of the bycatch in FAD fishing (Hall and Roman, 2013). Stocks of these fish bycatch species are considered in a healthy state and are commercialized in the local markets, especially in Côte d'Ivoire (Amandè et al.,2010; Chavance et al., 2015; Amandè et al., 2016). These estimates are variable depending on the region and fishing mode, with higher bycatch rates and more diversity observed in FAD fishing, i.e. about 2–9% of total catch by weight, than in free-schools sets, i.e. <2% of total catch by weight (Hall and Roman, 2013; Amandè et al., 2012; Torres-Irineo et al., 2014; Ruiz Gondra et al., 2017a; Justel-Rubio and Restrepo, 2017; Lezama-Ochoa et al., 2017; Lezama-Ochoa et al., 2018; Ruiz Gondra et al., 2018). Among sensitive species, sharks are the predominant group in purse seiners (i.e. on average less than 0.5 of the total catch and in the specific case of the Indian Ocean during recent years it is less than 5 tons of shark by 1,000 tons of target species). The shark bycatch is mainly composed by *C. falciformis* which in the Indian Ocean is mainly occurring in FAD sets (Restrepo et al., 2018; Ruiz et al., 2018). The contribution of the purse seiner fishery to the total shark catch is less than 4% in the Indian Ocean (Murua et al., 2013; Restrepo et al., 2017; Garcia and Herrera., 2018), while the principal fishery responsible of shark catches is the longline, gillnet and driftnet fishery (Murua et al., 2013; Garcia and Herrera, 2018).

On the other hand, man-made FADs traditionally consisted of floating bamboo rafts with PS net panels hanging underneath, but designs have been evolving to favor desirable characteristics that increase fish aggregation potential (Murua et al., 2018). FADs themselves, due to materials used in their construction, are a concern due to the increase in use of synthetic materials like plastic netting and flotation (Moreno et al 2017; Murua et al., 2018; Moreno et al 2018a, 2018b). These long-lasting synthetic materials may eventually end up sinking or reaching coastal ecosystems such as beaches, coral reefs or mangroves (i.e. beaching); damaging coastal habitats and contributing to marine debris. Studies in the Indian Ocean provide variable estimates of beaching rates, i.e. from 1% to 45% (Maufroy et al. 2015, 2017; Davies et al. 2017; Zudaire et al., 2018). Also, if entangling materials, such as large mesh size netting, are used in FAD construction, they can contribute to ghost fishing of associated fauna (e.g. sharks) (Filmalter et al., 2013). Results on turtles show that entangling rate is low for this group of animals (Bourjea et al., 2014).

In this context, mortality reduction and conservation of by-catch species has become a priority for RFMOs and for the fishing industry that are working for sustainability standards (e.g. Marine Stewardship Council). Considering all these potential impacts, since 2013 most RFMOs have gradually adopted the use of non-entangling FADs as bycatch mitigation measures and have promoted the use of biodegradable materials to reduce the incidence of entanglement of non-target species and littering on marine and coastal ecosystem. In addition, measures to safely release the sensitive fauna as turtles, sharks, whale sharks, and mantas are included, and the obligation of recording all the interactions with these species' groups to fill the data gaps and improve the managements of bycatch. These binding conservation measures are coming in force gradually in IOTC (**Table 1**) and in other RFMOs.

In this line, the Spanish tuna purse seiner associations ANABAC and OPAGAC, operating in all oceanic regions pioneered in 2012 a voluntary agreement for the application of a code of good practices (CGP) for responsible tuna fishing activities. Some of the mitigation measures were adopted voluntarily before the tuna RFMOs did and they were instrumental for the adoption of similar standards at the RFMO level. The CGP was developed with the aim of reducing bycatch mortality and potential environmental impacts of FADs. The program is subject to continuous revisions and adjustments, to respond to newly identified needs. This initiative has been also the precursor for other sustainability initiatives and standards such as the UNE 195006:2016 for Tuna from Responsible Fishing which includes the Best Practices as a must, or the conservation measure on transactions with vessels that use only non-entangling FADs by International Seafood Sustainability Foundation (ISSF)[5].

The aim of this work is to present the progress made on the implementation of the good practices in the Indian Ocean in terms of FAD use and methods to release fauna during the period 2015 to 2017.

2. Material and methods

2.1 Observer data

IOTC (Resolution 11/04) establishes a 5 % coverage as the minimum standard for scientific observer programs. In addition, 10% coverage is required by the European Union (EU) that is ensured via EU-funded data collection programs (Commission Regulation (EC) Nº 665/2008). Going beyond these requirements the CGP stablishes a 100% observer coverage for PS from 2015 and for supply vessels from 2017 onwards. This monitoring can be either done by human observers or by electronic monitoring systems (EMS). If this last case is chosen by a vessel, EMS should follow the minimum standards described by Ruiz Gondra et al. (2017b) which were endorsed by IOTC. In the same line, ISSF through its conservation measure 4.3[6] sets the 100% observer coverage for large-scale purse seine vessels (human or electronic if proven to be effective). In order to reach the 100% coverage, it is mostly managed by private contracts between industry and human observer or EM service providers. In the Indian Ocean, most human observers are managed by Seychelles Fishing Authority (SFA), but some specific trips are observed by coastal countries by Centre de Surveillance de Pêche de Madagascar (CSP) and Terres Australes et Antarctiques Françaises (TAAF) as well as by the Spanish Institute of Oceanography (IEO – Instituto Español de Oceanografía) under the EU Data Collection Framework (DCF) (Commission Regulation (EC) Nº 665/2008). Since 2016, a significant number of trips is being covered through EMS by DOS (Digital Observer Service) and AZTI. Data in the Indian Ocean have been collected in the specific observer forms designed for the evaluation of the CGP (Annex 1).

Observers collect specific information on FAD structures and components including the mesh size on the floating and underwater structure, if meshed material is present, and its configuration (i.e. open net or wrapped in coils) (Annex 1). All FADs are evaluated, the ones deployed by the fleet and any other FAD encountered at sea, either when arriving to the FAD or when leaving it at sea, to evaluate modifications on FAD material and design in each interaction if occurring. The non-entangling classification followed the definitions of the CGP, including as non-

[5] https://iss-foundation.org/what-we-do/verification/conservation-measures-commitments/.

[6] https://iss-foundation.org/what-we-do/verification/conservation-measures-commitments/monitoring-control-and-surveillance-4-3a-observer-coverage/

entangling, lower entanglement risk FADs that are constructed with non-entangling mesh (i.e. mesh size ≤ 7 cm) if the open net is present or tied-up in sausages, and non-entangling FADs constructed with no meshed material as referred in the ISSF classification criteria (ISSF, 2015). Thus, any open net above 7 cm mesh size was considered as entangling.

For sensitive fauna release, the CGP developed species-specific handling procedures that always prioritise crew safety while discouraging other practices that are less desirable, and specific material has been developed to inform observers and the crew about the best handling practices (Annex 1 and Annex 2). These release procedures are based on the outputs of the EU project MADE (Poisson et al., 2012, 2014a), which have been used as standard best practice for safe bycatch release operations in RFMOs. AZTI, in charge of coordinating, collecting, processing and analysing bycatch release data, developed specific forms in English, French and Spanish to collect detailed information on bycatch release operations through scientific observers (Annex 1). In each interaction the mode of release is recorded as described in the CGP: (i) using the brailer, (ii) using light equipment such as stretcher, fabric, *sarria* or cargo net, (iii) using specific equipment such as a hopper or lateral doors, (iv) manually from deck, (v) after disentangling; if in each release the practices applied were in line with the ones defined in the CGP, and since 2016, the cause of the non-application of the best releasing practices (i.e. residual mortality: RI; lack of specific material for the manipulation; application of incorrect practices), as well as the time used to release animals are registered for each species and species group (i.e. sharks other than hammerhead sharks and whale sharks, hammerheads sharks, whale sharks, mantas, rays and turtles). Also, the state of the animal at release is registered based in the states proposed by Heuter and Manire (1994), (i) excellent (very active and energetic, strong signs of life on deck and when returned to water); (ii) good (active and energetic, moderated signs of life on deck and when returned to water); (iii) correct (tired and sluggish, limited signs of life, moderate revival time required when returned to water, slow or atypical swimming away); (iv) poor (exhausted, no signs of life, bleeding from gills, jaw or cloaca, long revival time required when returned to water, limited or no swimming observed upon release); (v) very poor or moribund: moribund, no signs of life, excess bleeding from gills, jaw or cloaca, unable to revive upon return to water, no swimming movement, sinks. During 2019, these forms have been reviewed and included in the ObServe software for a standardized data management.

In the evaluation, the whale sharks and hammerheads sharks are classified in an independent group apart from sharks due to their size, morphology and sensibility which require specific handling. Information on biological parameters such as the size and sex of the specimens is also recorded when possible.

Entangling events on FADs were included in the CGP forms since 2016, when specific guidelines were included in the observer manuals for the registration of fauna entanglements on FADs. When a FAD is found by a purse seiner or a supply vessel at sea, observers record the presence or absence of specimens entangled in the FAD. The number of specimens or species is not generally recorded.

2.2. Evaluation of the coverage on Good Practices and data available for the assessment

Since 2015, in purse seiners 100% of the fishing trips are monitored by human observers or by EMS. This has been gradually implemented in supply vessels since 2017. In this study for the assessment on best practices, on those trips in which data on CGP have been collected, a cleaning data processing has been applied and the percentage of days monitored with valid data on best practices was computed, by summing up the duration of each fishing trip with data on the CGP relative to the total number of vessel activity in days. In case of support vessels, when the vessel entries and departures were not available for a given vessel, a yearly mean of activity is applied. For purse seiners, the observed coverage, in the sense of availability of data in good practices for this specific study, in terms of production (i.e. catch of yellowfin, skipjack and bigeye tuna) and percentage of coverage regarding to the number of sets is also given.

2.2. Evaluation of the entangling risk of FADs

In each interaction with FADs, FADs are evaluated when encountered at sea through either random encounter with non-owned or targeted encounters with owned and tracked FADs (i.e. at arrival), and thereafter when placed at sea after the encounter or as the result of a new deployment (i.e. at departure). 7 FAD categories are established as follows (from lowest to highest risk of entanglement): 1- Totally non-entangling, constructed with materials with non-entangling characteristics (i.e. if mesh material is present the mesh size is ≤ 7 cm or rolled in sausages); 2 - net of >7 cm in the bottom part of the raft; 3- net of >7cm in the upper part of the raft; 4: pieces of net >7cm in the underwater part; 5: underwater part with net >7cm; 6: raft and underwater part with net >7cm. 0- not visible (this last category was used when the underwater structure of the FAD was not visible for observers because the FAD was not lifted from the water to avoid interfering with the aggregation underneath or breaking the submerged structure and not evaluated by the observer). Given the FAD characteristics, in each interaction each of the FAD is classified in one of these categories. Note that, the same FAD could be subjected to multiple evaluations during its lifetime, i.e. at arrival and at departure. The resulting percentage in each category is the number of FADs classified in the corresponding category relative to the total visible FADs by timeframe (i.e. at arrival and at departure). The totally non-entangling FADs are the ones classified in the category 1 in which if mesh material is present the mesh size is ≤ 7 cm or rolled in sausages.

2.3 Evaluation of the interactions with fauna and releasing methods used by the crew

For the estimation of the bycatch rates, a mean weight by species is applied in this work. In this work the number of specimens released by set, number by 1,000 tonnes and tonnes by 1,000 tonnes is estimated based in the data collected in the frame of the Code of Good Practices Program.

