



HAL
open science

Collecting data on board French tropical tuna purse seiners with common observers : results of Orthongel's Voluntary Observer Program OCUP (2013-2017) in the Atlantic Ocean

Goujon Michel, Alexandra J Maufroy, Aude Relot-Stirnemann, Emilie Moec, Justin M Amandè, Pascal Cauquil, P.S. Sabarros, Pascal Bach

► **To cite this version:**

Goujon Michel, Alexandra J Maufroy, Aude Relot-Stirnemann, Emilie Moec, Justin M Amandè, et al.. Collecting data on board French tropical tuna purse seiners with common observers : results of Orthongel's Voluntary Observer Program OCUP (2013-2017) in the Atlantic Ocean. ICCAT Standing Committee on Research and Statistics (SCRS), Nov 2017, Madrid, Espagne. <ird-01905171>

HAL Id: ird-01905171

<https://ird.hal.science/ird-01905171v1>

Submitted on 25 Oct 2018

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization

Original: English

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

Goujon M.¹, Maufroy A.¹, Relot-Stirnemann A.², Moëc E.², Amandè M.J.³, Bach P.^{4,5}, Cauquil P.⁴, Sabarros P.⁴

Abstract

In order to comply with the different regulations and commitments requesting the presence of scientific observers onboard French 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) and several coastal countries. It was implemented in both Atlantic and Indian Oceans where the fleet adherent to ORTHONGEL is active. This paper describes the methodology of the OCUP program and presents and discusses its main results, focusing on the Atlantic Ocean.

In the Atlantic Ocean, 43 scientific observers from 6 African countries have been trained as OCUP. Together with 39 French observers from IRD and OD, 37 of these African scientific observers have covered more than 300 trips until September 1st, 2017 and the coverage of the French fleet has reached 100% since 2015. 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 réglementations et aux différents engagements pris par la flotte française de thoniers sennieurs 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 Développement (OD) et plusieurs pays côtiers. Le programme a été mis en place dans les océans Atlantique et Indien où est active la flotte de sennieurs 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 Atlantique.

Dans cet océan, 43 observateurs de 6 pays Africains ont été formés comme observateur OCUP. En complément des 39 observateurs français employés par l'IRD et OD, 37 de ces observateurs africains ont réalisé plus de 300 marées d'observation à ce jour et le taux de couverture des marées observées a atteint 100% en 2015. 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.

-
1. ORTHONGEL, 5 rue des Sardiniers, 29900 Concarneau, mgoujon@orthongel.fr (corresponding author)
 2. Oceanic Développement (OD), Concarneau, France
 3. Centre de Recherches Océanologiques (CRO), Abidjan, Côte d'Ivoire
 4. Institut de recherche pour le Développement (IRD), OB7, UMR 248 MARBEC, Sète, France
 5. Seychelles Fisheries Authority (SFA), Victoria, Seychelles

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 evaluation) is requested for by international law (art. 62 of UNCLOS, 1982), by 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 by ICCAT recommendations (Rec. 10-10, Rec. 15-01). In the case of the tropical tuna purse-seine fishery which activities take place 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 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 such 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 French shipowners to consider having accredited observers permanently onboard.

As it is not possible to embark more than one observer at a given time, ORTHONGEL has imagined and implemented since July 2013 a program to facilitate and optimize the boarding of scientific observers able to fulfil most of the tasks requested by the above-mentioned regulations or commitments taken by the French fleet. This voluntary program, called OCUP for "Observateur Commun Unique et Permanent" (Common Permanent Unique Observer) was conducted in collaboration with the French Institute for Research and Development (IRD), Oceanic Développement (OD) and BIGEYE SARL (BE) and funded by ORTHONGEL, France Filière Pêche (FFP) and French canneries for the program coordination and the observation of fishing trips in complement of trips covered by Data Collection Framework (DCF, funded by EU) and by national observers (in charge of the national administrations). The program was (and is still) implemented in both the Atlantic and Indian Oceans where the purse seiners of the adherents to ORTHONGEL are active. Its general objective is to address the requests of different origins with potential different contents in terms of observation aboard French purse seiners: (i) IRD for mandatory (EU Data Collection Framework – DCF, R(CE) 199/2008) or supplementary scientific data collection, (ii) French administration in compliance with RFMOs' regulations, (iii) coastal States in compliance with fishing agreements obligations (Sustainable Fisheries Partnership Agreement – SPPA – signed with EU or private agreements signed with ORTHONGEL), and (iv) shipowners to certify commitments made in the frame of responsible fishing schemes.

