# Main results of the Spanish Best Practices program: evolution of the use of Non-entangling FADs, interaction with entangled animals, and fauna release operations

Jon Lopez[1], Nicolas Goñi[1], Igor Arregi[1], Jon Ruiz[2], Iñigo Krug[3], Hilario Murua[1], Jefferson Murua[2], Josu Santiago[2]

## Introduction

About half of the tropical tuna caught worldwide annually is fished by purse seiners mainly using fish aggregating devices (FADs). These devices, although being a very effective fishing tool, are also controversial due to their potential impacts on the ecosystem. Since 2012, Spanish tuna freezer organizations OPAGAC and ANABAC have a voluntary self-regulated code for responsible tuna fishing. This agreement aims to decrease impacts and improve the long-term sustainability of the tuna fishery, with particular emphasis on FAD-related issues. The code promotes best fishing practices by reducing mortality of incidental catch of sensitive species (sharks, rays, mantas, whale sharks, and sea turtles) and the use of non-entangling FADs. In addition to that, the agreement is based on the following points: 100% observer coverage, continuous training of fishing crew and scientific observers, implementation of a FAD logbook, creation of a Steering Committee and continuous monitoring and data analysis by the independent scientific body AZTI.

In order to monitor and assess the level of compliance of these good practices, a system of monitoring and verification has being implemented since late 2014, and is continuously evaluated, in all the vessels of the ANABAC and OPAGAC fleets (64 purse seiners and 23 supply vessels), including Spanish and other flags, operating globally in 4 tuna RFMOs areas (ICCAT, IOTC, WCPFC and IATTC). The verification is based on specifically designed data-collection forms and in-situ observations recorded by trained scientific observers, and more recently, also by electronic monitoring systems (see the other document in this meeting by Lopez et al. to get details on the system of verification). Although several research institutes are involved in the program (e.g. IEO, Ocean Eye, SFA, TAAF, CSP…), AZTI is in charge of coordinating data collection and its posterior analysis by specifically developed R routines and programs. Significant results of the first two years of the Code of conduct are presented and discussed in this document.

## Data

Since the introduction of AZTI in the program as independent research body, information on more than 450 fishing trips have been collected and analysed for 2015-2016 (A total of 899 fauna release and FAD-related forms; Table 1). Although some trials were conducted at the beginning of the program in the Pacific Ocean with the Good Practices forms, their use was not finally established, due to certain restrictions outside the program's control. However, the successful collaboration with IATTC and WCFPC permitted to obtain data of vessels operating under its observer programs, which also include certain information of interest on the interaction and faith of sensitive species and FAD data.

In this analysis, a total of 37879 FADs have been observed and analysed, as well as 30355 fauna release operations (Table 2).

## Fauna release operations

In the Atlantic Ocean, a total of 13211 fauna release operations have been observed and analysed during 2015 and 2016. The level of conformity in the handling and releasing practices is very high, exceeding 80-90% of the conformity for most of the animal groups (sharks, whale sharks, rays and turtles) and reaching 100% in some cases (whales) (Table 3). Hammerheads and mantas, instead, showed values around 70% of conformity (66.5% and 70.6%, respectively). Figure 1 shows the evolution and the boxplots of the level of conformity for each animal group throughout the first two years of the program in the Atlantic Ocean.

[1] AZTI. Herrera Kaia Portualdea z/g, 20100 Pasaia, Basque Country, Spain., jlopez@azti.es
[2] AZTI. Txatxarramendi ugartea z/g - 48395 Sukarrieta, Basque Country, Spain.
[3] AZTI. Laurier Rd, 361 Victoria, Seychelles.

Although variability can be observed between trips, the level of conformity is high for most of the vessels and animal groups. Similarly, the analysis of the releasing time showed that most of the vessels use reasonable times for fauna liberation (<5 mins). In general, vessels showed improvements in this aspect in the last 6 months as well.

