COLLECTING DATA ON BOARD FRENCH AND ITALIAN TROPICAL TUNA PURSE SEINERS WITH COMMON OBSERVERS: RESULTS OF ORTHONGEL'S VOLUNTARY OBSERVER PROGRAM OCUP (2013-2017) IN THE INDIAN OCEAN

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Abstract

In order to comply with the different regulations and commitments requesting the presence of scientific observers onboard French and Italian purse seiners, and since it is not possible to embark more than one observer during a fishing trip, ORTHONGEL has imagined and implemented since July 2013 a program to facilitate and optimize the boarding of well-trained scientific observers. This voluntary program, called OCUP for "Observateur Commun Unique et Permanent" (Common Permanent Unique Observer) was conducted with the Institute for Research and Development (IRD), Oceanic Développement (OD), the Seychelles Fishing Authorities (SFA) and several coastal countries. It was implemented in both Atlantic and Indian Oceans where the fleet of the fishing companies member of ORTHONGEL is active. This paper describes the methodology of the OCUP program and presents and discusses its main results, focusing on the Indian Ocean. 32 scientific observers from 4 Indian Ocean coastal countries have been trained as OCUP. Together with 44 observers from IRD and OD, 24 of these Indian Ocean scientific observers have covered more than 250 trips until September 1st, 2017 (completed by 74 trips electronically observed) and the total coverage of days at sea of the French fleet has reached 84.4% in 2016. Since 2013, the OCUP program allows a better coverage of many fishing information such as bycatch or incidental catch and discards data but also provides the boat-owners information on the implementation of best practices aboard their vessels. Lessons learned from this program allow the authors to suggest a few recommendations.

Résumé

Afin de satisfaire aux différentes régulations et aux différents engagements pris par la flotte française et italienne de thoniers senneurs tropicaux, et puisqu'il n'est pas possible d'embarquer plus d'un observateur par marée, ORTHONGEL a imaginé et mis en place depuis 2013 un programme pour faciliter et optimiser l'embarquement d'observateurs scientifiques de bonne qualité. The programme volontaire, appelé OCUP (Observateur Commun Unique et Permanent) a été développé en collaboration avec l'Institut de Recherche pour le Développement (IRD), Oceanic Dévelopement (OD), la Seychelles Fishing Authorities (SFA) et plusieurs pays côtiers. Le programme a été mis en place dans les océans Atlantique et Indien où est active la flotte de senneurs adhérente d'ORTHONGEL. Ce document décrit la méthodologie du programme OCUP et présente et discute ses principaux résultats, en se concentrant sur le cas de l'Océan Indien. 32 observateurs provenant de 4 pays côtiers de l'Océan Indien ont été formés comme observateur OCUP. En complément des 44 observateurs français employés par l'IRD et OD, 24 de ces observateurs scientifiques de l'Océan Indien ont réalisé plus de 250 marées d'observation à ce jour (auxquelles s'ajoutent 74 marées observées de façon électronique) et le taux de couverture total des jours de mer observés a atteint 84.4% en 2016. Depuis 2013, le programme OCUP permet une meilleure couverture de nombreuses informations telles que les prises accessoires, les prises accidentelles d'espèces sensibles ou encore les rejets. Le programme fournit également aux armements des informations utiles sur le respect des bonnes pratiques à bord. Sur la base du retour d'expérience du programme, les auteurs formulent quelques recommandations.

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1. Introduction

The use of onboard scientific observers to monitor the activities of fishing vessels and collect fishing data for scientific purposes (*i.e.* stock assessment) is requested by international law (art. 62 of UNCLOS, 1982), the FAO guidelines for the promotion of responsible fishing practices (art. 84.3 of the FAO Code of Conduct for Responsible Fisheries, 1995), as well as IOTC resolutions 11/04. In the case of the tropical tuna purse-seiners operating in several EEZs, the flag State as well as several coastal countries (through fishing agreements) are therefore requesting the boarding of observers on board French and Italian purse seiners. In addition, the degree of accuracy of catch and discard data to be reported in logbooks is such that the presence in the crew of an observer collecting this information provides a useful assistance to skippers. Finally, the need for transparency and/or certification of the catch (e.g. FAD-free certificates) has brought ORTHONGEL member fishing companies to consider having accredited observers permanently onboard.

Since July 2013, as it is not possible to embark more than one observer at a given time, ORTHONGEL has imagined and implemented a program to facilitate and optimise the boarding of scientific observers able to fulfil most of the tasks requested by the above-mentioned regulations or commitments taken by the French and Italian fleet. This voluntary program, called OCUP for "Observateur Commun Unique et Permanent" (Common Permanent Unique Observer) is conducted in collaboration with the French Institute for Research and Development (IRD), Oceanic Développement (OD), BIGEYE SARL (BE) and the Seychelles Fishing Authorities (SFA). The coordination of the program and the training of observers is funded by ORTHONGEL, France Filière Pêche (FFP) and French canneries (see http://www.orthongel.fr/ocup.php for more information).

The program is implemented in both the Atlantic and Indian Oceans where the purse seiners of ORTHONGEL member fishing companies are active. In the Indian Ocean, participating coastal countries are Comoros, Madagascar, Mauritius and Seychelles. The general objective of the program is to address the requests of different origins with potential different contents in terms of observation aboard French and Italian purse seiners: (i) IRD for mandatory (EU Data Collection Framework – DCF, R(CE) 199/2008) or additional scientific data collection, (ii) French administration in compliance with RFMOs' regulations, (iii) coastal States in compliance with fishing agreements obligations (Sustainable Fisheries Partnership Agreement – SFPA – signed with EU or private agreements signed with ORTHONGEL), and (iv) fishing companies to certify commitments made in the frame of responsible fishing schemes.

This paper aims to describe the methodology of the OCUP program and presents and discusses its main results, focusing on the Indian Ocean. Observer data collected since 2013, that contains detailed and specific information available to scientists on the major catch (skipjack, yellowfin, bigeye and albacore tuna), bycatch (minor tunas and finfishes that could be landed, including discards) or incidental catches (sharks, rays or turtles not wanted by fishermen, including releases of alive individuals) are only briefly analysed here.

2. Methodology of the OCUP program

2.1. Definitions

Typology of observer trips in the Indian Ocean

In this paper, we distinguish three types of reasons for a common observer to be placed onboard a French and Italian purse seiners in the Indian Ocean: he can be placed onboard (i) by the Flag State in the frame of the, (ii) by a Coastal State as a consequence of a provision of the fishing agreement allowing the vessel to fish in its EEZ or (iii) by OD implementing ORTHONGEL's request to voluntary cover all fishing trips.

Although the work of the observer onboard is the same, it is necessary to distinguish these three kinds of observer trips to reflect the following differences:

- Observers on a "DCF" trip are mandated by the flag State and paid by the DCF, a 10% minimum coverage is mandatory as requested by EU regulation in relation to IOTC minimum observer coverage standards;

- Observers on a "fishing agreement" trip are mandated and paid by a Coastal State (generally the fishing agreement implies a contribution by the fishing companies), there is no minimum coverage but refusing such observer could be considered as not complying with the disposition of the fishing agreement;
- Observers on an "OCUP complement" trip are mandated by ORTHONGEL and paid by OD (which then bills the fishing companies), these observers embarked with the objective of reaching 100% of observed fishing trips.

In addition, the French Southern and Antarctic Lands (Terres australes et antarctiques françaises, TAAF) impose the boarding of IRD-TAAF observers onboard purse seiners granted access to its EEZ. The characteristics of the TAAF observer program prevented this program to be included in the OCUP coordination. Trips covered by IRD-TAAF observers are referred as "TAAF" and were not treated in this paper, except when analysing the total observation coverage of the fleet.