Actions 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 for scientific observer programs established later by ICCAT Rec. 16-14;
- setting a coordination for a permanent boarding of observers on all French 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.

For the Atlantic Ocean, participating coastal countries were initially Ivory Coast, Senegal and the Republic of Guinea, joined later by Gabon, Mauritania and São Tomé and Príncipe. More information on this program is available on <http://www.orthongel.fr/ocup.php>.

Here, it must be noted that the OCUP could be considered as scientific or transparency observers but, in line with the recommendations made by the ICCAT Scientific Committee (SCRS), should not be considered as controllers. It is however clear and accepted by French skippers and shipowners that data collected by

September 26, 2017 (1:05 PM)

national scientific observers could be used in case of possible litigation, as a consequence of transparency. The word “OCUP” is thereafter used only to refer to scientific observers trained within the OCUP framework. Independently of the funding, all fishing trips covered by OCUPs (DCF, moratorium, national observers or observers embarked to complement the coverage to 100%) were coordinated by the program.

This paper aims to describe the methodology of the OCUP program and presents and discusses its main results, focusing on the Atlantic 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. 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. It 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. Ivory Coast, Republic of Guinea and Senegal) and (ii) a steering committee dedicated to:

- set up 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);
- check the quality of the information collected during observed fishing trips and computerized, and if necessary, indicate the corrective actions to be implemented;
- evaluate and improve the proper implementation 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 BE (in charge of the regional coordination) based in Abidjan (Ivory Coast) where purse seiners are usually calling. The steering committee is composed of representatives of ORTHONGEL, IRD, OD, BE 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 coastal States are organised. Since July 2013, the steering committee met 12 times and 6 regional meetings 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 Indian Ocean.

2.2. 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.

September 26, 2017 (1:05 PM)

Organisation and content of the training

Two training sessions have been organised in the Atlantic Ocean (May 2014 and November 2016). The regional coordinator is in charge of organising each 2-week training session. Training sessions took place in Abidjan and 10 to 12 OCUP candidate 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.

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 PCT 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.

2.3. 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 embarkation 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 shipowners, the regulation constraints (ICCAT moratorium, 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).

September 26, 2017 (1:05 PM)

2.4. 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 ICCAT recommendations (e.g. fishing set on marine mammals, discards of small tunas, fishing set on a FOB within the moratorium). 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 programs¹ 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 these 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.

2.5. 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

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).

September 26, 2017 (1:05 PM)

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.

In addition, specific reports were produced to the French fisheries administration (DPMA) for the periods of FAD moratorium in compliance with ICCAT Recommendations. 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

Since July 2013 and up to June 2017, 43 scientific observers from 6 African countries have been trained as OCUP (table 5). 25 of these observers are employed by BE and the remaining 18 are national observers designated by the 6 countries (Ivory Coast, Senegal, Republic of Guinea, Gabon, Mauritania and São Tomé and Príncipe). Unfortunately, 6 of the trained national observers did not embark onboard a French vessel (as a decision of their administration); some have been missioned by their administration to embark on other fishing boats (in the case of Senegal and Republic of Guinea).

Together with the 39 French observers from IRD and OD (already or newly trained who are working either in the Atlantic Ocean or in the Indian Ocean), the 37 African observers have covered 307 trips since the beginning of the OCUP program (table 6) including 10 trips on the French support vessel (during moratorium periods). 91% of these trips were observed by BE observers, 3.6% by national observers and 4.9% by French observers.