The code of good practices stablishes several releasing practices for each species group (Annex 1 and 2) and observers when possible measure the time dedicated by the crew for fauna release. In this study the percentage of individuals released using each method is quantified by summing up the releases following each handling method relative to the total observed releases by species group in each year. In addition, the percentage of release actions occurring in 1 to 10 minutes, an hour and more than an hour from detection is computed by group and year.

3. Results and Discussion

3.1 Coverage and data available for the assessment on good practices

Since 2015 100% of the fishing trips on purse seiners were covered by observers (human or EMS). Different organisms and flag states have been gradually introduced in the collection on best practices data, and sometimes in order to assure the collection of official data, official data collection programs have been prioritized, as the information to be collected by observers in each set is significant. In this sense, in this work, between 2015 and 2017 information on 522 fishing trips (i.e. 367 in purse seiner and 155 in supply vessels) on 25 purse seine and 17 support vessels in the Indian Ocean have been analyzed under the Code of Good Practices Program. These trips have been monitored by 82 observers trained on Good Practices from different organisms (**Table 2**), for which specific observer guide was created as supporting material (Annex 1).

In terms of production (catches of target tuna-species - skipjack. yellowfin and bigeye tuna) and number of sets coverage, data on good practices on purse seiners included in this study increased progressively from around 7% in 2015, 50-55% in 2016 and 75%-80% in 2017 (**Table 3**). In terms of fishing days, similar increasing tendency on Good Practices Data coverage is observed from 2015 to 2017 on purse seiners (**Figure 1**). On supply vessels, a gradual increase is observed in the availability on good practices data since 2016 when the monitoring on best practices was gradually implemented prior to the integration of supplies in the CGP program and during 2017

when supply vessels were joined to the CGP. In purse seiners and supply vessels an increasing tendency is observed in the EMS, mainly in supply vessels, where due to the reduced space onboard the EMS is the main monitoring method (**Figure 1**).

The sampling coverage impacts on the bycatch estimates and 20-50% of bycatch sampling coverage has been estimated for a reasonable bycatch estimation in previous studies (Lenner-Cody., 2001; Babcock et al., 2003; Sanchez et al., 2007; Amandè et al., 2012). In the Atlantic Ocean and Indian Ocean estimates gained in precision through increased sampling coverage thanks to private contract agreements (Ruiz Gondra et al., 2017a, Ruiz et al., 2018). While RFMOs in the Pacific Ocean require a 100% coverage, in the Indian Ocean the Resolution 11/04 set a minimum of 5 % coverage for the scientific observer programs and a 10% by the European Union (EU) that is ensured via EU-funded data collection programs (Commission Regulation (EC) Nº 665/2008), being well below the recommendations (Lenner-Cody., 2001; Babcock et al., 2003; Sanchez et al., 2007; Amandè et al., 2012) which restricts the coverage to a time window and can induce to changes in the behavior of the crew when observers are present, resulting on statistical biases (Hall et al., 2017). In this sense the CGP allows to go further beyond RFMOs observer coverage requirements, provides data that can be used for accurate bycatch estimates (Ruiz Gondra et al., 2017a, 2018), has allowed to evaluate the FADs used by the purse seine fleet and support vessels and provided unique information to allow the industry and scientists to monitor the implementation of the good practices on board and to the design of corrective actions for a continuous improvement on the application of the mitigation measures, if required.

3.2 The use of Non-entangling FADs

Traditionally, the FADs used by industrial purse seiners consisted of bamboo rafts with extra floats (platform) and nets hanging below (submerged appendage), typically constructed using reused purse seine nets with large mesh size (>12 cm). As this kind of FAD with large mesh size is supposed to entail higher risk of entanglement for sensitive species like sharks or turtles (Filmanter et al., 2013), the CGP promoted a design, construction and deployment of FADs that minimize the potential of accidental animal entanglements. As such, the replacement and use of non-entangling FADs (including lower entanglement risk FADs referring to ISSF categories, ISSF 2015) has been promoted since 2012 under the Code of Good Practices. This voluntarily adopted mitigation measure has allowed replacing the traditional FADs by non-entangling FADs. In order to further assure that FADs are in line with the criteria stablished in the CGP, nowadays FADs used by the target fleet are mainly made in port, where the construction is supervised by companies (Fig 2).

At sea, observers on board evaluate the FADs' condition when the devices are encountered at sea due to either random encounters with non-tracked or planned encounters with tracked FADs (i.e. at arrival), and thereafter when placed at sea after the encounter or as the result of a new deployment (i.e. at departure). During the 3 years (2015-2017) 39,899 FAD evaluations "at arrival" and 55,764 "at departure" were recorded (note that for FAD activities other than new deployment the same FAD could be evaluated multiple times as subjected to the two evaluations in each visit, i.e., at arrival and at departure, and multiple visits during FAD lifetime) (**Table 4**).

In the Indian Ocean, from 2015 to 2017, the annual mean percentage of 33.6% (± 5.6) of the FADs at departure (e.g. a deployment or left at sea after an unplanned or a planned activity) were classified as not visible (Category 0). Discarding these cases and considering only those FADs that could be evaluated by observers at departure, the percentage of non-entangling FADs during 2017 has been high, being 78% of the visible FADs that were left at sea totally non-entangling (i.e., category 1: raft and underwater structure totally non-entangling). As shown in **figure 3**, a progressive improvement is observed since 2015, in which the percentage of evaluated FADs classified in the category 1 increases. The percentage of FADs evaluated at departure, made entirely with non-entangling material increased from 29.2% in 2015 to 72.8% in 2016 and to 78% in 2017.

A similar pattern is observed when analyzing characteristics of visible FADs at arrival or when encountered at sea (which could refer to tracked FADs or randomly encountered non-tracked FADs). Discarding the non-visible cases for the analysis (Category 0; annual mean of 54.8% (± 8.9)), the percentage of totally non-entangling FADs (Category 1) encountered at sea increased from 40.2% in 2015 to 73.4% in 2016, reaching 77.7% during 2017.

In 2017, entangling netting (i.e. open netting with mesh size >7cm) in the submerged structure of FADs used was a residual component of the total numbers of evaluated FADs at sea (at arrival: 1.7%; at departure: 3.1% [Ind.4. Ind.5. and Ind.6]). Although the entangling character of the floating structure has significantly been improved during the study period, some rafts (i.e. floating structure) in 2017 were found to be covered by entangling nets, mainly in the bottom part which may suppose a minor risk for turtle entanglement (i.e. 8.3 % at arrival and 12.5% at departure of FADs with entangling material in the bottom part of the raft [Ind.2]; and 12.2% at arrival and 6.4% at departure in the case of the upper part [Ind.3]). Those FADs that were left in the water or FADs at water classified as having entangling material could partially correspond to re-used FADs deployed by the fleet which had lost the non-entangling character due to the deterioration of the raft cover or break of the submerged structure. Could be also the case of FADs not deployed by the target fleet, which were not replaced by non-entangling material after a visit. However, in order to further reduce the entangling character of FADs in the water, whenever possible, the entangling material should be replaced by the non-entangling material or FADs should be repair if the material is deteriorated.

Results show that the voluntarily adopted commitment by the ANABAC and OPAGAC fleets and the effort made since the implementation of Good Practices is gradually replacing the traditional FADs in the water by non-entangling FADs, as shown by the characteristics of the FADs evaluated at arrival (i.e., tracked FADs or randomly encountered non-tracked FADs), and at departure (i.e., FADs left at sea as a result of a deployment or after a visit). The percentage of totally non-entangling FADs evaluated at departure and at arrival has increased since 2015, being close to 80% of the visible FADs classified as totally non-entangling following the CGP classification criteria [Category 1] in 2017 (**Figure 3**)**.**

Entanglement events on FADs started to be recorded in 2016. In 32,939 evaluations made on FADs at arrival, 122 cases of FADs with entangled fauna has been registered, i.e. 0.3% of FADs with entangled fauna have been observed. In best practices forms the absence or presence of entangled fauna was recorded in the study period, but the number of specimens or species was not usually recorded. In order to further evaluate the entangling rate, the forms have been updated to enable collecting detailed information of the number of specimens and species entangled in FADs.

Moving to non-entangling FADs constructed entirely without any net and with biodegradable material will help to minimize the potential entangling risk, detected when netting material is deteriorated over time, as requested in the Res. 19/02 of IOTC. Besides, eliminating all synthetic materials used in the construction of FADs will reduce their residence time at sea, and consequently their associated impacts in marine ecosystem (e.g. beaching), which will suppose a significant progress to the fishery (Davis et al., 2017; Moreno et al., 2018a). Currently, this fleet, together with the other EU and associated purse seine fleets, is working in parallel in different projects in the Indian and Eastern and Central Pacific Ocean to test new FAD prototypes built with biodegradable and non-entangling material (Moreno et al., 2017; Zudaire et al., 2017; Moreno et al., 2018b). The findings of these ongoing projects will potentially contribute to identify effective FAD designs and materials for those oceans, which will make possible at a short-medium term to stablish the basis for the gradual replacement of traditional FAD by biodegradable NEFAD.

3.3 Interactions with sensitive fauna and release operations

A total of 56,504 interactions with vulnerable specimens were registered during the study period (2015-2017) in the Indian Ocean (**Table 5**). Sharks (other than hammerhead shark and whale shark) were the dominant group with 55,675 records (98.5%), followed by hammerheads sharks (n=358, 0.6%), mantas (n=242; 0.4%) turtles (n=150, 0.3%), rays (n=68; 0.1%) and whale sharks (n=11, 0.02%). The most frequent identified species for sharks, hammerheads, mantas, rays and turtles were the *Carcharhinus falciformis*, *Sphyrna lewini*, *Mobula birostris*, and *Dasyatis violacea* and *Lepidochelys olivacea*, respectively. The number of specimens registered by species group per set and by catch of target species is included in **Table 6** for each year and by species group.

Shark species bycatch rates observed in this study are in line with those presented by Ruiz Gondra et al. (2018) in the Indian Ocean, which estimated a 2-5 t by 1,000 tons of tuna production for Indian Ocean for FAD fishery in recent years. In the case of sharks, purse seine bycatch rates are relatively low in comparison with longline gears fishing tuna (Gilman, 2011; Oliver et al., 2015; Hall and Roman, 2013; Garcia and Herrera, 2018), in which the effort of fishery overlaps with pelagic sharks distribution zones and hotspots (Queiroz et al., 2019). For instance, in longline fisheries targeting tuna, the shark bycatch ratios can surpass the 20% and can reach the 50-60%, in some cases, becoming target species (Gilman et al., 2008; Oliver et al., 2015).

