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# KOBE III Bycatch Joint Technical Working Group Harmonisation of Purse-seine Data Collected by Tuna-RFMOs Observer Programmes

## Background

The second Kobe meeting of the tuna RFMOs established a joint technical working group on bycatch with the first 12 month work-plan for this group approved at the third Kobe meeting in July 2011. Included in this work-plan is the "harmonisation of bycatch data collected by tuna RFMOs" with the intended purpose of identifying the minimum data standards and data fields that should be collected across all RFMOs with a view to allowing interoperability. In establishing the minimum standards it is recognised that these should maximise the detail recorded (where practical) so that data users can aggregate information to suit the questions asked. Harmonisation of data across tuna RFMOs is desired to allow for more comprehensive reporting on the status of bycatch species, to assist with the identification of factors that cause or increase bycatch, and to evaluate the performance of mitigation methods. At the same time, improvements in quality of the data collection should help stock assessments and other functions of t-RFMOs.

The Inter American Tropical Tuna Commission (IATTC) is the only tropical tuna RFMO that employs its own observers. They are managed by its secretariat to undertake duties in the Eastern Pacific Ocean (EPO). If vessels cross the RFMO boundary between the IATTC and Western and Central Pacific Fisheries Commission (WCPFC) they also undertake observer duties that contribute to the WCPFC Regional Observer Programme (ROP). National observer programmes also operate in the EPO. All recognized observer programmes in the EPO collect common data fields which are specified by the IATTC. In the Western and Central Pacific Ocean (WCPO) the secretariat of the WCPFC supervisors its ROP. The ROP is based on the use of existing regional, sub-regional and national observer programmes that were already in place when the 'Conservation and Management Measure for the Regional Observer Programme CMM 2007-01 entered into force on 15 February 2008. The WCPFC provides minimum data fields, observer programme standards, facilitates the use of authorized observers in the ROP as required by CMMs in the WCPO, and that the ROP addresses the data and monitoring requirements of the Commission's CMMs. The International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Indian Ocean Tuna Commission do not currently administer observer programs and have not yet develop minimum data fields or standards for observer programs operating in the Atlantic and Indian Ocean. Observer programs operating in these oceans are National Observer Programmes (eg. Spain and France). Mention of "t-RFMO observer programmes" in this report refers to those programmes (regional or national) listed here.

A meeting of technical experts from tuna purse-seine fisheries observer programs was convened from 5 - 9 March 2012, in Sukarrieta, Spain, and provided the first opportunity for progress towards completion of this task for purse-seine fisheries. The meeting was organized by Martin Hall from IATTC with financial support from International Seafood Sustainability Foundation and held at the AZTI facility in Sukarrieta. The abbreviated name given to the meeting was Sukarrieta II. The objective of this meeting was to harmonize data collection systems and variable definitions to improve research on bycatch mitigation, stock assessment and other topics. The report of this meeting is provided in Appendix 1 to this report.

In this progress report to the Joint Technical Working a summary of the discussions at Sukarieta II that were directly relevant to the working group is provided along with a first draft of the minimum data standards and data fields for purse-seine fisheries for revision by the technical working group. This includes identification of areas where some uncertainty in data definitions remains. Attendees at the Sukarrieta II

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meeting that are also members of the Joint Technical Working Group were Martin Hall, Shannon Cass-Calay, Pilar Pallares, Josu Santiago and Simon Nicol.

## Issues pertinent for interoperability of observer data collected in the purse-seine fisheries of tuna-RFMOs.

1. OBSERVER COVERAGE

A number of studies (Lawson, 1997; Hall, 1999; Lennert-Cody, 2001; Babcock et al., 2003; Lawson, 2006a; Sánchez et al., 2007; Amandè et al., 2010) show that biases and precision are minimised when observer coverage exceeds 20%. When coverages are below this level appropriate statistical designs are necessary for the placement of observers to minimise the introduction of bias. Placement designs should include stratifications based on characteristics of vessel, gear and other factors.