In the Indian Ocean, a total of 4646 fauna release operations have been observed and analysed during 2015 and 2016. The level of conformity in the handling and releasing practices is very high, exceeding 85% of the conformity for sharks and rays, and reaching 100% for turtles (Table 4). Mantas showed values around 70% of conformity. In the fishing trips analysed so far, no interaction with whale sharks, whales and hammerheads were observed. Figure 1 shows the evolution and the boxplots of the level of conformity for each animal group throughout the first two years of the program in the Indian Ocean as well. The level of conformity observed for most of the groups was high and the time used to release animals was reasonable.

As mentioned previously, the data provided by the IATTC for the Pacific did not completely fit Good Practices data requirements. However, it contained interesting information on the fate of the sensitive species included in the program. The destiny of a total of 12498 animals was investigated. The percentage of animals released as "released alive", "returned to the sea", "released unharmed" or "not involved in set" categories was high for all the groups (~90% or even 100% in some cases), except for sharks and hammerheads (41 and 63%, respectively) (Table 5). Figure 2 shows the evolution and the mean values of each releasing practice for each animal group considered in the program for Spanish vessels operating in the Pacific Ocean.

**FAD-structures and components**

During the first two years of the program, a total of 37879 FADs were observed and analysed (Table 2).

The number of FADs for which information was collected in the Atlantic Ocean and their entangling degree are shown in Table 2 and Figure 3. Vessels use about 50-200 FADs in each fishing trip in this area, only considering FADs left at sea. As it can be seen in Fig. 3, the degree of entanglement has been reducing through time and today many FADs are totally non-entangling. The major non-conformity in the construction is the use of non-permitted material in the upper part of the raft. Currently, there are very few FADs that present both raft and underwater part with certain non-conformity material (Fig. 3). It is interesting to note that the number of FADs for which the total conformity cannot be evaluated appears to be somehow important (~35%). However, the analysis in the verification system is able to reflect vessels' behaviours and suggest vessel-specific changes where necessary.

In the Indian Ocean, the number of FADs used and analyzed for each fishing trip and vessel ranged between ~50 and 300. As for the Atlantic Ocean, FADs that are completely in non-conformity have almost dissapeared (Fig. 3), and the main issue is related to the material used to cover the upper part of the raft. It is also interesting to note that the percentage of totally non-entangling FADs that are currently used has increased considerably through time (Fig. 3). Likewise, there is a significant part of the FADs that cannot be completely evaluated, as certain parts of the FADs were not observed or recorded by the observer (~30%). As such, future efforts may be conducted to try to lift all FADs that are encountered at sea. This improvement would assist to better understand the deterioration of the underwater part of the FADs through time as well as assess their progressive entangling potential.

In the Pacific Ocean, the number of FADs observed and analyzed for each fishing trip was 25-250. The data collected in this region lack information on the mesh size used to construct/cover the raft of the FAD. However, this data contains information on the mesh size used in the underwater part of the object. Because of this, the analysis conducted for this region was not identical to that applied in the Indian and Atlantic Oceans. Figure 4 shows the evolution and use of the different mesh size nets (< 3 cm; > 3 cm) to construct the underwater part of the FADs by the Spanish fleet. However, the ways nets are structured to construct the underwater parts are unknown (sausages, etc.), so the entangling potential cannot be accurately assessed for each FAD and thus, results are just descriptive. The 8872 FADs investigated in the two years data of the Pacific Ocean showed that 11 individuals were entangled at FADs (4 sharks, 7 turtles; Table 6). This means that the entangling ratio was 0.12% for the analyzed data. Detailed results on the entangling potential by mesh size category are shown in Table 6.

Results of the assessed fishing practices are used six-monthly to provide scientific advice to fishing companies and the Steering Committee, who take corrective mechanisms where necessary.