From 2013 to 2017, 12.0% of the fishing trips were observed under the EU DCF program (*i.e.* above the mandatory minimum 10% fixed by the EU legislation), 26.4% of the trips were observed during the area/time closure for the protection of juveniles of yellowfin and bigeye tunas (ICCAT Rec. 11-01, 13-01, 14-01, 15-01 and 16-01), 3.6% of the fishing trips were observed in application of the provisions of the fisheries agreements and 61.6% of the trips were observed on a voluntary basis in order to cover 100% of the activity of French vessels (trips referred as “complement”). 11 fishing trips realized under the EU DCF program during the moratorium were counted twice in these percentages (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, BE observers were trained and quickly started to embark onboard French purse seiners so that in 2014, the coverage of the fleet was almost 100%. Although national observers were trained in 2014, legal (and possibly funding) issues prevented the boarding of these observers. Some of them were however missioned by their authorities as fisheries observers on local vessels. It is only after 2 years of promotion of the program and the training of a new group of national observers that trips covered by national observers started to increase (table 6, figure 1). Considering the increase in the number of countries involved in the coordination of the program and their increasing motivation, it is expected that such fishing trips will become predominant in the coming months.

September 26, 2017 (1:05 PM)

In terms of number of days, the coverage of the French fleet (only purse seiners) increased from an average of 13.5% before 2013 to 46.4% in 2013 (54.3% for the period when the OCUP program was implemented *i.e.* from July 1st), 96.3% in 2014 and 100% since then (table 7, figure 2).

3.2. Observer reports

To this date, reports have been validated for 306 of the 307 observed fishing trips (one national observer trained in his country did not input data in ObServe during his trip). In addition to the 306 full reports and 306 short reports available on Obsweb, 444 EEZ reports (table 8) were compiled (as well as 193 reports for the sole international waters).

In addition, 42 reports were produced for the French administration for the periods of the FAD-fishing moratorium (January 1st at 0:00 to March 1st at 0:00) in compliance with ICCAT Rec. 11-01, 13-01, 14-01 and 15-01.

3.3. Data collected

The idea in this chapter is not to analyse the data collected but just to give a quick overview of the type and amount of data collected by OCUPs in addition to the data collected under the DCF program or during the moratorium periods (national observers and observers boarded as a complement to reach 100% coverage). Detailed analysis 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 compare them to data collected under the DCF program or during the moratorium periods.

Catch and bycatch data

As other observers aboard EU purse seiners, 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 17 438 samples have been made by OCUPs in the Atlantic Ocean (75.3% of all samples made during all observer programs) and 326 940 fishes were measured and/or weighted (74.3% of all individuals manipulated during sampling operations).

Bony fish (other than tunas and billfishes) represented the majority of individuals sampled by OCUPs from 2013 to 2017 (68.5% of individuals, figure 3) followed by non-target species of tunas (15.0%) and skipjack tuna (9.4%). Sharks species represented a significant fraction of individuals of sensitive species (2.4% of the total number of individuals sampled by OCUPs) with species such as the silky shark *Carcharhinus falciformis* (72.8% of sampled sharks), other Carcharhinidae species (8.2%), the scalloped hammerhead shark *Sphyrna lewini* (6.9%) or the smooth hammerhead shark *Sphyrna zygaena* (3.4%). 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 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 62.9% of bycatch estimates of billfishes, 65.9% of bycatch estimates of bony fishes (other than tunas and billfishes), 84.4% of bycatch and release estimates of sharks and 85.0% and 85.7% of observations of whale sharks and cetaceans respectively.

Fishing sets and observations at sea data

During observed fishing trips, OCUPs are 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 114 994 activities (67.6% of all activities reported by observers of all programs) and 5 701 fishing sets (70.2% of all fishing sets reported by observers of all programs) have been reported by OCUPs. All large proportion of the activities reported by observers only consisted of reporting the position of the purse seiner (36.6%, figure 4), followed by observations of FOBs (17.4%), observations of other fishing and support vessels (16.9%) and observations of tuna schools (15.4%). In addition, observations made by OCUPs provided information on marine mammals (1.3% of observations), marine birds (7.9%), sharks or whale sharks (0.2%). The 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 concerned either national observers boarded by the flag State or regional observers boarded mandated by a regional organisation (e.g. ICCAT transshipment observer program). Harmonizing the skills and work of national observer from flag and coastal States seems the best way to address all needs of observation on the “straddling” tuna purse seiners. With such a scheme, each country is able (i) to have at least once a year a national observer onboard one of the French purse seiners and (ii) to make sure that every time a French purse seiner is in its EEZ, an observer is present aboard to collect standardized data. Although the reliability of OCUP scientific observers can easily be acknowledged based on transparent procedures, it is however necessary that countries agree on the legal acknowledgment of common observers *i.e.* (i) each country mandated an OCUP onboard a purse seiner accept that data collected by this observer in the EEZ of another country is reported to this other country and (ii) each country recognizes the validity of the report of data collected in its EEZ by an OCUP 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. Such accreditation would be based on minimum standards in terms of skills and training of national observers such as in the OCUP program to guaranty a continuous quality and reliability of data collected.