There is potential for bias in the historical data of t-RFMOs. The observer coverage of purse seine effort in the EPO has been 100% for vessels with greater than 363 mt capacity (noting that these vessels represent over 90% of the catch of tunas in the EPO) for over two decades. In the WCPO 100% coverage has only been required for the last 2 years. The coverage rates varied by observer program prior to the introduction of the 100% requirement but has been >20% for all programs for the last decade. For ICCAT and IOTC the coverage is lower, but has been increasing in recent years.

When coverage rates are less than 100%, biases due to the placement of observers on vessels should also be checked. Observed and unobserved trips by vessels should be compared with regards to duration, catch rates, species composition, etc., to verify that there are no changes in vessel activity or fishers behavior in the presence of the observer.

References cited above:


Amandè, M. J., Lennert, C., Bez, N., Hall, M. A. and Chassot, E. 2010. How much sampling coverage affects bycatch estimates in purse seine fisheries? IOTC-2010-WPEB-20. 16 pp.

Babcock, E., Pikitch, E. and Hudson, C. 2003. How much observer coverage is enough to adequately estimate bycatch? Report of the Pew Institute for Ocean Science. Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL. 36 pp.

Hall, M.A. 1999. Estimating the ecological impacts of fisheries: What data are needed to estimate bycatches. p. 175-184 in Nolan, C.P. (ed.) Proceedings of the International Conference on Integrated Fisheries Monitoring, Sidney, Australia, 1-5 February, 1999. FAO, Rome, 1999. 378 p.

Lawson, T. 1997. Estimation of bycatch and discards in central and western Pacific tuna fisheries: preliminary results. Oceanic Fisheries Programme Internal Report. No. 33. Noumea, New Caledonia. 32 pp.

Lawson, T. 2006b. Scientific aspects of observer programmes for tuna fisheries in the western and central Pacific Ocean. Scientific Committee Second Regular Session, Manila, Philippines, August 7-18, 2006. WCPFC-SC2-2006/ST WP-1. Western and Central Pacific Fisheries Commission. 28 pp.

Lennert-Cody, C. E. 2001. Effects of sample size on by-catch estimation using systematic sampling and spatial post-stratification: summary of preliminary results. IOTC Proceedings No. 4. WPDCS01-09. pp. 48-53.

Sánchez, S., Murua, H., González, I. and Ruiz, J. 2007. Optimum sample number for estimating shark by-catch in the Spanish purse seiners in the western Indian Ocean. July 16-20, 2007. IOTC, WPTT-26. Indian Ocean Tuna Commission. 6 pp.

## 2. Definitions of TRIP

There are differences in the definition of trips between observer programs. WCPFC/IOTC/ICCAT define the conclusion of a trip when unloading occurs (regardless of % unloaded) whereas IATTC define a trip as 20 days and/or when at least 50% of the catch is unloaded. The IATTC definition of trip is defined under the requirements for the multilateral Agreement of the International Dolphin Conservation Program (AIDCP).

IATTC assign a sequential trip number to every observed trip at its commencement as they have a central role in coordinating observer activities. This is not currently the situation for the other t-RFMOs. The trip number in the WCPO is a combination of the observer_code + year + sequential_trip_number_of_observer. In the Indian Ocean and Atlantic Ocean the observer programs of France and Spain the trip number is a combination of the landing_date + boat_code. Although the assignment method and format differs between t-RFMOs all observer trip numbers are unique in each observer program.

## 3. Definitions of ZERO CATCH SETS

The reporting of skunk sets (Zero catch sets) can differ between the t-RFMOs. In some cases, the catch per set based in all sets made regardless of their catch, is used, while other analyses use catch per successful set, excluding the zeroes. When comparisons between data already summarized by t-RFMOs are made, how the skunk sets were treated should be checked to ensure comparability of data.