Finally, due to the risk of piracy in Indian Ocean, protection teams have systematically embarked onboard French and Italian purse seiners since July 2009, which prevented the boarding of observers aboard the smallest purse seiners. For these vessels (7 of the 12 French vessels), ORTHONGEL initiated in 2015 another program called OOE for "Optimisation de l'Oeil Electronique" (Optimization of Electronic Monitoring) described in Briand *et al*., 2017 using cameras onboard to collect information on the activity and catch of the vessel. A fourth type of covered trips is therefore defined as "eObservation". Installing and maintaining the cameras is the responsibility of the fishing companies, processing the videos collected is done by OD observers who have received a specific training. In the future, we are considering to extend this training to national observers.

Hereafter, the terminology "IRD/TAAF coverage" will refer to DCF and TAAF trips while the terminology "additional coverage" will refer to fishing agreements, OCUP complement and eObservation trips.

Program OCUP, OCUPs and OCUP fishing trips

The term "OCUP" will thereafter be used to refer to scientific observers trained within the OCUP framework and the terminology "OCUP fishing trip" will be used to designate fishing trips covered by an OCUP (DCF, fishing agreements and OCUP complement trips). Independently of the funding, all fishing trips covered by OCUPs (DCF, national observers or observers embarked to complement the coverage to its maximum) are coordinated by the program since 2013.

Here, it must be noted that though OCUP could be considered as scientific or transparency observers, they should not be considered as controllers, as recommended by the Scientific Committee. It is however clear and accepted by French and Italian skippers and fishing companies that data collected by national scientific observers trained as OCUPs can be used in case of possible litigation, as a consequence of transparency.

2.2. General organization of the program

The OCUP program started first through a trial period (from July 1st, 2013 to December 31st, 2014) and is routinely implemented since January 1st, 2015.
. Since the beginning of the program OCUP, actions have consisted in:

- defining with other stakeholders (participating flag and coastal States fisheries administrations and scientific institutes) the priorities and conditions of boarding to guaranty the security, reliability and independence of scientific observers in accordance with minimum standards internationally agreed;
- setting a coordination for a permanent boarding of observers on all French (12) and Italian (1) purse seiners;
- elaborating and providing a specific training for national observers from (and designated by) coastal countries willing to participate;
- implementing procedures to board, manage and debrief observers as well as collect, verify and archive validated data and establishing access rules to the archived information;

- implementing tools to communicate mandatory data and reports to relevant fisheries administrations (flag State, coastal State mandating the observer or coastal States which EEZ were visited during the fishing trip) and scientific institutes.

The program OCUP involves (i) a group of well-trained scientific observers originating from the flag State (France) or coastal countries where tropical tuna fishing occurs (e.g. Comoros, Madagascar, Mauritius and Seychelles) and (ii) a steering committee in charge of:

- the ad hoc organization for the optimal implementation of observer boarding in coordination with the shipowners, the IRD and coastal countries administrations (Ministry and Fisheries Monitoring Centre);
- the quality of the information collected during observed fishing trips and computerized, and if necessary, indicate the corrective actions to be implemented;
- the evaluation and improvement of the program with the cooperation of all involved stakeholders (observers, fishermen, managers and scientists).

To achieve these goals, the steering committee relies on a consortium involving OD based in France (in charge of the general coordination) and SFA (in charge of the regional coordination) based in Port Victoria (Seychelles) where purse seiners are usually calling. The steering committee (common for both Oceans) is composed of representatives of ORTHONGEL, IRD, OD, BE, SFA and open to representatives of the flag and coastal States. The steering committee meets regularly and yearly regional meetings with representatives of the flag and costal States are organised. Since July 2013, the steering committee met 12 times and 6 regional meetings (3 for each Ocean) with coastal countries' administrations were organised (often during RFMOs plenary meetings).

This scheme allows the participation of all stakeholders and the transparency and a continuous improvement of the program. Tables 1 and 2 summarize the involvement and role of each stakeholders. A similar scheme was also set up in the Atlantic Ocean.

2.3. Training of observers

Observer recruitment / designation

OCUP candidate are nominated by relevant fisheries administrations for national observers or selected by the steering committee from their curriculum vitae for other observers. All potential observers are then evaluated by the steering committee based on the criteria listed in table 3. Information on their education level and professional experience are scored from 1 to 5 for each criterion and candidates having a total score of 45 or more are selected for a training session.

Organisation and content of the training

Two training sessions have been organised in the Indian Ocean (May 2014 and June 2015). The regional coordinator is in charge of organising each 2-week training session. Training sessions took place in Port Victoria and about 12 OCUP candidates from coastal countries were trained per session. The content of OCUP training sessions is summarized in table 4. The objective of the training session is also to be attentive to the behaviour of the participants (participation, interest for the program, sociability) to evaluate their ability to become integrated onboard during their first fishing trip. Additional observers were trained at SFA by the coordinator to replace observers changing jobs.

Evaluation of observers

During the training session, each candidate observer is tested on various skills and knowledge: this includes a writing test (to evaluate French language skills, handwriting legibility as well handwriting speed), a form filling test (to test the speed of candidates when filling the forms and their ability to fill the different fields appropriately), a data entering test (to test the speed of candidates when using the software ObServe (Cauquil *et al*., 2015), their understanding of the different fields that should be filled as well as their computer skill), a species identification test (to make sure they will recognise the main catch, bycatch and incidental catch species), and a questionnaire on the program background and the tuna RFMOs

recommendations. At the end of the training session, a personal interview takes place with candidate observers to discuss the results of the tests and confirm the impression given by the candidate. An evaluation form is filled with information on the results of the tests, the behaviour of the candidate observer during the training session (including his attendance during the training session and his motivation) and results of the personal interview.

The first trip of the observer on a purse seiner is also considered as a test and a questionnaire is provided to the captain of the purse seiner to evaluate his satisfaction regarding the work and the behaviour of the OCUP during the fishing trip. The information collected in the questionnaire are then transmitted to the regional coordinator and the steering committee. When both tests are successful, an "OCUP certificate" is delivered by the steering committee to the observer. Since 2017, the observer receives a "fisheries observer individual passport" gathering all information on his/her training sessions, accreditations and work experiences as observer.

On one hand, this allows managers and fishermen to measure the quality and the reliability of the observer and, on the other hand, this valorises and professionalises the job of fisheries observer.

2.4. Coordination of observed fishing trips, boarding of observers and debriefing procedures

The boarding of OCUPs on tuna purse seiners to collect information on fishing activities is the most important part of the OCUP program. To ensure that observer boarding take place in the best conditions possible, a number of specific steps involving different actors must be followed. The identification of these steps as well as their practical implementation was one of the main results of the experimental phase of the OCUP program (2013-2014).

The sequence of steps in the observer boarding process is described in table 1. A live document (called OCUP Vademecum) was compiled and is continuously improved to gather protocols and reference documents for all steps of the scheme.

The coordination of observed fishing trips is ensured by the steering committee at the end of each year for the following year. It takes into account the provisional fishing trips dates provided by fishing companies, the regulation constraint (DCF), the availability of OCUPs from flag and coastal States and the level of catch in each EEZ (to weight the number of fishing trips observed by national observers of the different coastal countries). The "provisional calendar of observed fishing trips" is communicated to each stakeholder and endorsed by coastal States through the communication of official observer schedules to EU (in the case of SFPAs) or ORTHONGEL (in the case of private agreements).