4.2. Increased observer coverage

One of the main successes of the OCUP program was to increase the coverage of French 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 during ICCAT moratoria. The objective was to cover a minimum of 10 % of fishing trips (DCF) to comply with ICCAT Rec 10-10 and to ensure that fishers complied with closed areas (ICCAT moratoria). Since 2013, the coverage of fishing trips has quickly increased in the Atlantic Ocean to reach 100% in 2015. This increased coverage did not only allow covering 100% 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.

Acknowledgements

The authors would like to thank the French skippers and crews and the shipowners 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 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.

References

Cauquil P., Rabearisoa N., Sabarros P., Chavance P. and Bach P., 2015. ObServe: Database and operational software for longline and purse seine fishery data. Working documents IOTC-2015-WPB13-29.

FAO, 1995. Code of Conduct for Responsible Fisheries. Rome, FAO. 1995. 41 p.

Floch L., Damiano A., Tamegnon A., Cauquil P., Chavance P., Terrier I. and Chassot E., 2013. Statistics of the French purse seine fishing fleet targeting tropical tunas in the Atlantic Ocean (1991-2012). (SCRS/2013/162) *Collect. Vol. Sci. Pap. ICCAT*, **70** (6): 2669-2692

Goujon M., Claude A., Le Couls S., Mangalo C. (2014). Premier bilan du plan de gestion des DCP mis en place par la France en Océan Atlantique. (SCRS/2014/187) *Collect. Vol. Sci. Pap. ICCAT*, **71** (1): 573-591

Goujon M. (2015). Mesures prises par Orthongel pour réduire l'incidence des thoniers senneurs sur les tortues marines. Actes du Colloque Tortues Marines. Maison des océans, Paris, 8-10 septembre 2015

Poisson F., Vernet A. L., Séret B., Dagorn L. (2012). Good practices to reduce the mortality of sharks and rays caught incidentally by the tropical tuna purse seiners. EU FP7 project #210496 MADE, Deliverable 7.2. ; Convention DPMA 33246, CAT « Requins », 30p.

Poisson F., Séret B., Vernet A. L., Goujon M., Dagorn L. (2014). Collaborative research: Development of a manual on elasmobranch handling and release best practices in tropical tuna purse-seine fisheries. *Mar. Policy* **44**: 312-320

Legal texts cited

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

ICCAT Recommendation 10-10 to establish minimum standards for fishing vessel scientific observer programs.

ICCAT Recommendation 11-01 on a Multi-Annual Conservation and Management Program for Bigeye and Yellowfin Tunas.

ICCAT Recommendation 13-01 amending the Recommendation on a Multi-Annual Conservation and Management Program for Bigeye and Yellowfin Tunas.

ICCAT Recommendation 14-01 on a Multi-Annual Conservation and Management Program for Tropical Tunas.

ICCAT Recommendation 15-01 on a Multi-Annual Conservation and Management Program for Tropical Tunas.

ICCAT Recommendation 16-01 on a Multi-Annual Conservation and Management Program for Tropical Tunas.

ICCAT Recommendation 16-14 to establish minimum standards for fishing vessel scientific observer programs.

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.