**Table 1.** Number of fishing trips with forms of Good Practices (except *, which are data of IATTC observer program) collected during 2015-2016 for Spanish fleet operating in the Atlantic, Indian and Pacific Oceans.

| | **Atlantic Ocean** | **Indian Ocean** | **Pacific Ocean** | **Total** |
|---|---|---|---|---|
| **D2** | 341 | 53 | 77* | 471 (394) |
| **B2 & B3** | 278 | 33 | 117* | 428 (311) |
| **Total** | 619 | 86 | 194* | 899 (705) |

**Table 2.** Summary of the number of individuals manipulated and FADs evaluated in the 2015-2016 period.

| | **Fauna Release** | **FAD structure** |
|---|---|---|
| **Atlantic Ocean** | 13211 | 22532 |
| **Indian Ocean** | 4646 | 6475 |
| **Pacific Ocean** | 12498 | 8872 |
| **Total** | 30355 | 37879 |

**Table 3.** Summary of the species groups caught and released by Spanish tropical tuna purse seiners in the Atlantic Ocean for the 2015-2016 period and its level of conformity in handling and releasing practices. Note: the figures below do not correspond to the proportion of these species in the incidental catch but on the manipulated individuals.

| **Group** | **Proportion of individuals manipulated** | **Conformity** |
|---|---|---|
| Whales | 0.03 | 100 |
| Hammerheads | 16.7 | 66,5 |
| Mantas | 4.9 | 70,6 |
| Rays | 0.8 | 89,9 |
| Whale Sharks | 0.5 | 90 |
| Sharks | 68.1 | 82,6 |
| Turtles | 8.9 | 94,9 |

**Table 4.** Summary of the species groups caught and released by Spanish tropical tuna purse seiners in the Indian Ocean for the 2015-2016 period and its level of conformity in handling and releasing practices. Note: the figures below do not correspond to the proportion of these species in the incidental catch but on the manipulated individuals.

| **Group** | **Proportion of individuals manipulated** | **Conformity** |
|---|---|---|
| Whales | 0 | - |
| Hammerheads | 0 | - |
| Mantas | 0.6 | 69,2 |
| Rays | 0.3 | 86,7 |
| Whale Sharks | 0 | - |
| Sharks | 98.8 | 85 |
| Turtles | 0.3 | 100 |

**Table 5.** Summary of the species groups caught and released by Spanish tropical tuna purse seiners in the Pacific Ocean for the 2015-2016 period and their corresponding values for each destiny category. Note: the figures below do not correspond to the proportion of these species in the incidental catch but on the manipulated individuals.

| Group | Proportion of individuals manipulated | Percentage |
|---|---|---|
| Hammerheads | 0.26 | 63.6 |
| Mantas | 0.06 | 100 |
| Rays | 0.10 | 100 |
| Whale Sharks | 0.06 | 87.5 |
| Sharks | 98.5 | 40.9 |
| Turtles | 1.01 | 92 |

**Table 6.** Summary of the number of entanglements and the category of the mesh size of the net used to construct the underwater part of the FADs analyzed in the first two years of the program in the Pacific Ocean.

| Category | Number of FADs | Freq. entanglements | Percentage |
|---|---|---|---|
| **(0,3]** | 3047 | 4 | 0.1 |
| **(3,10]** | 2483 | 1 | 0.0 |
| **(10,20]** | 2826 | 2 | 0.1 |
| **(>20]** | 21 | 0 | 0.0 |
| **NA** | 495 | 4 | 0.8 |