Meanwhile, interactions with turtles, manta-rays and whale sharks are infrequent as shown in the **Table 6** and in previous studies (Amandè et al., 2010; Bourjea et al..2014, Hall and Roman, 2013; Ruiz Gondra et al., 2017a; Ruiz Gondra et al., 2018; Garcia and Herrera, 2018). Overall 150 specimens of turtles were registered in the frame of the Good Practices for 3 years period. Regarding turtles, higher bycatch rates are also observed in longlines fishing tuna or swordfish, being turtle bycatch in the order of 200,000 individuals caught annually in the Atlantic (Lewison et al., 2004) and with 25% of death at retrieval (Gilman, 2011), while in PS tropical tuna fisheries the annual number is 3 orders of magnitude lower, with a high rate of post-release survival, i.e. > 90% (Bourjea et al., 2014; Ruiz et al., 2018). In the Indian Ocean gillnets and longline gears contribute mainly to the turtle bycatch, i.e. 49% and 51% respectively (Garcia and Herrera, 2018)

Overall, compared with other fisheries and other gears fishing tuna, PS bycatch rates are much lower (Hurrington et al., 2005; Gilman, 2011; Hall and Roman, 2013; Oliver et al., 2015, Garcia and Herrera 2018). For instance, global bycatch rates of purse seiner are residual if comparing with trawls, crustacean or demersal fishery which can go to 80% of bycatch by target species (Hurrington et al., 2005). Bycatch levels on purse seiners are also lower than the overall estimates for the global tuna fishery which oscillates from 5% to 14% of the total catch depending on the study (Kelleher, 2005. Gilman et al., 2017). Global raised bycatch of tuna purse seiners are in particular 1.75 to 3 times lower than the estimates for longline fishery bycatch which accounts for the 7.5% to 22% of the total catch weight (Kelleher, 2005. Gilman et al., 2017). However, sensitive species are less resilient due to their K-selected life history strategy with slow growth, delayed sexual maturity and low fecundity (Heppell et al. 2000), making them vulnerable to fishing. For example, the population status of silky sharks, which are the dominant elasmobranch bycatch species of tropical tuna purse seiner (Amandè et al., 2012; Lezama-Ochoa et al., 2018; Garcia and Herrera, 2018; Ruiz et al., 2018), could potentially be affected. Declines in shark populations due to multiple causes can potentially impact ecosystem functioning, including extensive cascading effects on lower trophic levels.

When possible in each interaction observers note the handling method used for releasing the sensitive fauna. The percentage of specimens released by each method and species group, in those cases in which the releasing mode was recorded, is shown in the **Figure 4**. Except for whale sharks and mantas the specimens are mainly handled by hand, a technique that is described in the CGP (Annex 1 and Annex 2) which allows a quick release from the deck specially when various specimens are caught in a set. However, this also supposes a risk for the crew especially in case of sharks. Indeed, some accidents have been registered during the last years. Specific tools like stretchers or cargo nets are used mainly when releasing mantas. Mantas occur occasionally, and due to the size and specific morphology of this animals the handling usually requires the use of specific material. In case of whale sharks, the animals are released by submerging the floats or by breaking the net as described in the CGP (Annex 1 and Annex 2).

Whenever possible, observers also record the time passed between detection and release by the crew, making it possible to assess the response of the crew when a specimen is detected on board. Since 2015, thanks to the crew training and implication of the companies, the release time has been reduced in sharks, mantas and turtles, which can positively affect post-release survival rates (**Figure 5**). The low number of records in other species groups do not allow to assess the temporal evolution. Concerning mantas, it is observed how the handling of mantas takes in general more time than other species groups, mainly due to their size and morphology which requires the use of specific release tools as cargo nets and stopping the fishing maneuver.

In recent years, different tagging studies have been conducted to aim at exploring post release survival rates as well as the contribution of best fishing practices to the reduction of bycatch fishing mortality (**Table 7**). Results on sharks (including hammerheads and other sharks) show that bycatch rates are generally low, but on vessel

mortality in purse seiners is high. i.e. 52% to 72% depending on the study, species and set catch volume (in which on vessel mortality rates are directly correlated with set size) (Poisson et al., 2014b; Eddy et al., 2016). Post-release survival often depends on whether shark bycatch is entangled in the net or not, and on the time spent between the net closure and the release, e.g. first or subsequent brails, as well as on the state of the specimen at release (Poisson et al., 2014b; Hutchinson et al., 2015. Filmalter et al., 2015. Eddy et al., 2016). Overall, based on these studies, conformity with the best practices could contribute to increased survival rates, from a minimum of 5% to a maximum of 19% of incidentally caught sharks (**Table 7**). For whale sharks encircled and released following the Good Practices, the survival was estimated to be 100% (Murua et al., 2014; Escalle et al., 2018) and, thus, the tuna purse seiners' impact on direct mortality of this species is negligible if the recommended practices are applied, as is the case of the target fleet.

Interaction with mantas on purse seine FAD sets is very low, while non-associated sets have higher but still very sporadic mobulid catch rates (Hall and Roman. 2013). One study on purse seiners conducted on mantas in New Zealand showed that from 8 tagged mantas 3 survived (37.5%) which were the ones brailed on board, while the ones entangled in the net and released did not survive. Thus, various authors recommend the adoption of Good Practices to decrease the fishing mortality of mobulids (Poisson et al., 2014a; Francis and Jones, 2017; Hutchinson et al., 2017) as it has been estimated under different scenarios that the application of best releasing practices could help in the reducing the vulnerability of mantas in a cost effective way (Griffiths et al., 2019). However, further tagging work should be developed in tuna purse seiners to assess the post release survival estimates on this species group.

Finally, interactions with marine turtles in the tropical tuna purse seine fishery were shown to be low, with high survival rates (Bourjea et al., 2014; Ruiz Gondra et al., 2017a; Ruiz Gondra et al., 2018); therefore, the impact of the purse seine fishery over species within this group is low (Bourjea et al., 2014) whenever good practices are observed, as is the case of this program.

4. Conclusions and recommendations

Since the implementation of the Good Practices program, the commitment of the fleet and continuous training of crew on the application of the Code has contributed significantly to the improvement on FAD use. Traditional FADs deployed by the fleet have been gradually replaced by non-entangling FADs. The percentage of non-entangling FADs at departure and at arrival has increased since 2015 to reach the maximum percentage of non-entangling FADs in 2017.

Regarding interactions with fauna, bycatch rates of sensitive species are low when compared with other industrial fisheries (i.e. demersal and driftnet fisheries) and other fisheries fishing tuna (e.g. longline). It is observed that for sharks (other than whale sharks), turtles, and rays the animals are handled by hand and release time of sensitive fauna has been reduced, which can contribute positively to survival rates.

Based on the results and the experienced gained the following recommendations are proposed:

- Promote change in policy at national/regional level:
    - The adoption of high observer coverage has led to more precise estimates of bycatch rates, as shown by Ruiz Gondra et al. (2018). Therefore, in order to provide accurate estimates of bycatch for sensitive species, the minimum level of human observer coverage should be set to at least 20% as recommended by in the EU Annual Observer Coordination meeting in 2019. In addition, 100% observer coverage is recommended which could be achieved through electronic monitoring following minimum standards (Ruiz Gondra et al., 2017b), human observers, or a combination of both.

- Adoption of additional mitigation actions:

    - In line with new CMM that are coming into force, in a short term, the purse seiner fleet should move to non-entangling FADs constructed entirely without any net which will help to eliminate the potential entangling risk. Indeed, the low entangling risk material (open panels <7cm or large mesh size tight up into bundles) should be a transitional step towards the elimination of any netting (Restrepo et al., 2019).
    - In short/medium term move to non-entangling FADs constructed with biodegradable material which will help to eliminate the potential entangling risk and other environmental impacts. Companies should continue participating in coordinated experiments to test biodegradable materials. Given that the size of the submerged structure is increasing, stabilizing a maximum depth or simplifying the submerged structure could help in reducing the amount of synthetic marine debris.
    - To reduce the amount of synthetic marine debris, the fleet should improve the FAD management during the FAD lifetime by promoting and participating in FAD recovery programs along the lines of the FAD-Watch Project in the Seychelles (Zudaire et al., 2018; Herrera et al., 2019) and removing from the water, retain onboard and only dispose of in port the FADs that are not being used any more, avoiding the abandonment of FADs without buoys in the Ocean. In this line, sharing buoy track data with scientific community could help in developing FAD drifting models to enhance the efficiency on FAD use and diminish the FAD beaching or lost risk.
    - In sets where high incidence of sharks is observed, avoid loading them onboard by brailing them directly from net to water.
    - Although interactions with cetaceans are low, best handling practices should be considered for this group of animals in the Best Practices Program
    - In order to reduce the bycatch to target catch ratios, other mitigation options as avoiding setting on small schools (<10 tones) could be considered (Dagorn et al., 2012b).
    - Full retention of dead specimens has been proposed as a potential action to avoid waste and reduce the levels of bycatch (discarding species with non-retention requirements). This is in place in some EEZ and oceans and could be considered by the fleet for being adopted as a complementary mitigation action in the Best Practices Program.

- Enforcing research actions to further advance in improving bycatch species knowledge and developing, improving or evaluating mitigation actions:

    - Acknowledging the value of collaborations between industry and scientists in the development of new tools and gears to assist in release operations, improving handling methods while ensuring the safety of the crew, new mitigation approaches should be further explored and tested, e.g. promoting the release of shark from the net, avoidance of shark hot spots, the use of hopper, specific grids for mantas (e.g. HELEA project, which runs in parallel with the CGP program, develops and tests new tools with specific construction characteristics to release sharks and rays in tuna purse seiners).
    - In order to expand the knowledge on post-release survival rates, further experiments to estimate the mortality and track post-release movements of species of concern should be promoted.

- Promote the training and Capacity Building:

    - Continue with annual skipper workshops on best practices and strength training of the crew in third countries, which have shown to be an effective tool for strengthening the collaboration between industry and scientists, in the implementation of Best Practices and the development of new tools and gears to assist in release operations.
    - Conduct trainings on Coastal States to introduce the Good Practices on coastal states observer programs and to work on the harmonization and standardization on Observer Data Collection.

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Tables

Table 1. List of Conservation and Management Measures (CMMs) which affects to purse seiner fishery for sensitive fauna (i.e. elasmobranch and turtles) and Fish Aggregating Devices (FADs) for the International Commission for the Conservation of Atlantic Tuna, IOTC, in the Indian Ocean.

	CMM reference	**Description**
Elasmobranch	Res 12/09	Sets out a scientific and management framework on the conservation of Thresher sharks caught in association with IOTC managed fisheries. Includes prohibition of retention, encouragement for release of live sharks, data report requirements (target and incidental catches and live release), and research implementation (identification nursery areas)
	Res 13/05	Sets out a scientific and management framework on the conservation of whale sharks (*Rhincodon typus*) caught in association with IOTC managed fisheries. Includes prohibition of intentional setting on whale shark, safe release of whale shark incidentally encircled and data reporting (encirclement and status of release individual)
	Res 13/06	Sets out a scientific and management framework on the conservation of oceanic whitetip sharks (*Carcharhinus longimanus*) caught in association with IOTC managed fisheries. Includes prohibition of retention, encouragement for release of live sharks, data report requirements (target and incidental catches and live release), and research implementation (identification nursery areas)
	Res 15/01	Sets out a minimum requirement on recording Catch and Effort Data by fishing vessels in the IOTC area of competence including non-target catch as sharks and turtle.
	Res 17/05	Sets out a scientific and management framework on the conservation of sharks caught in association with IOTC managed fisheries. Includes data report requirements, full utilization of shark catches, 5% fin/ body ratio for retained catches, encouragement for release of live sharks, especially juveniles and pregnant females and research implementation (gear selectivity, identification of shark nursery areas)
	Res 18/02	Sets out management measured for the conservation of blue shark caught in association with IOTC fisheries, including data collection requirements, encourage undertaking research actions, and providing advice on management options for the long-term sustainability of the stock.
Turtles	Res. 12/04	Sets out a scientific and management framework on the conservation of marine turtles, encouraging the adoption of non-entangling FAD designs that reduce the incidence of entanglement of marine turtles according to international standards.