September 26, 2017 (1:05 PM)

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

Phases Steps	Involvement of stakeholders						
	Observer	OD	Bigeye	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	

- (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 and ICCAT recommendations 13-01, 14-01, 15-01 and 16-01
- (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, Bigeye, 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

September 26, 2017 (1:05 PM)

Table 3. OCUP candidates evaluation criteria

<i>Evaluation theme</i>	<i>Evaluation criteria</i>	<i>Evaluation indicator coefficient</i>
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

<i>Theme</i>	<i>Sub-themes</i>
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

<i>Nationality</i>	<i>Trained</i>	<i>Embarked</i>	<i>Number of observed trips for</i>			<i>Total number of trips</i>	
			<i>DCF</i>	<i>ICCAT Rec</i>	<i>Access agr. Complement</i>		
French	39	39	2		13	15	
Ivorian	25 ⁽¹⁾	22	24	81		176	281
Gabonese	2	2			1	1	
Guinean	4	3			0	0	
Mauritanian	2	2			4	4	
Sao Tomean	4	3			2	2	
Senegalese	6	5			4	4	
Total Atlantic observers	43	37	26	81	11	189	307

(1) Including 3 Ivorian observers from the administration who haven't yet embarked

September 26, 2017 (1:05 PM)

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

Program	Employer	2013 ⁽¹⁾	2014	2015	2016 ⁽²⁾	2017 ⁽³⁾	Total ⁽³⁾
DCF	OD/IRD	(5)	2	0	0	0	2 (+5)
	OD/BE	2	7	7	6	2	24
DCF & ICCAT Rec	OD/BE	0	4	2	3	2	11
ICCAT Rec	OD/BE	(10)	16	15	20	19	70 (+10)
SFPA	Senegal	-	2	0	0	2	4
	Gabon	-	0	0	(1)	1	1 + (1)
	Mauritania	-	0	0	0	4	4
	Sao Tome	-	0	0	0	2	2
OCUP complement	OD	10	3	0	0	0	13
	OD/BE	2	40	55	57	22	176
Total under OCUP coordination		14	74	79	86	54	307 (+16)
Trip without observer		45	4	0	0	0	49
Total trip during the year		74	78	79	87	54	372
Number of active purse seiners		9	9	9	10	10	
%age of trips observed by OCUP		18.9%	96.3%	100%	98.8%	100%	82.5%

(1) The OCUP program started July 1st, 2013.

(2) One trip was covered by a Gabonese observer outside of the OCUP coordination; data were not made available for trip. Another Gabonese observer (non-OCUP) embarked on another trip in addition to an OCUP.

(3) Observed trips compiled up to September 1st.**Table 7. Evolution of the number of observed fishing days by observation programs**

Program	2010 ⁽¹⁾	2011 ⁽¹⁾	2012 ⁽¹⁾	2013 ⁽²⁾	2014	2015	2016 ⁽³⁾	2017 ⁽⁴⁾	Total ⁽⁴⁾
DCF	355	295	350	167	389	307	313	155	2331
ICCAT Rec	0	0	0	584	604	514	758	566	2924
Access agreements	0	0	0	0	73	0	32 ⁽³⁾	308	326
OCUP complement	0	0	0	364	1457	1724	1720	614	5879
Total OCUP ⁽⁵⁾	0	0	0	589	2523	2545	2791	1556	10091
Without observer	2194	1919	2124	1287	96	0	0	0	7620
Total fishing days	2549	2214	2474	2402	2619	2545	2823	1556	19269
%age observed	13.9%	13.3%	14.1%	46.4%	96.3%	100%	100%	100%	60.5%

(1) Total fishing days obtained from Floch *et al.*, 2013. Observers were only embarked within the DCF program.

(2) The OCUP program started July 1st, 2013.













(3) One trip was covered by a Gabonese observer outside of the OCUP coordination.

(4) Observed trips compiled up to September 1st.

(5) Not including the trip covered by a Gabonese observer outside of the OCUP coordination in 2016.

September 26, 2017 (1:05 PM)

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

Country	2013 ⁽¹⁾	2014	2015	2016	2017 ⁽²⁾	Total
EEZ reports						
 Angola	1	8	2	11	1	23
 Cape Verde	0	3	0	0	0	3
 Gabon	10	26	32	15	-	83
 Ghana	9	24	23	18	10	84
 Guinea Bissau	-	-	5	4	3	12
 Ivory Coast	6	20	27	31	9	93
 Liberia	-	-	-	8	18	26
 Mauritania	0	5	-	1	1	7
 Republic of Guinea	-	-	-	-	10	10
 São Tomé and Príncipe	9	31	28	20	1	89
 Sierra Leone	-	-	-	2	10	12
 Senegal	-	-	1	1	0	2
Total EEZ reports	35	117	118	111	63	444
Other reports						
International waters	7	48	52	56	30	193
Moratorium reports	0 ⁽¹⁾	10	10	11	11	42
Full reports	14	74	79	86	53	306

(1) The OCUP program started July 1st, 2013.