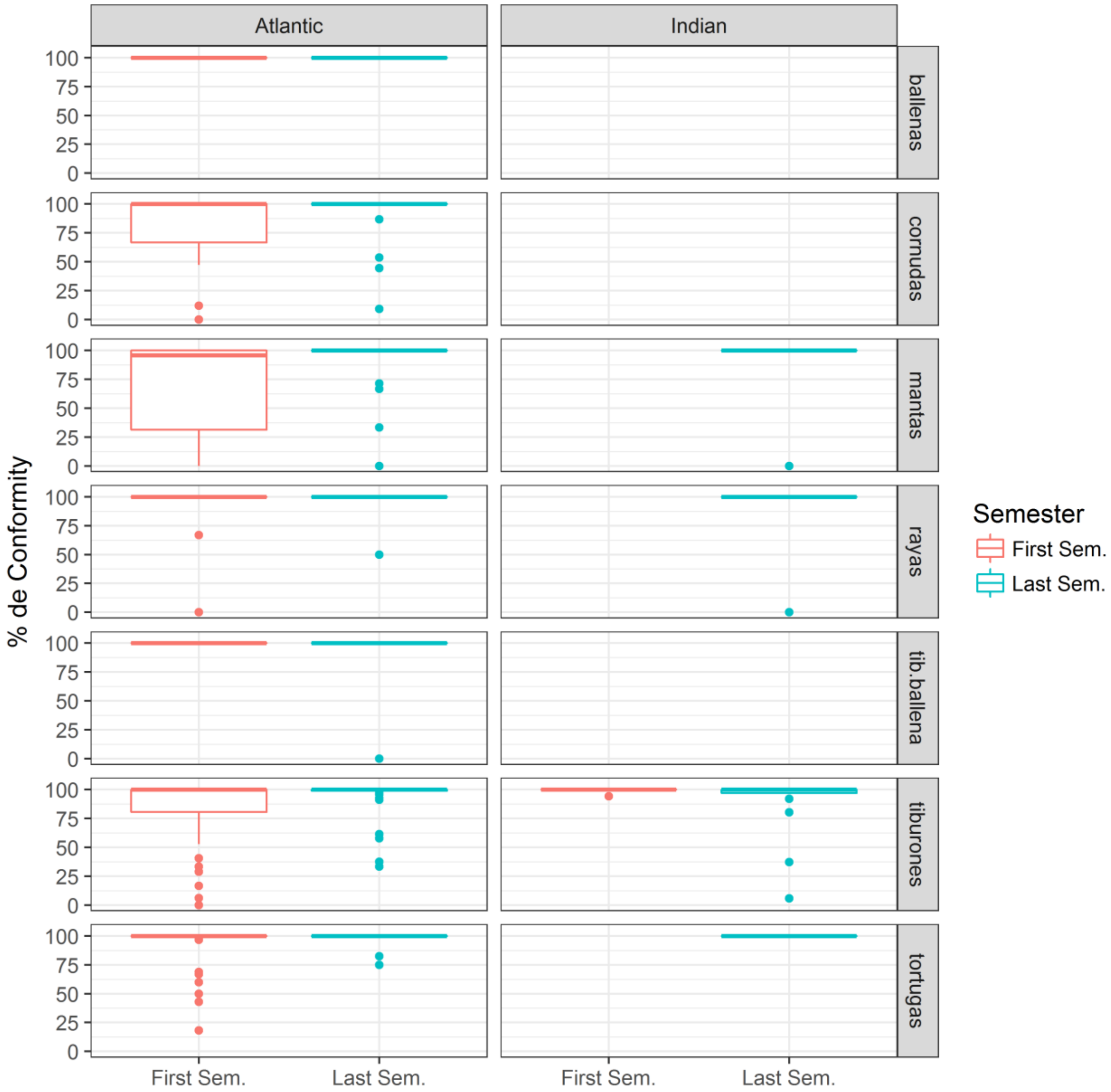


**Figure 1.** Evolution of the level of conformity of fauna release operations for each animal group in the Atlantic and Indian Oceans during the first years of the program. "First Sem." corresponds to the first semester of 2015 whereas "Last Sem." corresponds to the last semester of 2016.