2.5. Observer tasks and data collection

Each OCUP fill 5 forms, designed by OD and IRD (annex 1):

- Form A provides information on the position of the purse seiner, EEZ entry and exit notification, environmental information (e.g. temperature, currents) and information on the surrounding activities (other fishing vessels in the area and gear type type);
- Form B provides information on fishing activities (e.g. bycatch, discard and incidental catch estimates per species);
- Form C1 and C2 provide information on tuna and bycatch species size sampling performed by the OCUP;
- Form D provides information on floating objects (FOB) including the type of FOB (e.g. dFAD or tree log), the activity on the FOB (e.g. visit, deployment, retrieval) and the activity on the tracking buoy (e.g. deployment, exchange);

These forms (similar to those filled by other observers aboard EU tropical tuna purse seiners) are filled on paper and electronically by the OCUP during the fishing trip and directly stored in the dedicated IRD ObServe database using the ObServe software (http://www.ob7.ird.fr/mot/observe).

In addition to data collection, OCUPs should also assist purse-seine captains in reporting mandatory information on fishing activities (e.g. logbook data, Electronic Recording and reporting System – ERS).

Although OCUPs are not controllers, they are asked to report to the regional OCUP coordinator any type of activity that do not comply with tropical tuna fishing regulations: ORTHONGEL decisions (e.g. ban on shark finning, deployment of non-entangling FADs, …) or IOTC recommendations (e.g. fishing set on marine mammals, fishing around oceanographic buoys, discards of small tunas). The regional OCUP coordinator is in charge of relaying this information to OD and Orthongel (and when mandated by a country to their authorities). OCUPs are also asked to provide information on potential IUU fishing.

Since ORTHONGEL implemented several programs[1] to reduce the potential environmental impact of tropical tuna purse seining, OCUPs are asked to report on the correct implementation of the "best practices" and to suggest potential improvements in a dedicated form. They also report that only non-entangling dFADs are used by purse seiners in a specific form.

Finally, research institutes of coastal countries may require additional data collection or sampling. Provided that the data/sample collection protocol has been validated by the steering committee of the OCUP program, OCUPs are in charge of collecting this additional data/material.

For all the tasks described here-above, OCUPs fill out paper forms but also input electronically the different data on board using a laptop provided by the program and the ObServe software which allows various validations of the data.

2.6. Reports and data sharing

Observers are in charge of drawing up a report for each trip. Report templates and Excel files generating standardised analyses and graphs are provided by OD and the regional coordinator. The ObServe database can also be used to generate standardised tables.

The national observer can keep paper forms to transmit them to the fisheries administration that mandated him/her. In this case all forms are scanned during the debriefing. Else, the paper forms are stored by the regional coordinator. Data are transferred to IRD ObServe database and reports are stored on a server allowing all authorised persons (designated by the flag and coastal States administration and ORTHONGEL) to download the reports. The url of this server called Obsweb is https://www.obsweb.org/ocup/.

Three types of reports are produced:

- a short summary with general information related to the observed fishing trip (date and port of departure and landing, number of fishing sets, tuna catch, information on the purse seiner and the observer, problems encountered by the observer and infraction suspicion when applicable);
- a full report with tables and graphs summarising the information collected on fishing activity, tuna catch, bycatch, discards when applicable, activity related to FADs, at sea observations, species size measurements, …;
- for each EEZ visited, a "EEZ report" with the same tables and graphs than the full report but only for the information collected in the relevant EEZ.

Access to data and these different reports is conditioned by the legitimacy to access these data as described in table 2.

3. Results

3.1. Number of observers and coverage

1. The programs "Tuna Contract for the Future- Sharks" (2011-2012) and "Tuna Contract for the Future-Selectivity" (2013-2015) initiated by ORTHONGEL in collaboration with the IRD aimed at reducing the mortality of sensitive species such as sharks, rays and turtles caught incidentally by purse seiners (Poisson *et al*., 2012; Poisson *et al*., 2014). During this program, vessel crews were trained to release sharks and rays alive. The "Tuna Contract for the Future ecoFAD" (2011-2012) aimed at eliminating the entanglements of sea turtles in the surface structure (Goujon, 2015) and sharks in the underwater structure of dFADs (Goujon *et al*., 2014). Since 2013, 100% of entangling dFADs have been replaced with a non-entangling design in the Atlantic Ocean (ORTHONGEL decision n°11, 23th November 2011).

Since July 2013 and up to June 2017, 32 scientific observers from 4 African countries have been trained as OCUP (table 5). A few did not embark because they had other job opportunities, so only 24 OCUPs covered fishing trips. 15 of these observers have been employed by SFA and the remaining 8 have been national observers designated by Comoros and Madagascar.

Together with the 34 French observers from IRD and OD (already or newly trained who are working either in the Atlantic Ocean or in the Indian Ocean) and 10 Ivorian observers from BE called in reinforcements when there was a shortage of Indian Ocean OCUPs, the 24 Indian Ocean OCUPs have covered 252 trips since the beginning of the OCUP program (table 6) including 43 trips on Mauritian purse seiners and 36 trips on Seychellois purse seiners of one of the French fishing companies (SAPMER) hereafter referred as "associated purse seiners". 157 (62%) of these trips were observed by SFA or OD observers (OCUP complement), 46 (18%) by national observers (Access agreements) and 50 (20%) by DCF French observers (only onboard French flagged vessels *i.e.* above the mandatory minimum 10% fixed by the EU legislation). In addition, 74 fishing trips were observed through the electronic observation (program OOE) by OD observers (table 6).

During the first months of the program, French OCUPs were boarded in order to test and validate the OCUP program protocols. In the meantime, SFA observers were trained and quickly started to embark onboard French, Italian and associated purse seiners so that in 2016, the coverage of the fleet was 82.0 %.

In terms of number of days, the coverage of the French, Italian fleet and associated purse seiners increased from an average of 10 to 14 % before 2013 to 84.4% in 2016 (table 7, figure 2).

3.2. Observer reports

To this date, reports have been validated for 178 of the 183 fishing trips with human observer onboard (only French-flag vessels were considered). In addition to the 178 full reports available on Obsweb, 192 EEZ reports (table 8) were compiled (as well as 171 reports for the international waters).

3.3. Data collected

The objective of this section is not to analyse collected data but to provide a quick overview of the type and amount of data collected during by OCUPs in addition to the data collected under the DCF program (additional coverage). Detailed analyses will certainly be conducted in the future by scientists of IRD and/or coastal States research institute to explore the information contained in these data and validate their quality (as compared to the quality of DCF data).

Catch and bycatch data

OCUPs follow a standardised protocol that allows estimating bycatch, discards and incidental catches per species. As part of the protocol, observers are in charge of sampling a fraction of bycatch species (that can be measured and/or weighted on board) and use these samples to extrapolate to a total number of fish per species. From 2013 to 2017, a total of 3 932 samples have been made by OCUPs in addition to DCF trips in the Indian Ocean (59.1% of all samples made during all observed trips) and 238 968 fishes were measured and/or weighted (61.2% of all individuals manipulated during all sampling operations).