(2) Observed trips compiled up to September 1st.

- No access agreement

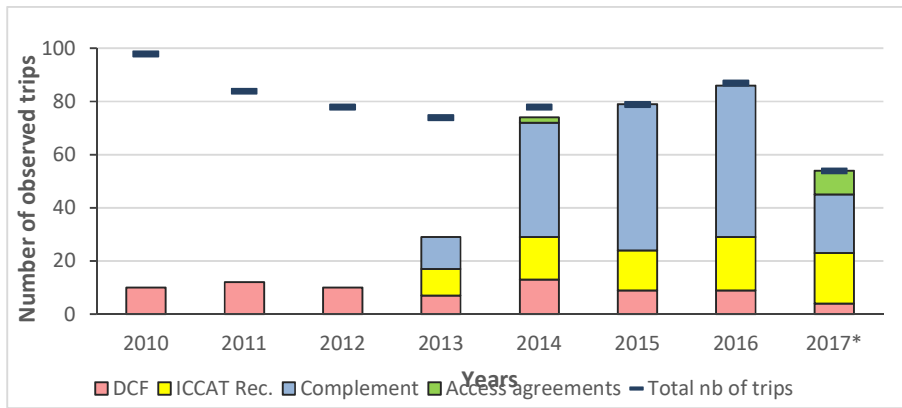


Figure 1. Evolution of the number of observed fishing trips from 2010 to 2017. The year of a trip is the year of the last day of the trip. OCUP program started in July 2013; 2017 (*) trips only include trips terminated before the end of August.

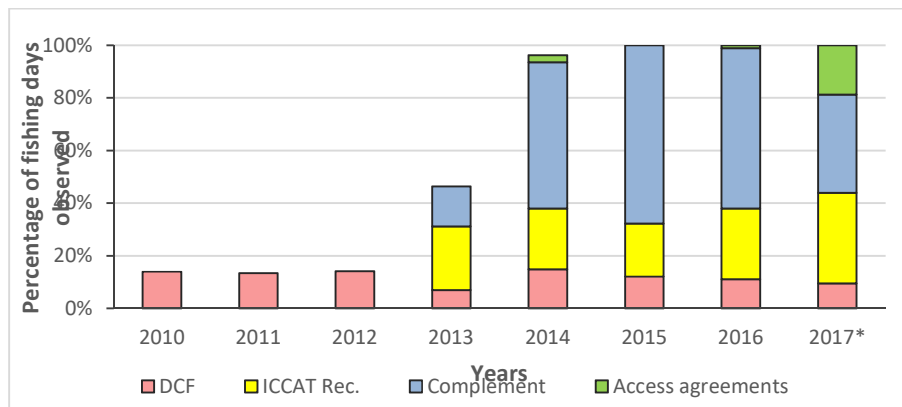


Figure 2. Evolution of the coverage of the French tropical tuna purse-seine fleet from 2010 to 2017 in proportion of number of observed days over total fishing days. OCUP program started in July 2013; 2017 (*) coverage only concerns trips terminated before the end of August.

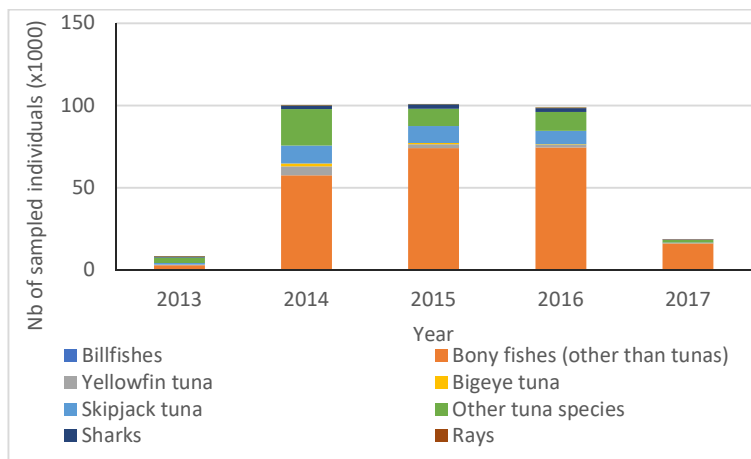


Figure 3. Number of individuals sampled by OCUPs per species and per year from 2013 to 2017.