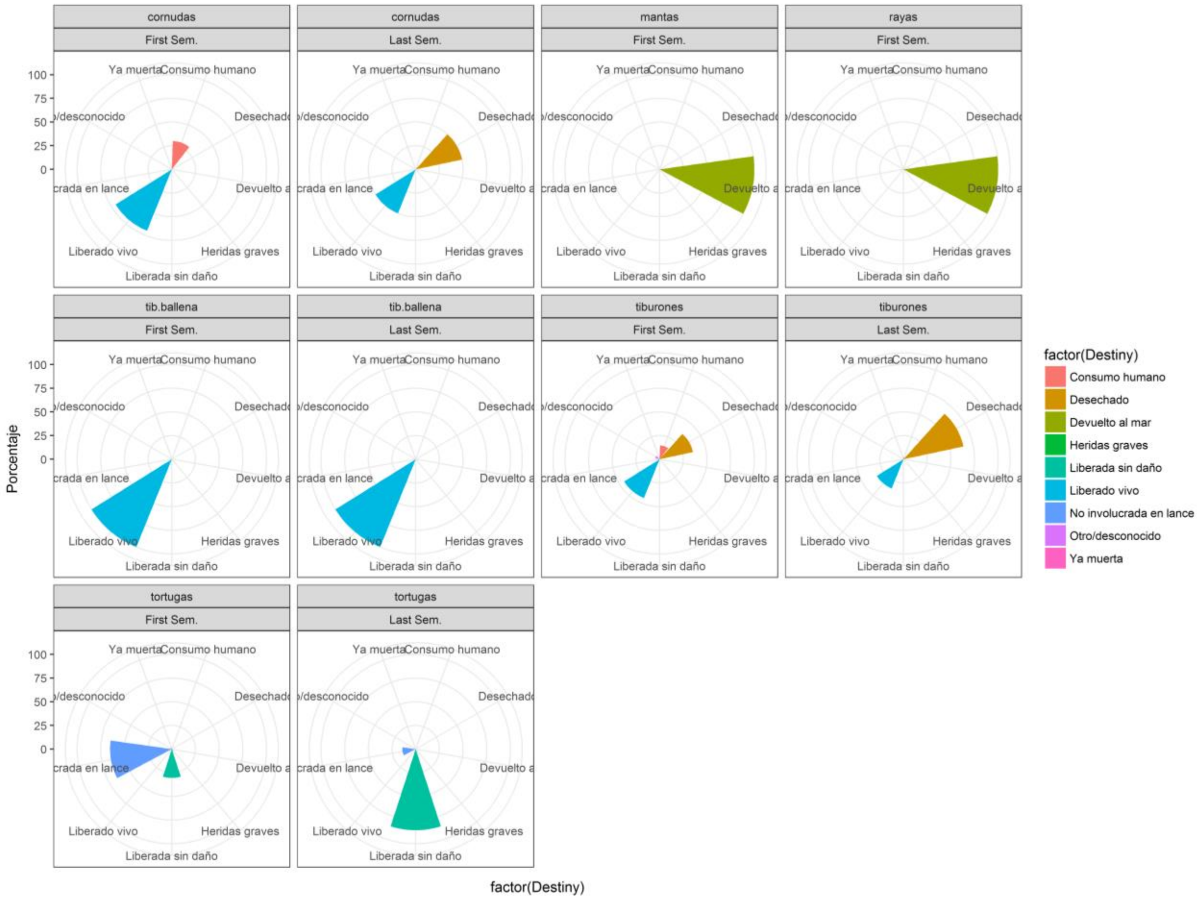


**Figure 2.** Evolution of destiny category for each animal group in the Pacific Ocean during the first years of the program. "First Sem." corresponds to the first semester of 2015 whereas "Last Sem." corresponds to the last semester of 2016.