Bony fishes (other than tunas and billfishes) represented the majority of individuals sampled by OCUPs during additional coverage fishing trips from 2013 to 2017 (70.8% of individuals, figure 3) followed by non-target species of tunas (14.7%) and skipjack tuna (9.6%). Sharks species represented a significant fraction of individuals of sensitive species (4.6% of the total number of individuals sampled by OCUPs) with the silky shark *Carcharhinus falciformis* (98.0% of sampled sharks) representing the vast majority of individuals. Note that measurements of alive individuals of sensitive species such as sharks, rays, whale sharks or sea turtles have been made following ORTHONGEL/IRD's best practices

Individuals sampled or observed by OCUPs during additional coverage fishing trips were then used to estimate the total number of individuals caught during a given fishing set using raising factors. From 2013 to 2017, the program OCUP contributed for example to 59.6% of bycatch estimates of billfishes, 50.8% of bycatch estimates of bony fishes (other than tunas and billfishes), 64.2% of bycatch and release estimates of sharks and 50.0% and 77.8% of observations of whale sharks and cetaceans respectively.

Fishing sets and observations at sea data

During additional coverage observed fishing trips, OCUPs are were also in charge of reporting the different activities of purse seiners (successive positions of purse seiners, tuna school detections, activities on FOBs and observations of megafauna) in addition to information on fishing sets. From 2013 to 2017, a total of 104 169 activities (65.8 % of all activities reported by observers of all programs) have been reported by OCUPs during additional coverage fishing trips. All large proportion of the activities reported by observers only consisted of reporting the position of the purse seiner (54.8%, figure 4), followed by operations on FOBs (24.0%), fishing sets (11.7%) and observations of tuna schools (8.3%). In addition, observations made by OCUPs during additional coverage fishing trips provided information on marine mammals (0.4% of observations), marine birds (8.7%), sharks or whale sharks (0.02%). The geographical position of the different types of observations was also reported (figure 5) providing useful information to increase the amount of spatial data available from observer programs.

4. Discussion and conclusions

4.1. An innovative international cooperation

The OCUP program is the first of its kind: previous programs were based either on national observers boarded by the flag State or regional observers boarded mandated by a regional organisation (e.g. IOC) . Harmonizing the skills and the work of national observers from flag and coastal States seems the best way to address all needs of observation for tropical tuna purse seiners operating in multiple EEZs and in the high seas. With such a scheme, each country is able (i) to have at least once a year a national observer onboard one of the French, Italian or associated purse seiners and (ii) to make sure that every time a French, Italian or associated purse seiner is in its EEZ, an observer is present on board to collect standardized data.

Although the reliability of OCUPs can easily be acknowledged based on transparent procedures, it is however necessary that countries legally acknowledge the role/set the legal conditions for of common observers i.e. (i) each country should accept that data collected in the EEZ of another country by its mandated OCUPs are reported to this other country and (ii) each country should recognize of the data collected in its EEZ by OCUPs mandated by another country. During regional meetings of the steering committee with administrations of coastal States, it was concluded that the easiest way to obtain this multilateral agreement would be through the accreditation of such common observers by the RFMO, in line for example with the development of a Regional Observer Scheme in the Indian Ocean (IOTC Resolution 11/04).

Such accreditation would be based on minimum standards in terms of skills and training of national observers to guaranty a continuous quality and reliability of collected data. Through its transparent observer selection, training and validation procedures, the program OCUP may be used to define these minimum standards in the Indian Ocean and even to harmonise regional observers schemes across tuna RFMOs.

4.2. An increased observer coverage

One of the main successes of the OCUP program was to increase the coverage of French and Italian tropical tuna purse seine fishing trips both in the Atlantic and Indian Oceans. Before the implementation of the program, fishing trips were only covered within the EU – DCF framework and, in the case of the Atlantic Ocean, during ICCAT moratoria. Since 2013, the coverage of fishing trips has quickly increased in the Indian Ocean to reach 82 % in 2016 and in Atlantic Ocean to reach 100% in 2015 (Goujon *et al*., 2017). In the Indian

Ocean, this increased coverage did not only allow covering more than 80% of fishing sets and activities of purse seiners in order to improve the transparency of the fishing fleet but also provided increased amount of information on the activities of purse seiners, encounters of marine mammals or whale sharks and catch, bycatch or incidental catch of sensitive species. In the future, this large amount of information should open new perspectives to scientists, in particular to improve estimates of bycatch and discards for tropical tuna purse seine fleets.

4.3 The future of OCUP

Since the end of the 2000s, issues of piracy have prevented the boarding of observers on board the smallest purse seiners, leading to the implementation of Electronic Monitoring System (EMS) for 7 of the 12 French purse seiners operating in the Indian Ocean (program OOE). Preliminary results of the program OOE indicate that EMS may be used to complement the work achieved by human observers to estimate discards and non-target catch aboard French and Italian purse seiners (Briand *et al*. 2017). Though EMS may not be suitable to fully replace human observers, the framework of the program OCUP will be extended to include a training on the analysis of EMS data by OCUPs.

We are also considering that collaboration with other fleets to adopt common procedures for the selection and training of OCUPs could reinforce the coverage and maintain a population of well-trained and independent national scientific observers. Such collaboration would be facilitate by the fact that tools are already common (such as the Observe database) and by the IOTC initiative to develop a Regional Observer Scheme in the Indian Ocean (IOTC Resolution 11/04).

Acknowledgements

The authors would like to thank the French and Italian skippers and crews and the fishing companies member of ORTHONGEL for their contribution to the OCUP program and for their efforts to facilitate the living and the work conditions of OCUPs on the French, Italian and associated purse seiners. We also thank all OCUPs for having done their job properly without interfering with the crew activities. A special thank is addressed to the administrative persons of the coastal States that contributed by their suggestions and support to the success of the program. Finally, we embrace in our thanks the French tuna canneries and France Filière pêche which contributed financially and promoted the program.

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Legal texts cited

United Nations Convention on the Law of the Sea (UNCLOS)

IOTC Resolution 11/04 on a regional observer scheme

Règlement (CE) n° 199/2008 du Conseil du 25 février 2008 concernant l'établissement d'un cadre communautaire pour la collecte, la gestion et l'utilisation de données dans le secteur de la pêche et le soutien aux avis scientifiques sur la politique commune de la pêche.

Décision n°11 du 23 novembre 2011 relative à l'utilisation de dispositifs de concentration de poissons.

Table 1. Program process, involvement and role of each stakeholders

Phases / *Steps*		*Involvement of stakeholders*						
		Observer	*OD*	*SFA**	*Scientists(1)*	*Admin.(2)*	*Orthongel(3)*	*Captains*
Recruitment & training of OCUPs								
	Designation of national observers (NO)					active		
	Designation of flag State observers (FO)(4)				for DCF	ICCAT Rec		
	Selection of other observers (OO)		active	active				
	Verification of minimum skills		for FO	for NO/OO	active	active	active	
	Training on land	recipient	active	active	active			
	Training at sea (first trip)	recipient		active				active
	Training validation		active	active				active
	Accreditation	recipient	active	active		active		
Trips planning and boarding preparation								
	Provisional calendar of trips		active	recipient	active	recipient	active	
	Endorsement of provisional calendar					for NO		
	Coordination and trip scheduling		active			active	active	
	Observer mission order	recipient	for OO		for DCF FO	for NO/FO		
	Briefing and introduction to captain	recipient		active				recipient
Fishing trip								
	Data collection on paper forms	active						
	Data input in laptop	active						
	Problem communication/resolution	active	informed	active		informed	informed	active
	Discussion of possible infraction suspicion(5)	active	consulted	active				active
	Notification of confirmed infraction suspicion	possible	recipient	active		recipient	recipient	recipient
End of mission								
	Trip auditing	consulted		active				consulted
	Debriefing	active	active	active		invited		active
	Data validation		active	active	active			
	Data storage in IRD Observe database				active			
	Report compiling and validation	active	active				consulted(6)	
Data and report diffusion								
	Full report	available	available	available	available	conditional(7)	available	available
	Report by EEZ		available	available	available	conditional(7)	available	
	Observed data		available	available	available	conditional(7)	available	

* The Seychelles Fishing Authority (SFA) intervenes here as a partner of OD for the coordination of OCUP. As it is also the administration body in charge of fisheries in Seychelles, SFA intervenes also as an administration involved in OCUP (see (2)

(1) IRD and national research institutes of involved coastal States (CRO, CRODT, CNSHB)

(2) French DPMA, CROSS, DG MARE, Ministries in charge of fisheries and Fisheries Monitoring Centre of coastal countries, each responsible for their national observers

(3) ORTHONGEL and the boatowners

(4) Mandatory observers in compliance of EU DCF

(5) When an observer suspects an infraction, a contradictory debate is organised by the regional coordinator prior to any notification, although observers have the possibility to communicate at any time with their administration.