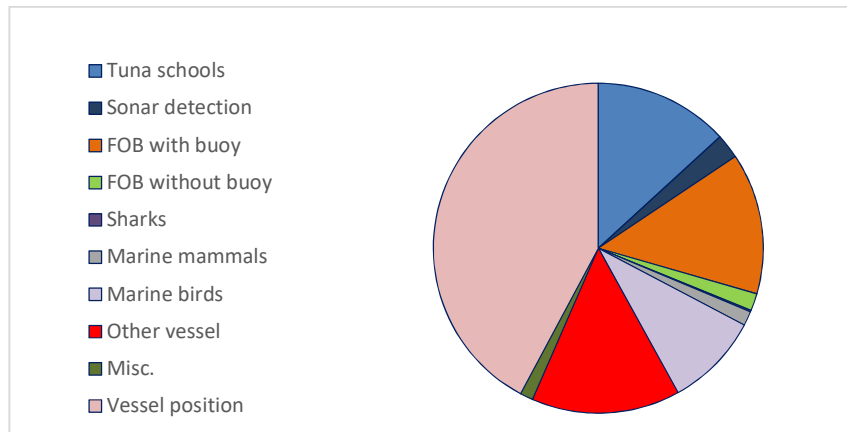


Figure 4. Distribution of observations made by observers during fishing trips between 2013 and 2017.

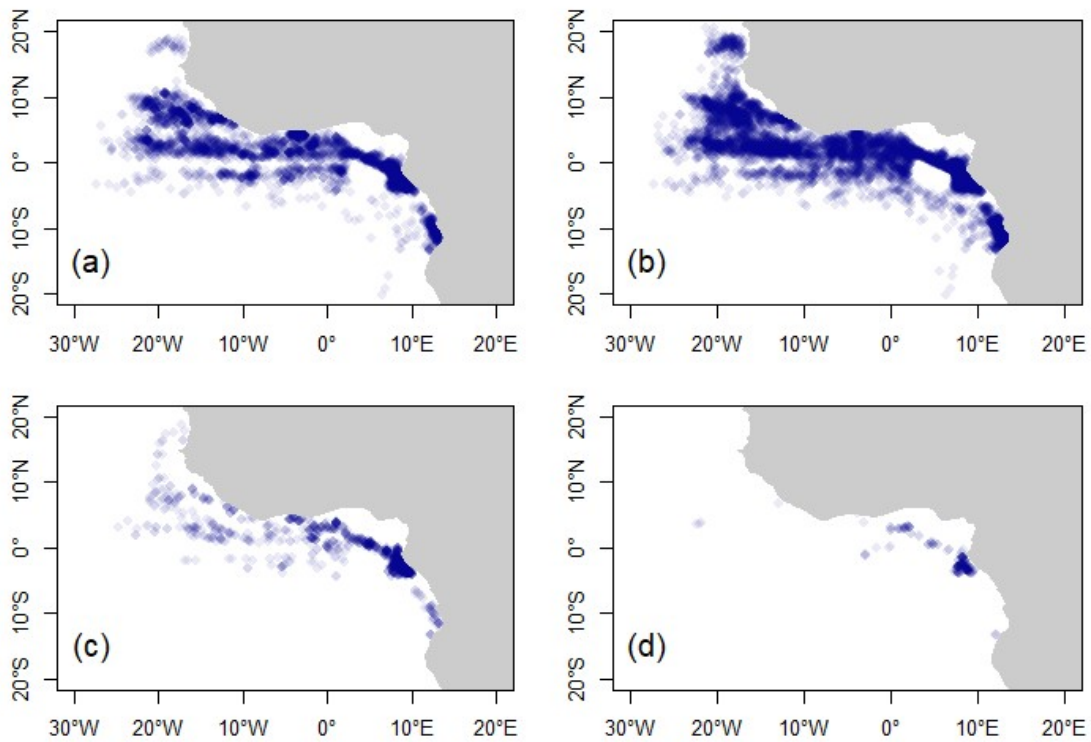


Figure 5. Geographical distribution of sets (a), FOBs (b) and macro fauna (c: marine mammals and d: whale sharks) observed by OCUPs between 2013 and 2017.