	Res 15/01	Sets out a minimum requirement on recording Catch and Effort Data by fishing vessels in the IOTC area of competence including non-target catch as sharks and turtle.
FADs	Res 16/07	Sets out a management framework on the use of artificial lights to attract fish. Includes prohibition of the use of artificial lights on FAD and vessel for the purpose of aggregating tuna and tuna like species
	Res. 18/01	On an interim plan for rebuilding the Indian Ocean yellowfin tuna stock in the IOTC Area of Competence; limits the number of active FADs, supply vessels and the interaction between purse seiners and supply vessels
	Res. 18/08	This resolution replaces Res 17-08. Sets out a scientific and management framework on FAD fishing in the IOTC area of competence; limits the number of active and acquired FADs; stablished data collection and submission requirements; includes guideline for FAD management plans; sets the principle for the design and deployment of FADs.
	Res. 19/02	This resolution will replace Res 18-08. Sets out a scientific and management framework on FAD fishing in the IOTC area of competence; includes a set of definitions for standardizing terminology on FADs, further limits the number of operational and acquired FADs; stablished data collection and submission requirements; includes guideline for FAD management plans; sets the principle for the design and deployment of FADs.

Table 2. Number of trips on best practices included in this study, analyzed by each organism, and number of trainned observers collecting the data.

Organism	**n of trips**	**n of observers**
AZTI	97	6
Digital Observer System	204	8
Instituto Español de Oceanografía	17	11
Seychelles Fishing Authorities (SFA)	191	49
Centre de Surveillance de Pêche de Madagascar (CSP)	10	6
Terres Australes et Antarctiques Françaises (TAAF)	3	2

Table 3. Number of trips included in this work for the assessment of good practices (n trips) and the corresponding number of sets (n set) and catch (catch (t)). The percentage of the sets evaluated on Good Practices (% sets) in this study and the corresponding catch (% catch), relative to the total number of trips covered by observer is shown.

year	n trips	n set	catch (t)	% sets	% catch
2015	18	470	13794	7.3	6.7
2016	137	4036	122919	51.7	53.4
2017	212	5513	223128	77.7	81.6

Table 4. Number of evaluations on FADs done by observers “at arrival” (during unplanned or planned FAD encounters) and “at departure” (when placed at sea after the encounter or because of a deployment) by year and ocean during the study period (2015 to 2017).

year	At arrival	At departure
2015	1,550	2,669
2016	18,515	22,266
2017	19,834	30,829

Table 5. Number (n) of specimens by species registered in the framework of the Code of Good Practices Data Collection program from 2015 to 2017 in the Indian Ocean.

Group	Scientific_name	Species code	n
Hammerheads sharks	*Sphyrna lewini*	SPL	250
	Sphyrnidae	SPY	108
Whale Sharks	*Rhincodon typus*	RHN	11
Other Sharks	*Carcharhinus albimarginatus*	ALS	4
	Alopias vulpinus	ALV	1
	Carcharhinus melanopterus	BLR	1
	Carcharhinus brachyurus	BRO	8
	Prionace glauca	BSH	5
	Alopias superciliosus	BTH	2
	Carcharhinus altimus	CCA	4
	Carcharhinus cautus	CCC	6
	Carcharhinus leucas	CCE	153
	Carcharhinus obscurus	DUS	16
	Carcharhinus falciformis	FAL	45597
	Isurus spp.	MAK	8
	Carcharhinus longimanus	OCS	738
	Carcharhinidae	RSK	8820
	Euselachii	SKH	302
	Isurus oxyrinchus	SMA	8
	Galeocerdo cuvier	TIG	2
Marine Turtles	*Lepidochelys olivacea*	LKV	20
	Eretmochelys imbricata	TTH	13
	Caretta caretta	TTL	7
	Testudinata	TTX	101
	Chelonia mydas	TUG	9
mantas	Mobulidae	MAN	5
	Manta spp	MNT	3
	Manta birostris	RMB	78
	Mobula japanica	RMJ	41
	Mobula mobular	RMM	18
	Mobula tarapacana	RMT	5
	Mobula spp	RMV	92
rays	*Myliobatis aquila*	MYL	1
	Dasyatis violacea	PLS	42
	Rhina ancylostoma	RRY	2
	Rajiformes	SRX	3
	Dasyatidae	STT	20

Table 6. The number of specimens (n), number of specimens by set (n/set) and number and tones by 1,000 tons catch (n/1000t and t/1000t, respectively) by group and year based on the 367 evaluated trips in purse seiners.

	2015				2016				2017			
Group	n	n/set	n/1000t	t/1000t	n	n/set	n/1000t	t/1000t	n	n/set	n/1000t	t/1000t
hammerheads	0	0.00	0.00	0.00	0	0.00	0.00	0.00	358	0.06	1.60	0.15
mantas	18	0.04	1.30	0.16	91	0.02	0.74	0.10	133	0.02	0.60	0.08
rays	6	0.01	0.43	<0.01	37	0.01	0.30	<0.01	25	<0.01	0.11	<0.01
whale sharks	0	0.00	0.00	0.00	5	<0.01	0.04	0.07	6	<0.01	0.03	0.04
sharks	1,318	2.80	95.55	1.92	21,712	5.38	176.64	3.16	32,645	5.92	146.31	2.37
turtles	3	0.01	0.22	<0.01	50	0.01	0.41	0.00	97	0.02	0.43	0.00

Table 7. Post release mortality on vulnerable species estimated in previous studies conducted in the Atlantic Ocean (AO), Indian Ocean (IO), Western and Central Pacific Ocean (WCPO) and Eastern Pacific Ocean (EPO)

Species group	Reference	Ocean	fishing stage	mortality rate of the released individual	Overall mortality rate
Sharks	Poisson et al., 2014	IO	entangled in the net	18%	81%
			brailing	48%	
	Hutchinson et al., 2015	WCPO	pre-set	0%	84%
			entangled in the net	31.3%	
			First brail	83.3%	
			posterior brails	93.3%	
	Eddy et al., 2016	EPO	brailing	62%	80% - 95%.
	Sancristobal et al., 2016	AO	pre-set	0%	-
Whale sharks	Escalle et al., 2018	AO	encircled	0%	0%
	Capietto et al., 2014	AO/IO	encircled	1.4%	1.4%
	Murua et al., 2014	AO	encircled	0%	0%
Turtles*	Bourjea et al., 2014	AO/IO	encircled	-	AO = 5% IO = 11%
	Ruiz Gondra et al., 2017a	AO	encircled	-	1%
	Ruiz Gondra et al., 2018	IO	encircled	-	3%
Mantas	Francis and Jones., 2016	New Zealand	brailed	62.5	62.5

**Overall mortality rate on turtles is estimated from observers records and not from tagging studies*

Figures

Figure 1. Percentage of days with data on good practices (GP) which has been included in this anlysis by type of observation method (i.e. Electronic Monitoring System, EMS, or human observerd) in purse seiners and support vessels in the Indian Ocean during 2015-2017. Discarded or nto available data on good practices refers to days in which priority has been given to official data collection programs or failure on EMS.

Figure 2. Example of non-entangling FADs constructed and used in the Indian Ocean

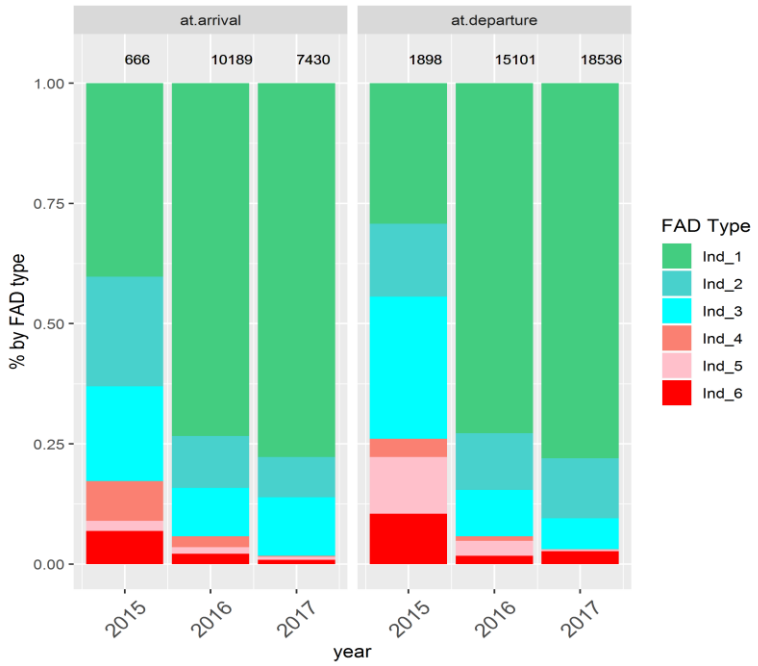

Figure 3. Evolution of the FAD types (% of number of FADs by category) in interactions with FADs for observed FADs at arrival and at departure during the study period (re-scaled with no consideration of non-visibles [mean percentage of 33.6% at departure and 54.8% of observations in case of at arrival]). The indices refer to FAD categories classified from lowest to highest risk of entanglement: Ind 1 (totally non-entangling); Ind 2 - net of >7 cm in the bottom part of the raft; Ind 3- net of >7cm in the upper part of the raft; Ind 4: pieces of net >7cm in the underwater part; Ind 5: underwater part with open net >7cm; Ind 6: raft and underwater part with net >7cm. The coverage fluctuates depending on the vessel type and year (see Figure 1).

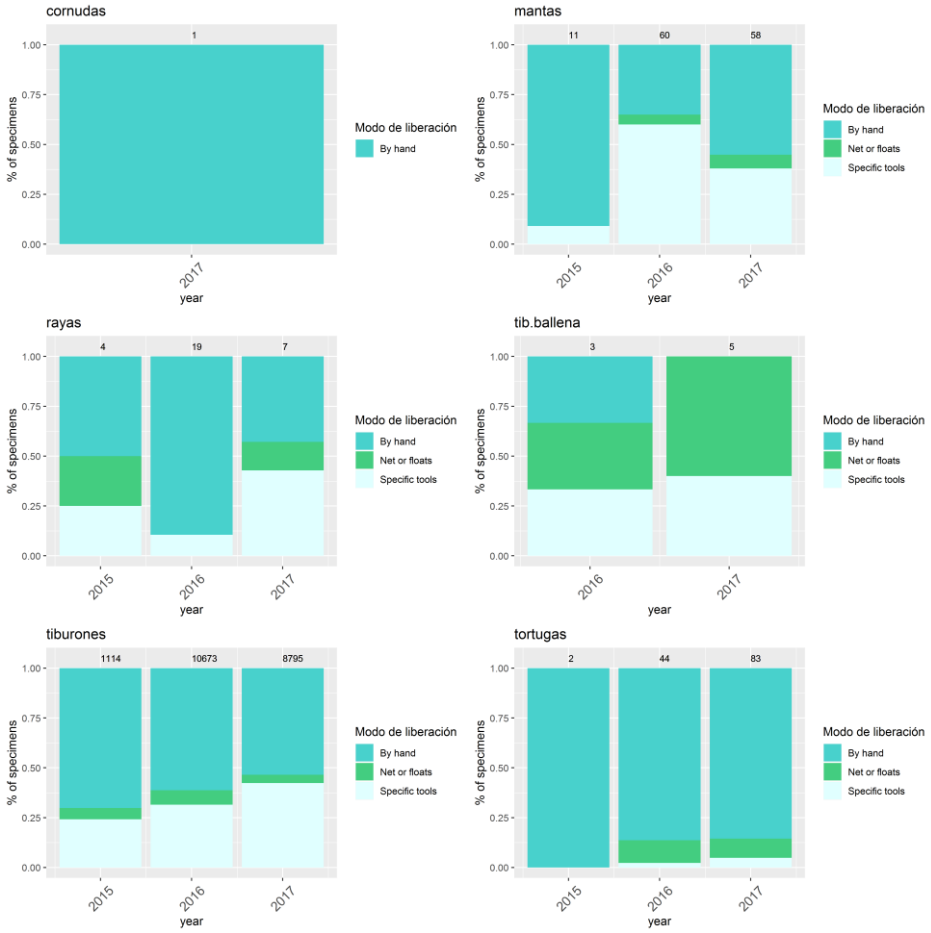

Figure 4. The percentage of specimens released by each handling by each animal group and year in the Indian Ocean, for interactions in which the animal handling method was recorded. These are the results of the 367 trips analysed on purse seiners (see Table 3 and Figure 1).