(6) Reports are sent to boatowners for them to check that irrelevant information is not included (confidential or discriminatory)

(7) Access to report and data is granted according to rules presented in table 2.

Table 2. Rules of diffusion of reports and data

Data / report types	*Level of precision*	*Diffusion (in addition to OD, SFA*, ORTHONGEL)*
Global information related to the fishing trip (summary report)	general	FS admin, MS admin, all visited ZS admin
Detailed information covering the full trip (full report)	summarized	FS admin, MS admin
Detailed information concerning a given EEZ (EEZ report)	summarized	ZS admin
Fishing data (fauna, FOB, …) collected everywhere	fine and spatialized	FS sci, FS admin, MS sci, MS admin
Fishing data (fauna, FOB, …) collected in a given EEZ	fine and spatialized	ZS sci, ZS admin
Auxiliary data collected everywhere	fine and spatialized	FS sci, MS sci
Auxiliary data collected in a given EEZ	fine and spatialized	ZS sci
Tuna and bycatch sampling data	aggregated	FS sci, MS sci, all cooperating ZS sci

FS admin = flag State administration (DPMA and DG MARE), MS admin = administration of the State mandating the national observer, ZS admin = administration of the State of a given EEZ, FS sci = flag State scientist (IRD), MS sci = scientists of the State mandating the national observer, ZS sci = scientists of the State of a given EEZ

Table 3. OCUP candidates evaluation criteria

Evaluation theme	*Evaluation criteria*		*Evaluation indicator coefficient*
Requirements	Qualification (diplomas, education) in fisheries science		2
	Other relevant qualifications (fishing, maritime safety, computer skills)		1
	Languages: French (native speaker or working knowledge)		3
Experience	Professional experiences	Level of experience in fisheries	3
		Other relevant experiences	1
		At sea working ability (experience at sea)	2
Other skills	Computer skills	Database information entering, Word/Excel	3

Table 4. Content of the OCUP training sessions

Theme	*Sub-themes*
Background	- Fisheries regulation - Tuna RFMOs / fishing agreements - Logbooks - Tropical tuna purse seine fishing (fishing techniques and strategies)
Program presentation	- Objectives and definitions - Phases of the program - ORTHONGEL - Roles and tasks of the OCUP
Tasks of the OCUP	- Verification of best practices - Main catch and bycatch species - DCF data collection protocol (sampling method, visit of a purse seiner) - Data collection (forms, ObServe software, report) - Observer's guide and manual
Maritime safety	Certified STCW training from marine school educators (5 days)

Table 5. Number of observers trained and number of trips observed

Nationality	*Trained*	*Embarked*	*Number of observed trips for*			*Total number of OCUP trips*	*eObs*
			DCF	*Access agr.*	*Complement*		
French (+ Ivorian [1])	39 [2] (+25)	34(+10)	50		22+15 [1]	87	74
Seychellois	18	16			115	115	
Comorian	4	3		20	5 [2]	25	
Malagasy	6	5		25		25	
Mauritian	4	0				0	
Total IO observers	**32**	**24**	**50**	**45**	**157**	**252**	**74**

(1) A few times, as there were no French or national observers available to embark, Ivorian observers employed by the Atlantic partner of OD (Bigeye S.A.) were embarked
(2) Including 3 observers trained for fishing trips "electronic observation"

Table 6. Evolution of the number of observed trips by observation programs and nationality

Program	*Employer*	*2013 [1]*	*2014*	*2015*	*2016*	*2017 [2]*	*Total [2]*
DCF	OD/IRD	(2)+4	12	16	15	6	53 (+2)
SFPA	Comoros	-	0	6	12	-	18
	Malagasy	-	2	6	0	9	17
OCUP complement	OD & BE	3	8	7	6	3	27
	SFA	-	14	12	25	13	64
	Comoros	-	-	-	-	4	4
eObservation		-	-	16	45	13	74
Total under OCUP coordination		**7**	**36**	**63**	**103**	**48**	**257**
Trips with IRD-TAAF observers		7	6	10	11	8	42
Trips without observer		105	83	52	25	32	297
Total trips during the year		121	125	125	139	88	598
Number of active purse seiners		13	13	13	13	13	13
Global %age of trips observed		**13.2%**	**33.6%**	**58.4%**	**82.0%**	**63.6%**	**50.0%**

(1) The OCUP program started July 1st, 2013.
(2) Observed trips compiled up to September 1st.

Table 7. Evolution of the number of observed fishing days by observation programs

Program	*2013 [1]*	*2014*	*2015*	*2016 [2]*	*2017 [3]*	*Total [3]*
DCF	206	360	462	392	162	1582
Access agreements	0	55	416	252	303	1026
OCUP complement	142	616	516	837	443	2554
eObservation	0	0	625	1488	348	2461
Total OCUP et DCF	348	1031	2019	2969	1256	7623
IRD-TAAF	553	1216	2350	3267	1469	8855
Without observer	3352	2735	1519	606	1002	9214
Total fishing days	3905	3951	3869	4873	2471	18069
%age observed	**14.2%**	**30.8%**	**60.7%**	**84.4%**	**59.4%**	**55.8%**

(1) The OCUP program started July 1st, 2013.
(2) Trips covered by a IRD-TAAF observer outside of the OCUP coordination.
(3) Observed trips compiled up to September 1st.

Table 8. Number of reports produced by OCUPs and available on Obsweb

Country	*2013 (1)*	*2014*	*2015*	*2016*	*2017 (2)*	*Total*
EEZ reports						
Comoros	0	0	0	7	-	7
French Islands	0	0	0	1	3	4
Kenya	0	2	4	0	0	6
Madagascar	0	0	0	1	3	4
Mauritius	0	3	2	3	0	8
Seychelles	3	32	30	47	37	149
Tanzania	0	5	1	7	1	14
Total EEZ reports	**3**	**42**	**37**	**66**	**44**	**192**
Other reports						
International waters	4	34	41	50	43	172
Full reports	**4**	**35**	**43**	**53**	**43**	**178**

(1) The OCUP program started July 1st, 2013.
(2) Observed trips compiled up to September 1st.
- No access agreement

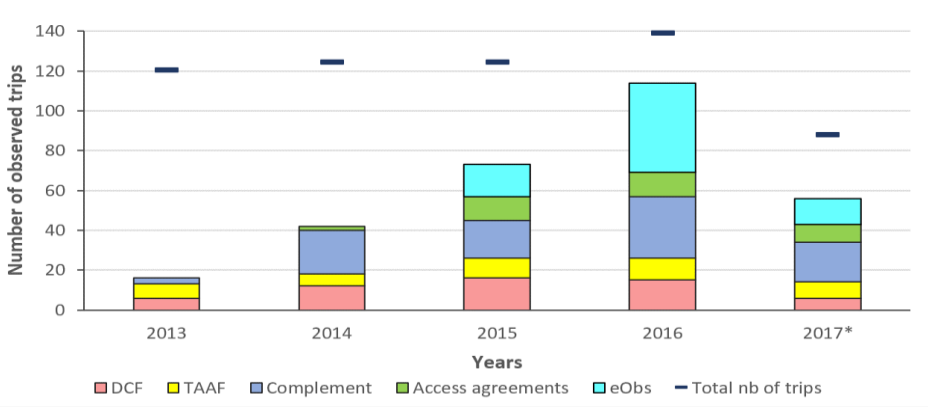


Figure 1. Evolution of the number of observed fishing trips from 2013 to 2017. The year of a trip is the year of the last day of the trip. OCUP program started in July 2013; 2017 (*) trips only include trips terminated before the end of August and processed.