## 4. VESSEL REGISTER

### Vessel Number

Vessel characteristics strongly influence the catch of purse seine vessels and in many statistical analyses of catch data the “vessel effect” is explicitly included in these models to interpret results (e.g. standardisation of effort, tracking of performance with regard to bycatches, characterising tuna fisheries). Such analyses can be compromised if vessels change flag or name and this is unknown to the data analyst (resulting in bias and psedo replication). The t-RFMOs currently have vessel registers of various forms to track vessel name and flag for compliance and other reasons. Movements of vessels between t-RFMOs also occur and explicitly including such movements in inter T-RFMO comparisons would make them more statistically powerful. Consequently, standardisation or interoperability in these RFMO registers is desirable. The unique vessel identifier system (TUVI - see http://www.tuna-org.org/vesselpos.htm) that list all authorized vessels for all T-RFMOs provides an opportunity for standardisation and interoperability. On the basis that t-RFMO continue to fully participate in TUVI then this number could be recorded on observer forms and vessel logsheets allowing association of data to vessels.

### Vessel/Well capacity

The variation between vessel capacities is a significant determinant of vessel catch and operational strategy and it is desirable that this be included in the vessel registry to further help with the interpretation of data analyses. Currently capacity is measured either in metric tonne or in cubic meters depending on the country of vessel registration. Measurement in cubic meters is more common and standardising to this unit in the vessel register would be more efficient. The use of a conversion formula from metric tonne to cubic meters is required to facilitate comparison with historical data.

How wells are used during each trip can also vary (e.g. sealed, for non-tuna spp) and it is desirable that this be included in the details that observers record.

Vessel Nets

There are differences in the nets used by vessels that are likely to influence the presence and quantity of bycatch. Information on net characteristics is desirable for both standardisation of information and for identifying net types that may minimise interactions with bycatch. Establishing a catalog of net types is needed and could be established from port inspections or manufacturers. The IAATC have drafted a data form suitable for collecting the relevant net information. Changes in nets are infrequent on purse-seine vessels and the net-type could be included in the information stored on TUVI. Observers currently record an estimate of net size and depth and this information could be used to assist with updating TUVI information and identify when alterations to vessel nets are made.

## 5. Vessel Captain/Fishing Master Name

The experience of the vessel captain/fishing master influences the fishing strategy adopted and catch of purse seine vessels and the explicit inclusion of this effect in statistical models benefits the interpretation of results. As vessel captains/fishing masters change vessel a unique identifier similar to TUVI for captains/fishing masters would be desirable. This would require additional collaboration amongst the t-RFMOs to establish such a standardised register.

## 6. Fishing Location Information

Observers are currently asked to collect information of the detection equipment used to determine fishing locations (such as bird radar capabilities etc). The inclusion of such information is also likely to assist with the interpretation of results and trends from statistical analyses. Rather than observers recording equipment capacity information it would be preferable that equipment manufacturer and model is recorded as the capability information can be collected from the supply companies.

Vessels are often provided with advice on where to fish through 3rd party analyses of real-time oceanography which is then relayed to the vessel. The inclusion of this information in statistical models may also assist with interpretation of results. The recording of whether 3rd party information was provided would be beneficial for analyses.

## 7. Observer Placement

Placement meetings that specify the roles, obligations and responsibilities of observers and vessel staff should be adopted by all t-RFMO as this helps ensure the collection of higher quality information. The exchange of information used in the placement meetings by the different t-RFMOs will help in adding consistency and completing the list of issues addressed. This is particularly important for vessels that may fish across the jurisdictions of t-RFMOs (e.g. Pacific) on a trip where RFMO requirements may differ.

## 8. Data Reviews by Skippers

There is no homogenous policy regarding the right of captains/fishing masters to review and make comments regarding the data that the observer collects. Some RFMO observer programs are bound by the requirements of their organization, like the IATTC/AIDCP observer programs, but others do not have these requirements. It is advisable that when such review occurs that this is recorded so that data analysts are aware of differences in data collection procedures. This information is likely to be particularly pertinent where independence between vessel logbook and observer data is assumed.

## 9. Environmental Data

Environmental data is currently collected on observer forms with some consistency in data collected across RFMOs (e.g. wind speed, SST). These have been collected to help inform analyses on catchability (e.g. currents, wind strength that may affect set malfunction), and to better understand aggregation rates and/or species assemblages under FADs (eddy activity, frontal conditions, thermocline depth, etc.). The availability of high-resolution environmental data from satellites, moorings, and oceanic general circulation models has increased significantly in recent times and it may be more efficient to obtain this information from this source in the future.