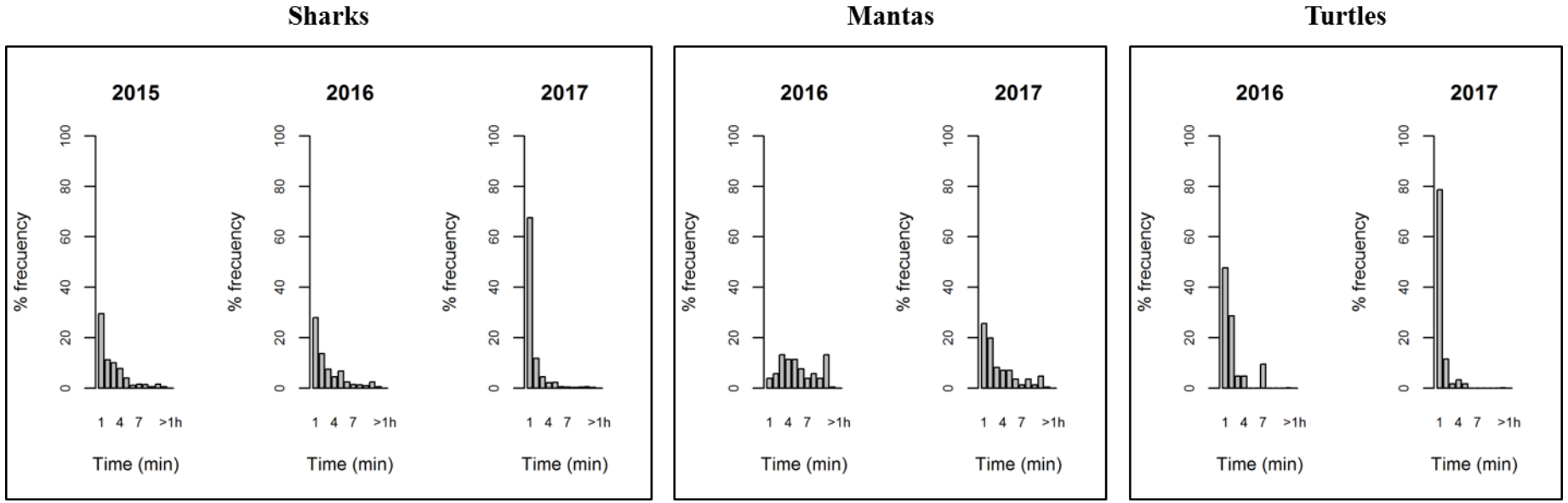

Figure 5. Time dedicated to release sharks, mantas and turtles of each species group from 2015 to 2017.

2017 June

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INDICE

INTRODUCTION – CONTEXT AND GENERAL INSTRUCTIONS

The organizations of tuna purse-seiners ANABAC and OPAGAC signed in February 2012 a Code of Good Practices for responsible tuna purse-seine fishing. This code, in force in all the OPAGAC-AGAC and ANABAC-OPTUC fleets, aims to (1) improve the operations performed in the tuna purse-seine fleet by both organizations, (2) improve the selectivity of fishing with FADs and (3) minimize the impact of fishing on the ecosystem.

To do this, rules were established regarding the design of fish aggregating devices (FADs) and the release of the fauna that can be found associated with the FADs. Specific objectives are the total replacement of non-conform FADs by non-entangling FADs, and the release of incidentally caught or FAD-associated fauna, ensuring the safety of the crew and maximizing the survival of released animals.

AZTI Foundation is in charge of developing and implementing a system of verification of this Code of Good Practices in tuna purse-seine fishery. In this system, the role of observers will be primordial. You will be in charge of registering information on each FAD that is being planted, visited or on which a fishing event occurs, and on animals that are released. The correct registry of the information will be the base of the functioning of all the system of verification. Just as the forms you usually fill in, for these new ones you will be responsible of the exactness of the data you record. **Falsifying information is MUCH MORE SERIOUS than not recording it.** The information that you record is **STRICTLY CONFIDENTIAL**. You must not make copies, or make any comment or statement in front of others, except for the skipper or captain, both at sea and on land. The skipper or the captain have the right to check every moment the notes that you take.

During the fishing trip, you must not make any personal activity that may hinder your ability to collect the required information.

This manual summarizes the information you need to collect to conduct this project as well as the forms (paper and Excel) and the instructions to fill them. The technical notes to identify species and the protocol for shooting are the same as in the current observers' handbook. Check often and regularly both handbooks. This can avoid repeated errors in the data you collect.

1. RELEASE OF ASSOCIATED FAUNA (Forms B2 and B3)

The aim is to record the operations of release of sharks, whale sharks, rays / skates and turtles. The priority will always be the quick and gentle release of animals. If in some cases the rapid release of an animal does not allow to record all the required information, the release of the animal will be prioritized. If there is little time to observe an animal, observe in priority its release mode, then it's state, then its individual characteristics (size, sex). You should never intervene in the operations performed by the crew.

Two forms need to be completed in conjunction with the current form B on the characteristics of catch: **B2** form in which you record individual shark releases (except whale shark) and **B3** form in which you will record the releases of whale sharks, rays / skates, and turtles.

Next, in paragraphs 1.1, 1.2, 1.3 and 1.4 you will find a description of the practices to be performed for the release of bycatch species to be considered good practice.

1.1. SHARKS

1.1.1. Operations of release

When sharks are dispersed within a tuna aggregation under an object, there is currently no efficient method to remove them from the purse-seine. Sometimes a large shark can be detected at the surface inside the purse-seine; in that case the brailer can be used to remove it. In most cases sharks are released when they appear on deck or entangled in the net. If they are small, the fishermen can manually release them quickly and carefully, avoiding damage to the animal and preserving the safety of the crew during the operation. The crew shall handle the sharks holding (not pulling) the tail and holding the fins (Figure 1).

Medium-sized sharks shall be handled by two crew members. For larger sharks, and depending on the availability of material, the crew can use equipment to help release, such as stretchers, "sarrias" (see 1.3.1.), cargo nets or tarpaulins placed near the brailer. More specific equipment may also be used, such as a hopper or tray with ramp or deck hatches.

Important:

- The crew members **avoid** using ties or poles, to avoid damaging the animal
- They **avoid** dragging, pushing, hitting or squeezing the animal.
- As far as possible, they **avoid** leaving sharks much time on deck under direct sunlight.
- They **avoid** lifting the shark by the tail, or handling it by the gill slits (gill operculum). This harms the animal and it can have dangerous reactions.

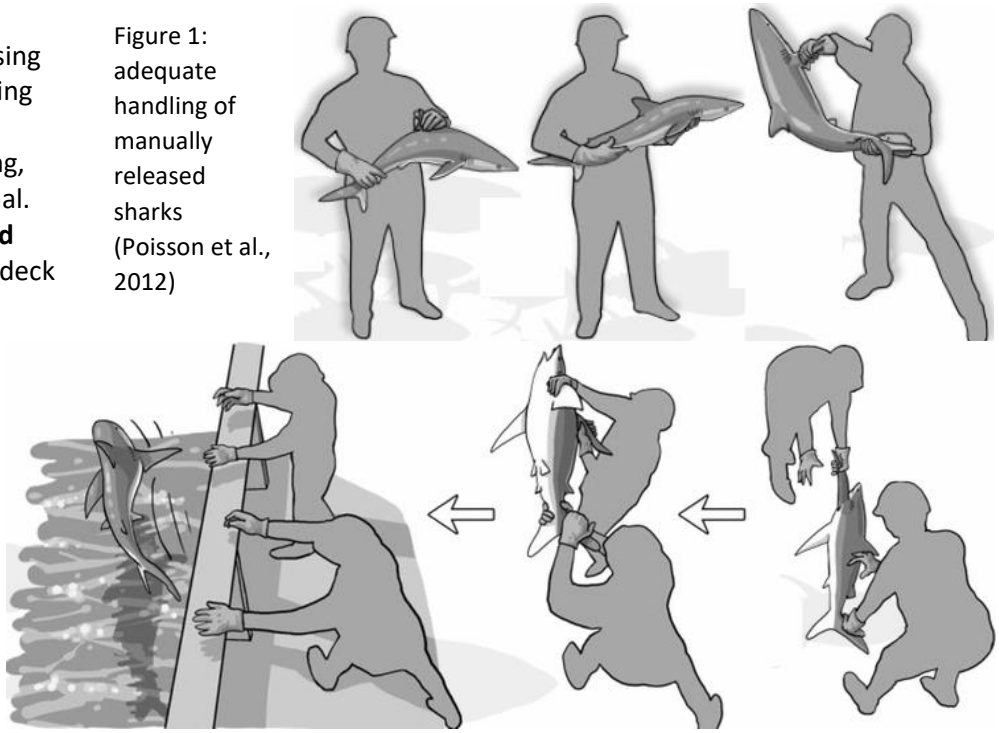

Figure 1: adequate handling of manually released sharks (Poisson et al., 2012)

1.1.2. Registry of the information

You will fill the FORM **B2** (see next page). If you have taken pictures, mention the codes of the corresponding ones (see example page 14).

1.2. WHALE SHARKS

1.2.1. Release operation

If a whale shark is found in the purse-seine, the purse-seine is hauled carefully to isolate the animal in a small area of the purse. Fishermen collect the purse-seine to drive the whale shark near the closest cork line. The purse-seine is always hauled from the tail to the head of the animal and on its underside, trying to make the fish slide to the cork line. The cork line is submersed to ease the exit of the whale shark, and the crew waits for the whale shark to swim out by itself from the purse-seine (fig2).

If the whale shark is pushing with his head against the purse-seine before the cork line could be submersed and if it cannot move back so as to submerse the corks, from the vessel the crew will proceed to submerge the cork line with poles or rods, so that the animal can release its head above the cork (fig2).