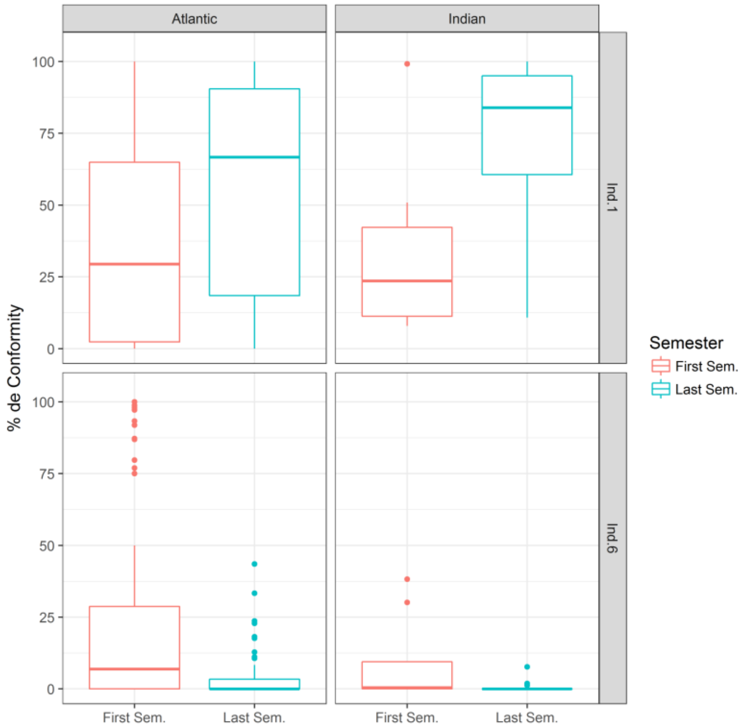


**Figure 3.** Evolution of the Index 1 (totally conform) and Index 6 (raft and underwater part non-conform) FAD categories in the Atlantic and Indian Oceans during the first years of the program (re-scaled with no consideration of unknowns [~35% of observations]). "First Sem." corresponds to the first semester of 2015 whereas "Last Sem." corresponds to the last semester of 2016.

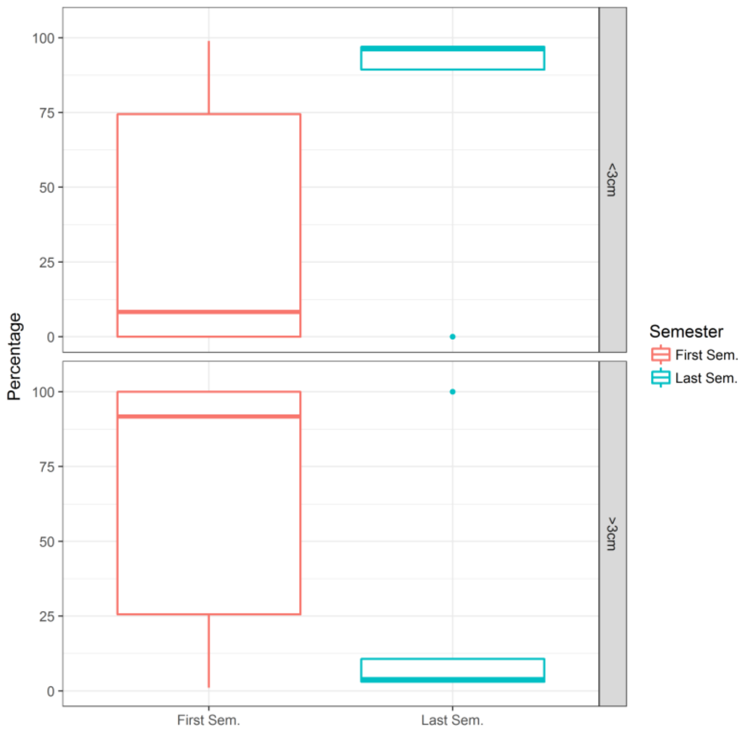


**Figure 4.** Evolution of the FAD underwater part mesh size categories (<3cm or >3cm) in the Pacific Ocean during the first years of the program (re-scaled with no consideration of unknowns [6.9% of the observations]). "First Sem." corresponds to the first semester of 2015 whereas "Last Sem." corresponds to the last semester of 2016.