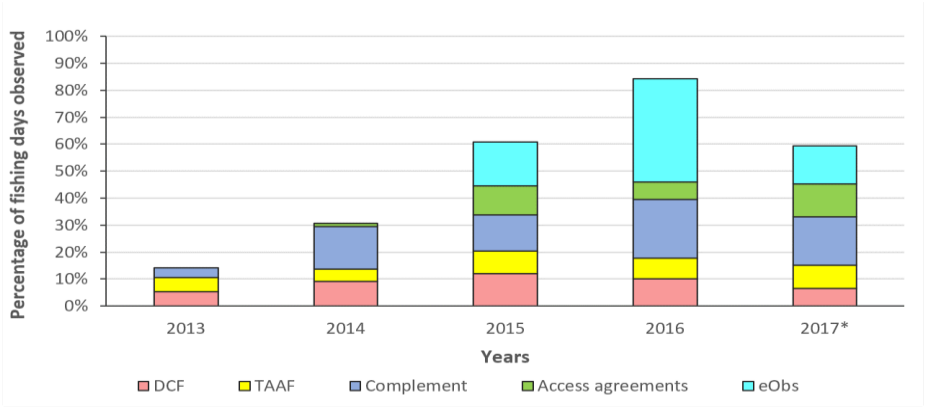


Figure 2. Evolution of the coverage of the French tropical tuna purse-seine fleet from 2013 to 2017 in proportion of number of observed days over total fishing days. OCUP program started in July 2013; 2017 (*) coverage only concerns trips terminated before the end of August and processed.

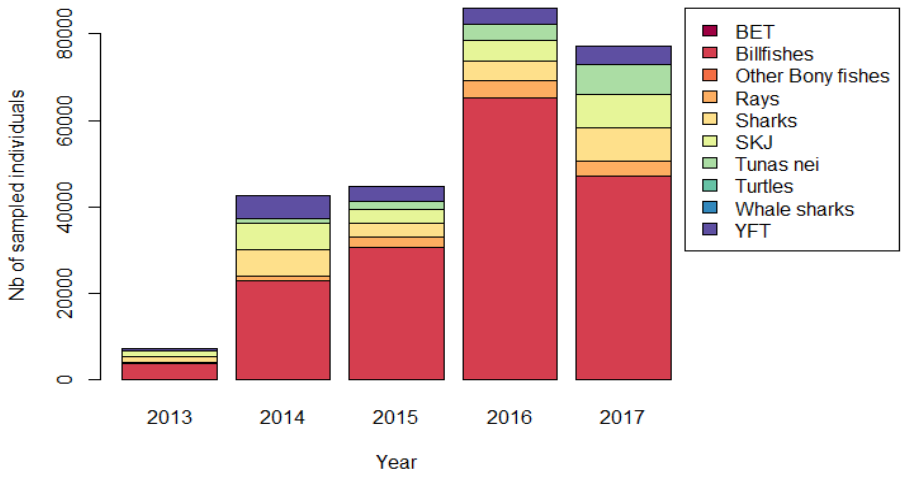


Figure 3. Number of individuals sampled by OCUPs per species and per year from 2013 to 2017.

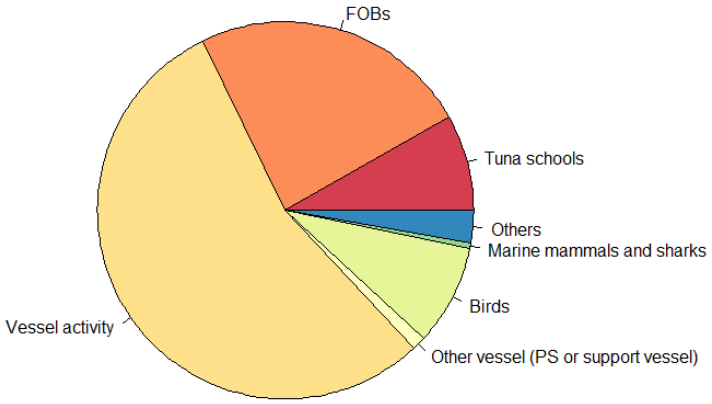


Figure 4. Distribution of observations made by observers during fishing trips between 2013 and 2017.