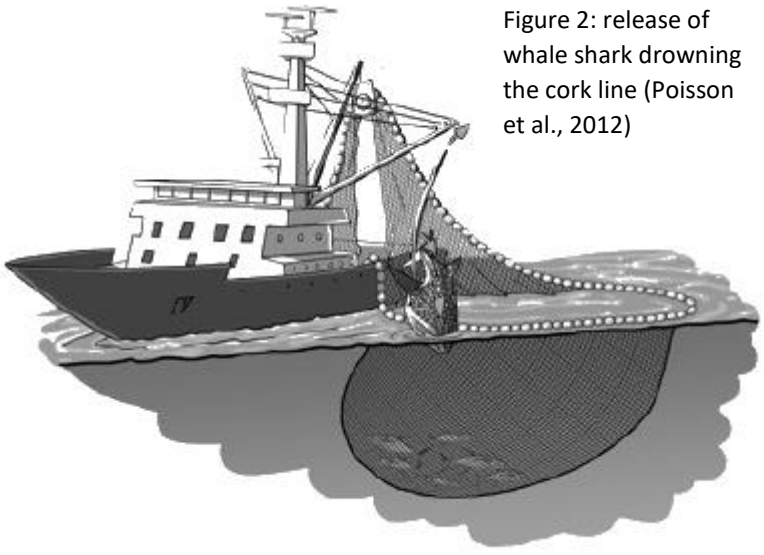

Figure 2: release of whale shark drowning the cork line (Poisson et al., 2012)

Form B2 - Head (identical in B2 and B3)	
tting nº	umber correlatively each of the settings, as in form B
ate	rmat of date: **dd/mm/aaaa**
oute form nº: **oute line nº:**	t the number of form A and the number of the line that corresponds to the set, in form B
elease form nº	t a correlative number for each form, starting with 1 at the beginning of each p.
ip code	e example page 14.
rse shaping start time	hen the fishermen start to strap the purse-seine to concentrate the tuna. Tin MT/UTC (Greenwich Mean Time / Coordinated Universal Time) (4 digits)
Released fauna - sharks	
ere is room for 30 individuals. The information of each individual is registered in a same row, following tl ample given in row 0. If more than 30 sharks appear in the fishing event, you will use a second form th u will number correlatively. If you have taken pictures, mention the codes of the corresponding pictur ee example page 14).	
Individual	
ODE of the species	e species codes (3 digits) in the observers' handbook
ze	timated or measured (if possible) size, in centimeters. If there is no time to easure the animal, you will try to take a picture close from an object of known e.
ex	t can be identified. 1: male, 2: female, 3: undetermined.
Release mode	
ollowing details mentioned in the previous paragraph, the sharks will be released through 5 possible way	
brailer	ey use the same brailer used to brail the catch onboard, in that case it is used to tract the ray or skate from the purse seine.
stretcher, tarpaulin, arria" or cargo net	is light equipment, if available on the boat, can be found near the brailer.
specific equipment	e specific equipment can be a Hopper or tray with ramp, deck hatches, or other uipment. In notes you will mention the equipment.
anual from deck	e crew members handle the sharks taking them by the fins and sustaining carefull e caudal part.
ter disentangling	hen a shark is entangled in the purse seine the crew members proceed to cut the esh to extract the animal.
n conform	e release of the shark is not conform to good practices
eason of non nformity	case of non-conform release, mention the reason: RI (residual unavoidable ortality: the animal comes dead, or is not detected and is kept on board, o is tected in lower deck and cannot be handled safely); M (lack of material); NC (not mplying: good practices are not applied although the conditions allow their plication
Time	
tection of the animal	hen the shark is detected on deck, or in the net (if entangled) or at the surface the water (if extracted by brailer). Time in format GMT / UTC (Greenwich Mea me / Coordinated Universal Time) (4 digits)
lease of the animal	hen the shark is released at sea. Time in the same format.
State of the animal	
cellent, **ood,** **rrect,** **or,**	r each animal, you value on a scale of 5 values the general condition of the animal. **cellent**: Very active and energetic, strong signs of life on deck and when returned to water; **ood**: active and energetic, moderated signs of life on deck and when returned to water;

nacceptable	**rrect**: tired and sluggish, limited signs of life, moderate revival time required when returne water, slow or atypical swimming away; **or**: exhausted, no signs of life, bleeding from gills, jaw or cloaca, long revival time required nen returned to water, limited or no swimming observed upon release; **acceptable**: moribund, no signs of life, excess bleeding from gills, jaw or cloaca, unable to vive upon return to water, no swimming movement, sinks.

Verification of Good Practices ANABAC/OPAGAC

Form **B2**

version 2017

RELEASE OF ASSOCIATED FAUNA

fishing set nº:	Date:	fishing trip code
route form nº:	route line nº:	
fauna liberation form nº:		purse shaping start time: h h m m

Released fauna - sharks (1 line by individual, see example)

	individual			release mode								time		(4) state of the animal				
	(1) species	(2) size	(3) sex	using brailer	by stretcher, fabric, sarria, cargo net	with specific equipment	manual from deck	after disentangling	non conform	reason of non conformity (6)		animal detected	animal released	Excellent	Good	Fair	Poor	Unacceptable
0	FAL	140	2					1				7:35	7:47		X			
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
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24																		
25																		
26																		
27																		
28																		
29																		
30																		

Notes (5):

(1) put species code - see usual observers handbook. **(2)** in centímeters Data verified

(3) sex: 1 male; 2 female; 3 undetermined **(4)** score as show n in the manual: Excellent, Good, Fair, Poor, Unacceptable;

(5) if photos of the individuals w ere taken, mention code of the corresponding photos **(6)** RI (residual unavoidable mortality: the animal comes dead, or is not detected and is kept on board, o is detected in low er deck and cannot be handled safely); M (lack of material); NC (not complying: good practices are not applied although the conditions allow their application

If more than 30 individuals are released, continue on a new form

If the whale shark is caught in the purse seine with its head facing stern, the crew members localize the junction between two panels that is closest to the head of the animal, proceeding to cut the junction on a couple of fathoms so as to create a window through which the whale shark can escape, pulling down the panels until submersing this window (fig.3).
If the whale shark does not appear at the surface, they start to brail the catch until the whale shark appears at the surface. In that moment they stop brailing the tuna and proceed as indicated initially.
If the whale shark is small (less than 2m) they release it using the brailer.

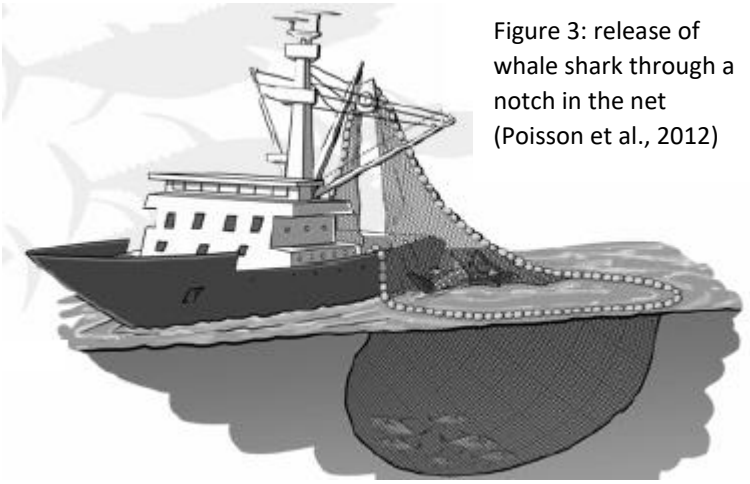

Figure 3: release of whale shark through a notch in the net (Poisson et al., 2012)

1.2.2. Registry of the information

Form B3 - Head (identical to B2, see previous table)	
Released fauna – whale sharks	
There is room for 3 individuals. Very few times you will find more in a same set. The information of each individual is registered in a same row, following the example given in row 0. If more than 3 whale sharks appear in the fishing event, you will use a second form that you will number correlatively. If you have taken pictures, mention the codes of the corresponding pictures (see example page 14).	
Individual	
Code of species	Only one species: *Rhincodon typus*. Code RHN
Size	Estimated size, in centimeters. You will always try to take a picture of the whale shark.
Sex	If it can be identified by the pterygopodes. 1: male, 2: female, 3: undetermined
Release mode	
Following details mentioned in the previous paragraph, the whale shark the sharks will be released through possible ways	
By brailer	If the animal is small (< 2m) they use the same brailer used to brail the catch onboard, in that case it is used to extract the whale shark from the purse seine.
Drowning the cork line	The crew members drown the cork line so that the whale shark can swim above it.
Notch in the purse seine	The crew members make a notch in the purse seine net close to the head of the animal to create a window, through which the whale shark can get out.
Non conform	The release of the whale shark is not conform to the good practices
Reason of non conformity	In case of non-conform release, mention the reason: RI (residual unavoidable mortality: the animal comes dead, or is not detected and is kept on board, o is detected in lower deck and cannot be handled safely); M (lack of material); NC (not complying: good practices are not applied although the conditions allow their application
Time	
Detection of the animal	When the whale shark is detected in the purse seine. Time in GMT / UTC format (Greenwich Mean Time / Coordinated Universal Time) (4 digits).
Release of the animal	When the whale shark gets out of the purse seine. Time in the same format.

State of the animal	
	Same instructions as for form B2, see previous table

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Verification of Good Practices ANABAC/OPAGAC

RELEASE OF ASSOCIATED FAUNA

Form **B3**

version 2017

fishing set nº:	Date:	fishing trip code
route form nº:	route line nº:	

fauna release form nº:

purse shaping start time			
h	h	m	m

Released fauna - whale sharks, rays (1 line/individual, see example)

	individual			release mode									time		(4) state of the animal				
	(1) species	(2) size	(3) sex	drowning the corks	notch in the net	using the brailer (small shark)	using the brailer	by stretcher, fabric, sarria, cargo net	with specific equipment	manual from deck	non conform	reason of non conformity (6)	animal detected	animal released	Excellent	Good	Fair	Poor	Unacceptable
0	RHN	520	3	1									7:49	8:36	X				
1																			
2																			
3																			
0	RMB	120	2							1			8:44	8:49		X			
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			

Released fauna - turtles (1 line/individual, see example)

	individual			release mode					onboard 1d	time		(4) state of the animal				
	(1) species	(2) size	(3) sex	after disentang.	manual from deck	through removing net/plastic remains or hook	non conform	reason n.c.		animal detected	animal released	Excellent	Good	Fair	Poor	Unacceptable
0	TTL	90	1		1					9:04	9:21	X				
1																
2																
3																
4																
5																
6																
7																

Notes (5):

(1) put species code - see usual observers handbook. (2) in centímeters Data verified

(3) sex: 1 male; 2 female; 3 undetermined **(4)** score as shown in the manual: Excellent, Good, Fair, Poor, Unacceptable;

(5) if photos of the individuals were taken, mention code of the corresponding photos **(6)** RI (residual unavoidable mortality: the animal comes dead, or is not detected and is kept on board, o is detected in lower deck and cannot be handled safely);

M (lack of material); NC (not complying: good practices are not applied although the conditions allow their application

1.3. RAYS AND SKATES

1.3.1. Release operations

If manta rays or skates appear on the surface when the purse seine is closed or when the crew is brailing the catch, the brailer can be used to take them directly from the purse seine and release them at sea. If not, they will be released when they appear on deck. If they are small, they are manually released by crew members, up by their fins, avoiding damage to the animal and without compromising the safety of the crew. If they are larger, other device type can be used, such as a tarpaulins, stretchers, sarrias (small round nets, Figure 4) or cargo nets, which prevent any damage to the animal and the crew. Depending on availability of materials, more specific equipment may also be used, such as hopper or tray with ramp or deck hatches.

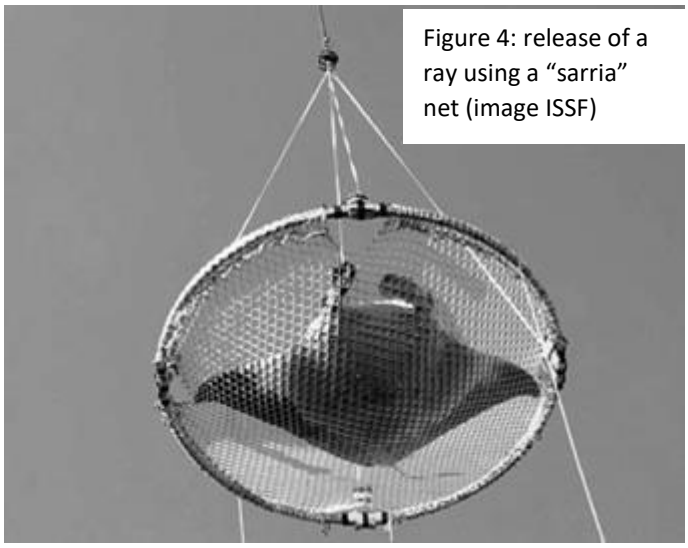


Figure 4: release of a ray using a "sarria" net (image ISSF)

Important:

- Crew members **avoid** dragging, pushing, hitting or squeezing the animal.
- As far as possible, they **avoid** leaving manta rays and skates much time on deck under direct sunlight.
- They **avoid** lifting manta rays and skates by the tail, or manipulating them by the gills or the cephalic lobes. This harms the animal and it can have dangerous reactions. In particular, handle a ray's tail is dangerous for the spine that many of these animals have on their tail.