September 26, 2017 (1:05 PM)

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



Programme national de collecte des données de base (France)
Route et paramètres d'environnement

Formulaire A
Version 5.1
octobre 2016

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 :

Type	Heure GMT		Qua drant		Latitude			Longitude			Activité bateau	Activité environ	Visesse bat. (nds)	Tempér. Surf. (dd°d)	Visesse vent	Ter mode défaut.	Raison non-cablé	Systèmes observés	Distance en milles (nm, m)	N° formulaires		Code ZEE	Notes : Indiquer notamment les sorties/entrées de ZEE (une ligne indépendante pour chaque changement de zone)	
	hh	mm	TI	dd	mm	ss	ddd	mm	ss	T2A	T3	T4	T5	T6	T7	B	D	FPA (T, 2B)						
1																								
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								
13																								
14																								
15																								
16																								
17																								
18																								
19																								
20																								
21																								
22																								
23																								
24																								
25																								
26																								

Données vérifiées :

September 26, 2017 (1:05 PM)

Form C1: Information on discarded tuna size sampling



Programme national de collecte des données de base (France)
Echantillonnage des thonidés rejetés

Formulaire C1
N° de permis de pêche
Janvier 2015

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

N° de calée :
N° de ligne de la route :

Date :
Code IRD du bateau :

Auxiliaire BLT FRI :
Ravil FTA KAW :



Dans le tableau ci-contre, inscribe 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 bichettes que vous grouperez par 5 comme ci-après



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

Notes :

Données vérifiées :

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

September 26, 2017 (1:05 PM)

Form C2: Information on bycatch species size sampling



Programme national de collecte des données de base (France)

Echantillonnage des espèces associées

Formulaire C2

Version 3.0
Juillet 2015

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

N° de cage :

Date :

N° du formulaire roue :

N° de ligne de la roue :

Code IRD du bateau :

Remarque importante : pour les rates 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	Nb individus	Code espèce	Nb individus	Code espèce	Nb individus	Code espèce	Nb individus	Code espèce	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 pesé)	N° ligne	Code espèce	L1	Sexe	photo n°	Poids en kg (si pesé)
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) :

N° du formulaire route :

N° de ligne de la route :

Date :

Code IRD du bateau :

Opération sur objet (une seule réponse) :	
1 - Mise à l'eau	<input type="checkbox"/>
2 - Visite / rencontre (sans pêche)	<input type="checkbox"/>
3 - Pêche	<input type="checkbox"/>
4 - Récupération sans pêche	<input type="checkbox"/>

Caractéristiques de l'objet	
Type d'objet (T12)	<input type="text"/>
Devenir de l'objet (T13)	<input type="text"/>
Nombre de jours en mer	<input type="text"/>
Appartenance de l'objet ?	<input type="text"/>
Ce navire ou cet armement	<input type="text"/>
Navire d'autre armement	<input type="text"/>

Opérations sur balises	
Type d'opération (T14)	Opération 1 <input type="text"/>
Type de balise (T15)	Opération 2 <input type="text"/>
N° identifi. de la balise	<input type="text"/>
Marque de la balise	<input type="text"/>
Nationalité de la balise (T17)	<input type="text"/>
Indiquer le nom du navire propriétaire de la balise	<input type="text"/>

Estimation du banc s'il n'y a pas eu de calée	
Espaces de thons	Estimation (en tonnes)
<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>

Présence de tortues ou de poissons (requins, porte-épées) dans un rayon de 10m autour du radar		
Code espèce	Statut (T16)	Nombre d'individus
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>

Notes :

Données vérifiées :

September 26, 2017 (1:05 PM)

Annex 2. Equipment of the OCUP

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

<i>Documents</i>	<i>Source/author</i>
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.

<i>Equipment</i>	<i>Use</i>
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