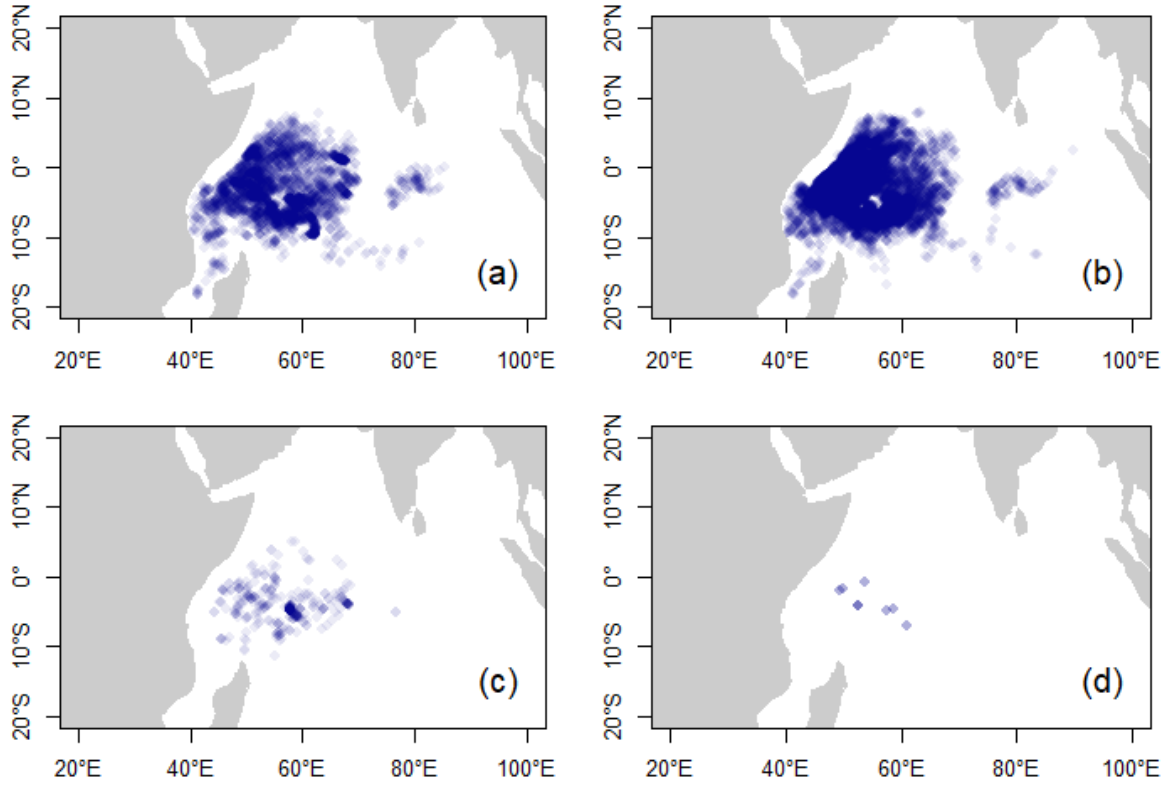
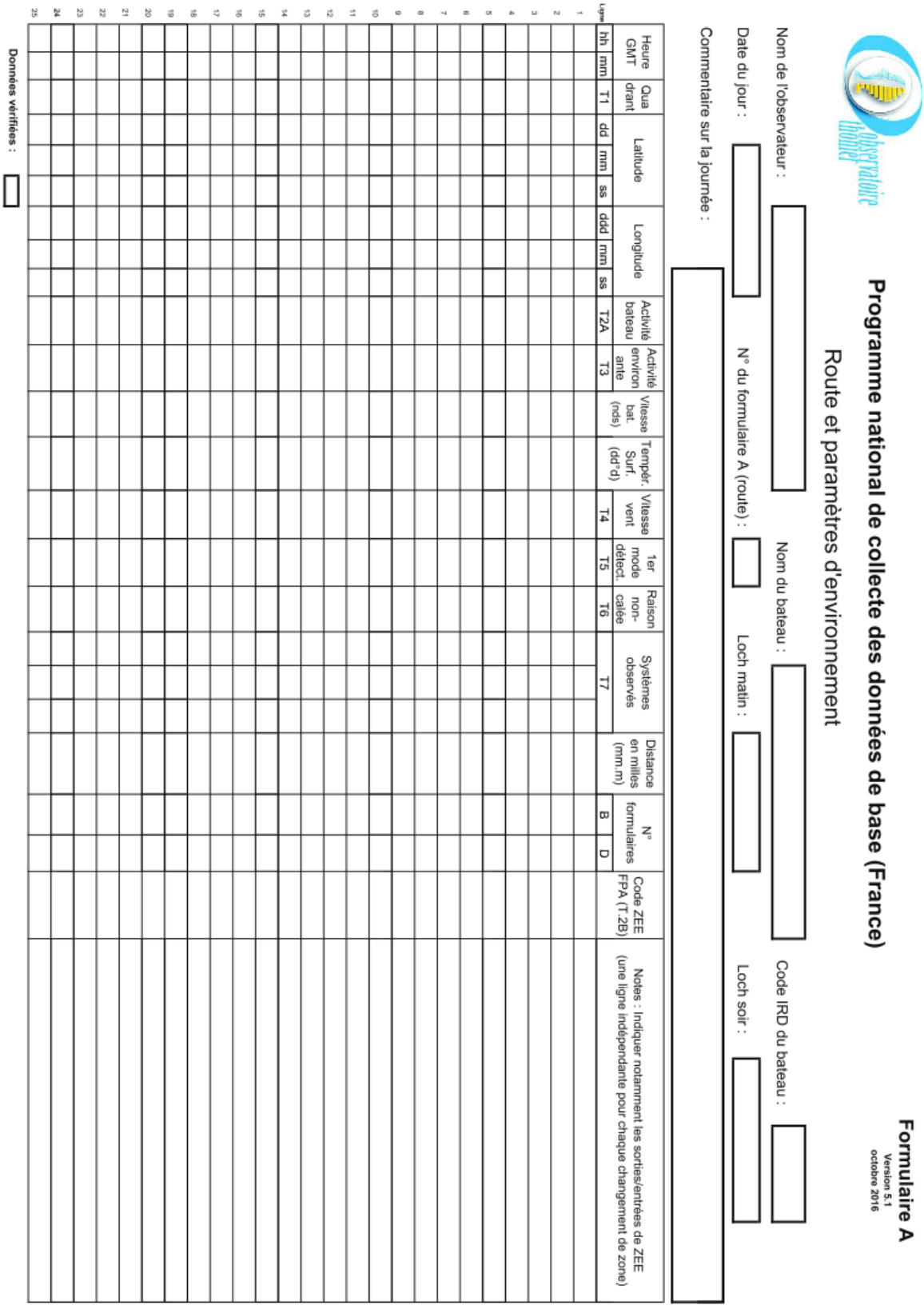


Figure 5. Geographical distribution of sets (a), FOBs (b) and macro fauna (c: marine mammals and d: whale sharks) observed by OCUPs between 2013 and 2017.

Annex 1. Forms used by OCUP

Form A*: *Information on the position of the purse seiner, EEZ entry and exit notification, environmental information and information on the surrounding activities



Formulaire A
Version 5.1
octobre 2016

Programme national de collecte des données de base (France)

Route et paramètres d'environnement

Nom de l'observateur :

Nom du bateau :

Code IRD du bateau :

Date du jour :

N° du formulaire A (route) :

Loch matin :

Loch soir :

Commentaire sur la journée :

Ligne	Heure GMT hh	Heure GMT mm	Quadrant T1	Latitude dd	Latitude mm	Latitude ss	Longitude ddd	Longitude mm	Longitude ss	Activité bateau T2A	Activité environnante T3	Vitesse bat. (nds)	Temper. Surf. (dd°d)	Vitesse vent T4	1er mode détect. T5	Raison non-calée T6	Systèmes observés T7	Distance en milles (mm.m)	N° formulaires B	N° formulaires D	Code ZEE FPA (T.2B)	Notes : Indiquer notamment les sorties/entrées de ZEE (une ligne indépendante pour chaque changement de zone)
1																						
2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						
13																						
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16																						
17																						
18																						
19																						
20																						
21																						
22																						
23																						
24																						
25																						

Données vérifiées :

Form B: Information on fishing activities

Formulaire B
Version 5.1
octobre 2016

Programme national de collecte des données de base (France)

Caractéristiques de la pêche

N° du formulaire B (calée) : ____ **Date :** ____

Si au cours de la calée un nouveau système, non repéré lors du remplissage du formulaire A, apparaît, pensez à le rajouter dans les systèmes signalés au formulaire A

N° du formulaire route : ____ **N° de ligne de la route :** ____ **Code IRD du bateau :** ____

Début de la calée (hhmm GMT) : : **Fin de coulissage (hhmm GMT) :** : **Fin de la calée (skiff à bord) (hhmm GMT) :** :

Estimation du banc

Espèce	En tonnes (t)	Poids moyen (kg)
Albacore (YFT)		
Listao (SKJ)		
Patudo (BET)		
Tout le banc		

Raison du coup nul (T8): ____

Nom du supply : ____

Courant (le plus fort dans les 100 premiers mètres)

Vitesse du courant en nœuds	
Direction du courant en degrés	
Profondeur du courant (en m)	

Informations du sonar

Epaisseur du banc (en m)	
Profondeur moyenne (en m)	
Profondeur début (en m)	

Thon conservé (Conserveries et marché local)

Code thons	Catég. T9	Poids (en t)	Cuve

Thon rejeté

Code thons	Catég. T9	Raison du rejet T11	Poids (en t)	Monté sur le pont O/N

Faune accessoire

			1 des 2 réponses obligatoire		1 des 2 réponses obligatoire	
Code espèces accessoires	Devenir T10	Raison du rejet T11	Poids total estimé (en t)	Nombre total estimé	Poids moyen (en kg)	Taille moyenne (en cm)

Notes :

Données vérifiées : ____

Form C1: Information on discarded tuna size sampling

Programme national de collecte des données de base (France)