1.3.2. Registry of the information

Form B3 - Head (same as B2, see corresponding table)	
Released fauna – rays and skates	
here is space for 12 individuals. Information of each individual is recorded in one row, following t ample given in row 0. If more than 12 rays or skates appear in the set, a second form will be used a nsecutively numbered. If you have taken pictures, photos mention corresponding codes (see examp ge 14).	
Individual	
DDE of the species	e species codes (3 digits) in your usual handbook
ze	timated or measured (if possible) size, in centimeters. If there is no time to easure the animal, you will try to take a picture close to an object of known e.
x	it can be identified. 1: male, 2: female, 3: undetermined.
Release mode	
Following details of paragraph 1.3.1., skates and rays are released by 4 modalities	
brailer	ey use the same brailer used to brail the catch onboard, in that case it is used to tract the ray or skate from the purse seine.
stretcher, "sarria" rpaulin, cargo net	is light equipment, if available on the boat, can be found near the brailer.
specific equipmen	e specific equipment can be a hopper or tray with ramp, deck hatches, or other uipment. The equipment will be mentioned in notes.
anual from deck	e crew members manipulate the rays and skates holding them by the fins and oiding manipulating the tail, the gills slits or the cephalic lobes.
n conform	e release of the ray/skate is not conform to the good practices

eason of non-nformity	case of non-conform release, mention the reason: RI (residual unavoidable ortality: the animal comes dead, or is not detected and is kept on board, o is tected in lower deck and cannot be handled safely); M (lack of material); NC (no mplying: good practices are not applied although the conditions allow their plication
Time	
tection of the imal	hen the ray or skate is detected at the surface (if extracted using brailer) or c ck. Time in GMT / UTC (Greenwich Mean Time / Coordinated Universal Time digits)
lease of the anim	hen the ray or skate is released at sea. Time in the same format.
State of the animal	
	me instructions as for form B2, see corresponding table

1.4. TURTLES

1.4.1. Release operations

If turtles are encountered entangled in devices or in the purse seine when it is being closed, the crew tries by all means to release them. They avoid above all making turtles pass through the power-block, stopping immediately the operation when detecting a turtle entangled. They proceed to the release of all turtles that can be located inside the purse seine, avoiding damaging them. Turtles are handled by the shell either by one crew member (Fig 5) or by two for large turtles. In this case they will avoid holding the shell right behind the head, to keep their hands safe if the animal retracts its head.

Important:

- The crew members **avoid** dragging, pushing, hitting or squeezing the animal.
- As far as possible, they **avoid** leaving the turtles much time on deck with direct sun.
- **They avoid** leaving turtles upside down or handling them by the legs.

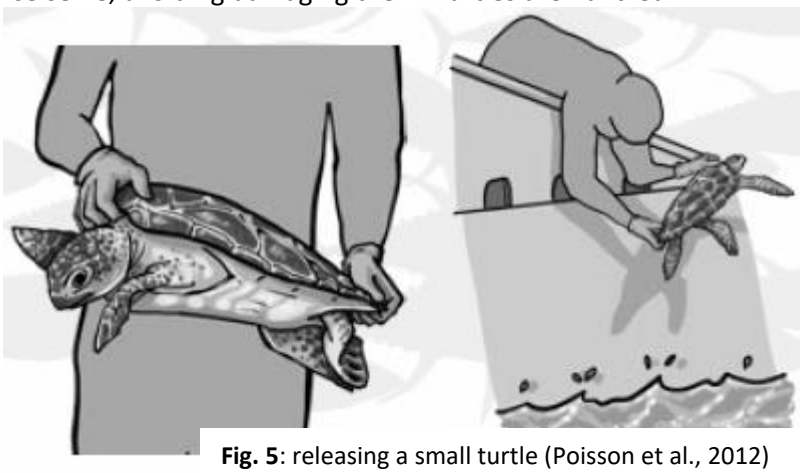


Fig. 5: releasing a small turtle (Poisson et al., 2012)

If any damage to the animal occurs during the operation, if possible the animal is kept one day onboard at shade, periodically wetted and verifying that it recovers before releasing. If the animal carries plastic or net remains or longline hooks inserted, the crew can remove them, even if they do not come from the recent activity of the vessel. Also, if when visiting an object without fishing, a turtle is found entangled, the crew should disentangle and release it in the same way.

1.4.2. Registry of the information

Form B3 - Head (same as B2, see corresponding table)	
Released fauna – turtles	
ere is room for 7 individuals. The information of each individual is registered in a same ro llowing the example given in row 0. If more than 7 turtles appear in the fishing event, you will u second form that you will number correlatively. If you have taken pictures, mention the codes e corresponding pictures (see example page 14).	
Individual	
DDE of the species	e species codes (3 digits) in your usual handbook
ze	timated or measured (if possible) size, in centimeters. If there is no time t easure the animal, you will try to take a picture close to an object of know ze.

ex	it can be identified. 1: male, 2: female, 3: undetermined.
Release mode	
llowing details mentioned in the previous paragraph, the turtles are released through 4 possib modes	
ter disentangling	e turtle is disentangled from the purse-seine or from the FAD
anual from deck	e crew members handle the turtle holding it by the Shell and avoiding olding it by the legs.
ter removing net or astic remains / hook	the animal carries plastic or net remains, or a longline hook inserted, the ew can remove and / or disentangle them, even if they do not come from e recent activity of the vessel
ay onboard	the turtle is kept one day on board to help it recover, put 1 in the rresponding square.
on conform	e release of the turtle is not conform to the good practices
eason of non-nformity	case of non-conform release, mention the reason: **RI** (residual unavoidable ortality: the animal comes dead, or is not detected and is kept on board, o is tected in lower deck and cannot be handled safely); **M** (lack of material); **NC** ot complying: good practices are not applied although the conditions allow eir application
Time	
tection of the animal	hen the turtle is detected in the purse-seine or on the FAD. Time in GMT TC format (Greenwich Mean Time / Coordinated Universal Time) (4 digits
lease of the animal	hen the turtle is released at sea. Time in the same format.
State of the animal	
	me instructions as for form B2, see corresponding table

2. STRUCTURE OF THE DEVICES (FADs)

2.1. DESIGN

The objective will be to record the detailed characteristics of all the devices that are planted, that are removed and kept on board, that are visited and on which fishing events occur. The goal will be on the one hand to be able to determine precisely the non-entangling nature of the devices, on the other hand to get detailed information on their structure and to be able to know the evolution of the type of devices. You will observe the structure and coverage of the raft (superficial part) of the devices as well as the submersed part. After notifying the captain or skipper, you can also take pictures of the devices.

Same as for fauna release, the observer should never take part in the operations done by the crew members on the devices.

Together with the current form **D** regarding the monitoring of drifting FADs, you will fill the form **D2**, in which you will record the characteristics of each device encountered and/or left at sea.

Note: the submerged part of the devices can be of three types according to the code of good practices:

- made of loose ropes or any other non-entangling material (fig.6)
- made of open nets with a mesh size ≤ 7cm
- made of old tuna nets rolled in “sausages” (fig 7)

If the crew members modify or replace a part of a device, this will be recorded in the form.

Fig 6.Device with uncovered raft and submersed part made of loose ropes

2.2. REGISTRY OF THE INFORMATION

<table>
<tr><th colspan="5">Form D2 - identification</th></tr>
<tr><td>Form D2</td><td colspan="4">Put a correlative number for each form, starting with 1 at the beginning of each trip.</td></tr>
<tr><td>Boat nam</td><td>Full name of the boat</td><td>Trip start dat</td><td colspan="2">Format: dd/mm/aaaa</td></tr>
<tr><td>Observe</td><td>Your full name</td><td>Fishing trip cod</td><td colspan="2">See example page 14</td></tr>
<tr><td>Form D nº</td><td colspan="4">The number of form D corresponding to the device you describe.
REGISTER INFORMATION FOR ALL VISIT, FISHED AT, DEPLOYED OR MODIFIED FADs.</td></tr>
<tr><td>When arriving
when leaving</td><td colspan="4">Tick the square “when arriving” and fill the row with device characteristics when encountering the device at sea.
Tick the square “when leaving” and fill the row with device characteristics when the device is left at sea, if modifications have been done.
If the device is not modified during the operation, fill only one row and tick both “when arriving” and “when leaving”.
If it is a new device deployed, fill only one row and tick “when leaving”.
If the device encountered is kept on board, fill only one row and tick “when arriving”.</td></tr>
<tr><td rowspan="2">Own / else’s</td><td colspan="2" rowspan="2">Note P (personal) if the FAD belongs to the vessel, A (another) if it belongs to another one</td><td>Date</td><td>Format: dd/mm/aaaa</td></tr>
<tr><td>Time (GMT/UTC)</td><td>Hour and minutes</td></tr>
<tr><th colspan="5">Characteristics of the FAD</th></tr>
<tr><td>Raft</td><td colspan="4">For each row, put a cross in the relevant options:
Canes/bamboo (canes and/or other vegetal material), metallic or PVC (made of metal and/or plastic elements or any other synthetic material). Write a cross on both fields if the FAD is made of both natural and synthetic materials.
NET (exterior): covered with net whose mesh whose size is ≤ 7cm or > 7cm, above and/or below.
Cover. no mesh: the raft is covered with a non-meshed material, above and/or below
No cover: the superior and/or inferior part of the raft is not covered
Cannot see: it is not possible to see the upper and/or lower coverage of the raft
They modify it: the crew members modify some elements of the raft
They replace it: the raft is entirely replaced by another one</td></tr>
<tr><td>Subsurface structure</td><td colspan="4">For each row, put a cross in the relevant options:
Sausage: the subsurface structure is made of nets rolled in “sausages” (fig 7).
Open net: the subsurface structure is made of open net.
Single pieces: the subsurface structure contains open single pieces of net
For the 3 previous options, tick either ≤ 7cm or > 7cm according to the mesh size.
Rope / no mesh: the subsurface structure contains no mesh and/or is made if loose ropes
Cannot see: it is not possible to see the subsurface structure
Without tail: there is no subsurface structure
They modify it: the crew members modify some elements of the subsurface structure
They replace it: the submersed structure is entirely replaced by another one</td></tr>
<tr><td colspan="5">ther components: If other components are present, put crosses in the corresponding squares (fields). If an animal is tangled, note the species if you can identify it (note the state of the animal in observations).</td></tr>
</table>

g. 8: Raft uncovered (image ISSF)

ʒ **7**: Device with raft covered above with non-entangling mater
ıd submersed part made with old nets rolled in “sausages”
nage ISSF)

Verification of Good Practices ANABAC/OPAGAC

Form D2 nº:

1 line by FAD if no modification, 2 lines by FAD if modification (state when arriving and state when leaving)

BOAT name: | **Fishing trip start date:**

OBSERVER: | **Fishing trip code:**

Nº Form D	when arriving	when leaving	own / else's	DATE	TIME	RAFT: Canes / Vegetal	RAFT: Metallic or PVC	RAFT: Superior: Net ≤ 7cm	RAFT: Superior: Net > 7cm	RAFT: Superior: cov. w/o net	RAFT: Superior: non covered	RAFT: Superior: not visible	RAFT: Inferior coverage: Net ≤ 7cm	RAFT: Inferior coverage: Net > 7cm	RAFT: Inferior coverage: cov. w/o net	RAFT: Inferior coverage: non covered	RAFT: Inferior coverage: not visible	RAFT: they modify it	RAFT: they replace it	SUBSURFACE STRUCTURE: net in sausage ≤ 7cm	SUBSURFACE STRUCTURE: net in sausage > 7cm	SUBSURFACE STRUCTURE: open net ≤ 7cm	SUBSURFACE STRUCTURE: open net > 7cm	SUBSURFACE STRUCTURE: single net pieces ≤ 7cm	SUBSURFACE STRUCTURE: single net pieces > 7cm	SUBSURFACE STRUCTURE: rope / no mesh	SUBSURFACE STRUCTURE: not visible	SUBSURFACE STRUCTURE: no subs. struct.	SUBSURFACE STRUCTURE: they modify it	SUBSURFACE STRUCTURE: they replace it	OTHER COMPONENTS: plastic	OTHER COMPONENTS: Corks	OTHER COMPONENTS: Bags	OTHER COMPONENTS: Palms, canes...	OTHER COMPONENTS: Color belts	OTHER COMPONENTS: weights	OTHER COMPONENTS: entangled animal
45	*X*			*14/03/2014*	*13:22*	*X*		*X*								*X*		*X*		*X*														*X*			
45		*X*		*14/03/2014*	*13:22*	*X*				*X*					*X*					*X*														*X*			

3. TRANSMISSION OF THE INFORMATION

3.1. Excel File

The information registered during the day in the forms will also be introduced in the attached Excel file. You will find a common table for the information of forms B2 and B3, and another one for the information of forms D2.

In these tables you will fill **one row by individual** in the case of release operations (forms B2 and B3) and **one or two rows by device** in the case of form D2 (just as in in the paper form).

These tables are composed of three fields (from left to right): one field for general information, one field for event identification, and one field for release characteristics (forms B2 and B3) or device characteristics (forms D2). The subfields to be filled in each one are the following:

eneral information (both sheets):	oat	
oserver's Name	Observer	
Boat	p code	
entification of the event (forms B2 and B3)	**entification of the event (form D2)**	
hing set nº	rm D2 nº	
ıte	rm D nº date	
ute form nº	nen arriving / when leaving	
ute line nº	vn /else's (write P or A)	
ıadrant sector (same as in ObServe Data Base)	te and time	
for NE, 2 for SE, 3 for SW, 4 for NW)	ıadrant sector (same as in ObServe Data Base)	
titude (deg and min, degrees South as negative)	for NE, 2 for SE, 3 for SW, 4 for NW)	
ngitude (deg and min, degrees West as negative)	titude (deg and min, degrees South as negative)	
lease form nº	ngitude (deg and min, degrees West as negativ	
ırse shaping start time		
	mber of photos / - code first photo	
ıaracteristics of release (forms B2 aı 3)	**aracteristics of the device (form D2)**	
dividual	ft	
ecies	nes/vegetal	net with mesh ≤ 7 cm below
ze	etal or PVC	net with mesh > 7 cm below
x	t with mesh ≤ 7 cm above	covered w/o mesh below
lease mode	t with mesh > 7 cm above	non covered below
ing the brailer	vered without mesh above	cannot see below
stretcher, tarpaulin, "sarria" or car	n covered above	hey modify it
et	nnot see above	hey replace it
specific equipment	bmersed part	
anual from deck	sausage » with mesh ≤ 7 cm	ope / no mesh
ter disentangling	sausage » with mesh ≤ 7 cm	cannot see
owning the cork line	en with mesh ≤ 7 cm	no submersed part
rough a notch in the net	en with mesh > 7 cm	hey modify it
ter removing net / plastic remains	ngle net pieces w mesh ≤ 7 cm	hey replace it
ook	ngle net pieces w mesh > 7 cm	
nboard 1 day		
n conform	her elements	
ason of non-conformity	astic containers	palms / canes
tection time and release time of t	rks	color belts
nimal	gs	veights
ate of the animal – value (P, M, S or	tangled animal (species) (note the sta	
ch part : eyes, head, skin, fins and g	the animal in observations).	
ts (sharks, rays) or legs and sh		
urtles)		

The data of latitude and longitude will be taken from the usual form A.

The goal is simply to introduce the same information in one single Excel file, always filling **one row by individual** in the case of release operations (forms B2 y B3) and **one or two files by FAD (according to the case)** in the case of device characteristics (form D2).

3.2. After the fishing trip

- **The filled forms must be always under your control during the way back.** They must never be delivered to a third person, or put into a bag that will travel in the baggage hold, or deposited in a left-luggage office.
- Notify, immediately after your arrival, Foundation AZTI (contacts below) and follow the instructions that will be given to you for data sending.
- **You will then deliver all the forms ordered and the material that was given to you, as well as all the samples and pictures you have taken.**

ZTI		
A - AZTI shing Port, Victoria ahe, SEYCHELLES el + 248 670300 ax: + 248 224508	errera kaia portualdea z/g 0110 Pasaia (Gipuzkoa) PAIN el +34 94 657 40 00 ax: +34 94 657 25 55	atxarramendi ugartea z/g 3395 Sukarrieta (Bizkaia) PAIN el +34 94 657 40 00 ax: +34 94 657 25 55
igo Krug el. +248 278 69 94 rug@azti.es	**n López** el. +34 634 20 97 38 pez@azti.es	**n Ruiz** el. +34 667 17 43 75 uiz@azti.es

ther addresses where to let the paper forms for sending	
tlantic Ocean	**ndian Ocean**
entre de Recherche Océanologique (C.R.O.) P V18 BIDJAN **ÔTE D'IVOIRE** ax: (225) 21 35 11 55	eychelles Fishing Authority (SFA / AZTI*)* P 449 CTORIA, Mahé **EYCHELLES** ax: (248) 670300
entre de Recherches Océanographiques Dakiaroye (C.R.O.D.T.) P 2241 AKAR **ENEGAL** ax: (221) 33 832 82 62	rres australes et antarctiques françaises (TAAF) ue Gabriel Dejean 7410 Saint-Pierre, île of the Réunion **RANCE** el: 0(033)2 62 96 78 78

As specified in the observers' handbook, when finalizing your trip onboard you must provide **a report** of three or four pages summarizing your general impression, as well as problems, observations and suggestions. Apart from this report, you will summarize on one page the following points:

Fauna release:

Eventual problems or difficulties to observe and/or identify the operations, to identify the species, to estimate the state of the animals.

Easiness or difficulties for the crew members to realize release operations that are conform to the code of good practices.

Non entangling devices:

Eventual problems or difficulties to observe and/or identify the non-entangling devices

Suggestions

to solve those problems, if encountered

Other problems or difficulties and other suggestions

4. GENERAL RECOMENDATIONS

- Note down the information right after their observation. Do not rely on your memory.
- All the information will be noted, by pencil (type B1 or HB2), at the moment of their observation.
- The information must be readable and the corresponding forms and spaces must be completed.
- If you are not sure about a given element, leave the corresponding space blank and put an explanatory note in the section **NOTES**.
- At night, check all the information you have taken during the day.
  - If you see you have forgotten to mention an element and can recover it, add it on the form.
  - However, if you are not sure about the exactness of the recovered information, do not mention it in the form.
- Once you have checked that all the data are as complete as possible, tick the square **Data verified**, situated in in the lower part of each form.

HANDBOOKS THAT MUST BE IN YOUR POSSESSION

- Handbook of observers onboard tuna purse-seiners 1
- Handbook of observation of good practices onboard ANABAC and OPAGAC tuna purse seiners (the present handbook) 1

FORMS (in addition to the usual ones):

The following amounts refer to the needs for 1 or 2 trips (60 to 85 days at sea):

✓	Forms B2 (release)	80	YES / NO
✓	Forms B3 (release)	50	YES / NO
✓	Forms D2 (devices D2)	25	YES / NO

CODE of the FISHING TRIP:

It is a 14-digit alphanumeric code. You will make this code using the initials of the observer, of the name of the ship and the trip start date (departure from port) be drawn. Example:
Observer: Gorka Ocio Andrés; Boat Egaluze; start date 2014-april-05: **GOAEGA20140405**

CODE of the PICTURES:

You will use the code of the fishing trip + the FAO code of the species and a correlative number. In the case of devices, you will add FAD and a correlative number, starting from 1. The numbering will be distinct for released species and for FADs. Examples:

Rhincodon typus (shark whale shark): GOAEGA20140405_RHN.01
Device: GOAEGA20140405_FAD.01

OTHER:

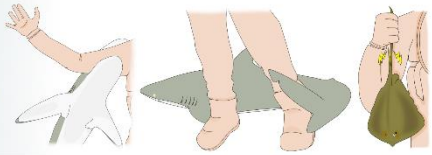
Among your persona effects, you must wear a watch. We suggest including waterproof clothes and shoes for use in the inner rooms (rest).
Japanese-type cotton gloves, helmet and safety footwear for use in working deck and / or lower deck are provided by the owner and should be requested to the supervisor once shipped.

RETURN THE UNUSED FORMS TO SFA-AZTI, do not leave any equipment onboard

ANNEX 2

Código de Buenas Prácticas
Code of Good Practices
Code de Bonnes Pratiques

Riesgos
Risks
Risques



Requisitos Requisites Requises

Material liberación
Release tools
Libération outil

No aleteo
No finning
Pas d´aileronnage

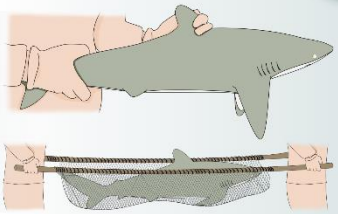
No enmallante
Non-entangling
Non maillants

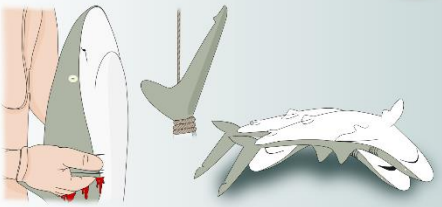
100% Observadores
100% Observers
100% Observateurs

Si Yes Oui

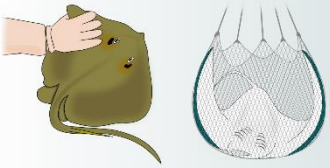
No Non

Tiburón
Shark
Requin

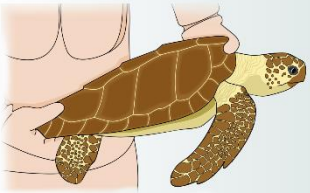


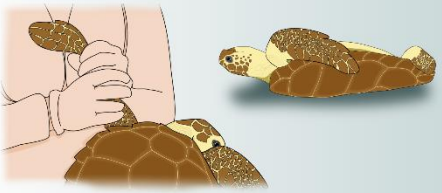


Mantarraya
Manta ray
Raie manta

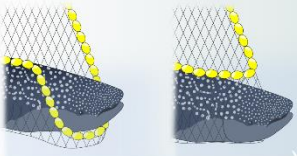


Tortuga
Turtle
Tortue





Tiburón ballena
Whale shark
Requin baleine



References: Poisson F., Vernet A. L., Séret B., Dagorn L. 2012. Good practices to reduce the mortality of sharks and rays caught incidentally by tropical tuna purse seiners.
https://www.azti.es/atunerocongeladores/recursos/buenas-practicas-para-una-pesca-atunera-de-cerco-responsable/

Diseño: Izaskun Alberdi Landaluze