Echantillonnage des thonidés rejetés

Formulaire C1
Version 5.0
juillet 2015

N° du formulaire C1 (échant. thon rejeté) : ☐

N° de calée : ☐

Date : ☐

N° du formulaire route : ☐

N° de ligne de la route : ☐

Code IRD du bateau : ☐

Dans le tableau ci-contre, inscrire dans la colonne Taille les chiffres des dizaines en fonction de la distribution des tailles de poissons que vous avez à mesurer (ex. 60, 70, 80), puis reporter les individus mesurés à l'aide de bûchettes que vous grouperez par 5 comme ci-après 𝍸

Dans le cas d'un rejet de germon rayer une des espèces inutilisées et la remplacer par Germon ALB

Notes :

Données vérifiées : ☐

Albacore YFT				Patudo BET				Listao SKJ		Auxide BLT FRI		Ravil FTA KAW	
Taille	Nb individus	Taille	Nb individus	Taille	Nb individus	Taille	Nb individus	Taille	Nb individus	Taille	Nb individus	Taille	Nb individus
0		0		0		0		0		0		0	
1		1		1		1		1		1		1	
2		2		2		2		2		2		2	
3		3		3		3		3		3		3	
4		4		4		4		4		4		4	
5		5		5		5		5		5		5	
6		6		6		6		6		6		6	
7		7		7		7		7		7		7	
8		8		8		8		8		8		8	
9		9		9		9		9		9		9	
0		0		0		0		0		0		0	
1		1		1		1		1		1		1	
2		2		2		2		2		2		2	
3		3		3		3		3		3		3	
4		4		4		4		4		4		4	
5		5		5		5		5		5		5	
6		6		6		6		6		6		6	
7		7		7		7		7		7		7	
8		8		8		8		8		8		8	
9		9		9		9		9		9		9	
0		0		0		0		0		0		0	
1		1		1		1		1		1		1	
2		2		2		2		2		2		2	
3		3		3		3		3		3		3	
4		4		4		4		4		4		4	
5		5		5		5		5		5		5	
6		6		6		6		6		6		6	
7		7		7		7		7		7		7	
8		8		8		8		8		8		8	
9		9		9		9		9		9		9	

Form C2: Information on bycatch species size sampling

Programme national de collecte des données de base (France)

Echantillonnage des espèces associées

Formulaire C2
Version 5.0
juillet 2015

N° du formulaire C2 (échant. espèces associées) : ☐

N° de calée : ☐

Date : ☐

N° du formulaire route : ☐

N° de ligne de la route : ☐

Code IRD du bateau : ☐

Remarque importante : pour les raies et requins, privilégier la remise à l'eau "vivant" après avoir photographié l'animal à proximité d'une règle

Saisie par classe de taille

Code espèce		Code espèce		Code espèce		Code espèce		Code espèce	
Taille L1	Nb individus	Taille L1	Nb individus	Taille L1	Nb individus	Taille L1	Nb individus	Taille L1	Nb individus
0		0		0		0		0	
1		1		1		1		1	
2		2		2		2		2	
3		3		3		3		3	
4		4		4		4		4	
5		5		5		5		5	
6		6		6		6		6	
7		7		7		7		7	
8		8		8		8		8	
9		9		9		9		9	
0		0		0		0		0	
1		1		1		1		1	
2		2		2		2		2	
3		3		3		3		3	
4		4		4		4		4	
5		5		5		5		5	
6		6		6		6		6	
7		7		7		7		7	
8		8		8		8		8	
9		9		9		9		9	
0		0		0		0		0	
1		1		1		1		1	
2		2		2		2		2	
3		3		3		3		3	
4		4		4		4		4	
5		5		5		5		5	
6		6		6		6		6	
7		7		7		7		7	
8		8		8		8		8	
9		9		9		9		9	
0		0		0		0		0	
1		1		1		1		1	
2		2		2		2		2	
3		3		3		3		3	
4		4		4		4		4	
5		5		5		5		5	
6		6		6		6		6	
7		7		7		7		7	
8		8		8		8		8	
9		9		9		9		9	

Saisie par individu

N° ligne	Code espèce	L1	Sexe	photo n°	Poids en kg (si pesée)	N° ligne	Code espèce	L1	Sexe	photo n°	Poids en kg (si pesée)
1						31					
2						32					
3						33					
4						34					
5						35					
6						36					
7						37					
8						38					
9						39					
10						40					
11						41					
12						42					
13						43					
14						44					
15						45					
16						46					
17						47					
18						48					
19						49					
20						50					
21						51					
22						52					
23						53					
24						54					
25						55					
26						56					
27						57					
28						58					
29						59					
30						60					

Notes :

Données vérifiées : ☐

Form D: Information on floating objects (FOB)

Programme national de collecte des données de base (France)

Suivi des objets flottants

Formulaire D
Version 5.1
octobre 2016

Attention ! Pour remplir un formulaire D il est nécessaire, au préalable, de créer une ou plusieurs activités dans le formulaire A. Voir manuel p.23

N° du formulaire D (objets flottants) :

Date :

N° du formulaire route :

N° de ligne de la route :

Code IRD du bateau :

Opération sur objet (une seule réponse) :	
1 - Mise à l'eau	
2 - Visite / rencontre (sans pêche)	
3 - Pêche	
4 - Récupération sans pêche	

Caractéristiques de l'objet		
Type d'objet (T12)		
Devenir de l'objet (T13)		
Nombre de jours en mer		
Appartenance de l'objet ?	Inconnue	
	Ce navire ou cet armement	
	Navire d'autre armement	

Opérations sur balises	Opération 1	Opération 2
Type d'opération (T14)		
Type de balise (T15)		
N° identific. de la balise		
Marque de la balise		
Nationalité de la balise (T17)		
Indiquer le nom du navire propriétaire de la balise		

Estimation du banc s'il n'y a pas eu de calée		
Espèces de thons	Estimation (en tonnes)	

Présence de tortues ou de poissons (requins, porte-épées) dans un rayon de 10m autour du radeau		
Code espèce	Statut (T16)	Nombre d'individus

Notes :

Données vérifiées :

Annex 2. Equipment of the OCUP

The following material is provided to the OCUP at the end of his training.

Documents	*Source/author*
MANUALS:	
Data collection manual	IRD
ObServe user's guide	IRD
Species identification guides	
Bonyfishes	IRD
Turtles	IRD
Sharks	ICCAT/IOTC
Best practices guide	ORTHONGEL
OCUP guide	Oceanic Développement
OTHERS:	
Fisheries observer individual passport	Oceanic Développement

The following equipment is provided to the OCUP before each fishing. Regional coordinators are in charge of the maintenance of the equipment, control of its functioning, provision to observers before each fishing trip and recuperation at the end of the trip.

Equipment	*Use*
CLOTHING:	
Safety shoes	Protection against falling objects
Gloves	Protection against injuries during the manipulation of fish
MEASURING DEVICE:	
Board – Ichtyometer	Size of small individuals
Measuring tape	Size of large individuals (sharks, billfishes)
10 kg spring scale	Weight of individuals in the sample
SMALL EQUIPMENT:	
Forms	Data collection
Pencils	Notes in wet conditions
Ball pen	Form filling in dry conditions
Eraser	Note corrections
Writing tablet	Notes in wet conditions
Writing surface	Rigid surface to fill paper forms
Calculator	Sampled fraction calculation
Notebook	Notes
ELECTRONIC DEVICES:	
Laptop	Data entering Internet data transmission Data storage
USB stick 4 GO	Data backup (duplicate of the data stored on the laptop hard drive)
Numeric camera	Photos in case of difficult species identification