## 10. Data Quality and Management

Auditing systems are critical to ensure the highest quality of observer data is available for users. Inter RFMO analyses would benefit from the application of consistent quality control measures to all data. In this respect, the auditing/editing system developed by IATTC is very comprehensive and could easily be adopted by the other t-RFMO's. This would assist with all t-RFMOs achieving data standards.

There recording of vessel activity TIME in UTC format is preferable for data consistency. IATTC observers collect the time of sunrise/sunset which is used to synchronise ship's time with the time in the area of operation. WCPFC observers synchronise UTC time with ship's time at the start of each day, which enables the ship's time recorded for activities during each time to be converted to UTC time. While both methods are different, there was enough information collected to determine UTC time in each database. The French and Spanish observer programs report time in UTC.

## 11. Length Measurement of tuna discards

IATTC observers collect an estimate of target tuna discard weight in size range (weight) bins but WCPFC observers take length measurements from a random sample of the discards to get size distribution and species composition of the discards and estimate the overall tuna discards. Despite differences in the methodology, the general requirement (i.e. the catch by species estimate and size distribution of discards) is consistent between these two RFMOs. The size bins approach may however restrict the application of length increment based analyses (eg. cohort) if the bin range is too large.

## 12. Definition of Set types

The language used to describe set types varies between t-RFMOs. Documentation is required that specifies definitions of set types for each t-RFMO to avoid the potential for incorrect assignment of set type for cross t-RFMO comparison. The Sukarrieta II meeting identified the following broad thesaurus of terms:

| Preferred term and preliminary definition | IATTC | WCPFC | IRD IEO AZTI |
|---|---|---|---|
| **School set**<br>*Sets on schools were there are no indications of association with floating objects, marine mammals or whale sharks* | 1. Boilers<br>2. Breezers<br>3. Finners<br>4. Foamers<br>5. Jumpers<br>6. Rippler<br>7. Shiners<br>8. Splasher<br>9. Subsurface | 1. Unassociated<br>2. Feeding on baitfish<br>3. Free School | Free School |
| **Drifting FAD set**<br>*Sets on floating objects constructed and deployed or encountered and modified by the fishers to attract fish to facilitate their aggregation and capture. This may include using the vessel (or its support boats) to act as the FAD.* | | 1. Drifting raft<br>2. Drifting FAD<br>3. Drifting payao | FAD set |
| **Log set**<br>*Sets on encountered floating objects, including natural, man-made objects, dead animals, etc., as far as they are not intentionally deployed or modified by human intervention* | | 1. Drifting log<br>2. Drifting debris<br>3. Dead animal | FAD set |
| **Payao set**<br>*Sets on encountered man-made floating object that are anchored* | | 1. Anchored FAD<br>2. Anchored raft<br>3. Payao | |
| **Whale set**<br>*Sets are made very close or encircling the live whale(s).* | | 1. Live whale | |
| **Whale shark set**<br>*Sets are made very close or encircling the live whale shark.* | | 1. Live whale shark | |
| **Dolphin set**<br>*Common only in the eastern Pacific. There is a clear association, and the set is preceded by a chase of the dolphin herd.* | | | |
| **Baitboat set**<br>*Sets occur in association with a baitboat. The baitboat drifts or sails slowly, attracts a tuna school, and may keep it by chumming the water. They are left as a separate class because of the potential effect of chumming that makes it different from a regular floating object.* | | 8 Other floating object | |
| **Seamount set** | | | |

To aid in establishing solid statistical basis for pooling data it would also be desirable for analyses be undertaken to ascertain the differences in catch and assemblage composition between the difference set types within and across t-RFMOs.

13. FAD Records

FAD sets are easily identified when the FAD is encircled, but occasionally the sets may happen in the vicinity of the FAD. There is some uncertainty in these circumstances on how to define the set type. The Sukarrieta II meeting suggested that if a FAD was observed within a small distance (e.g. 0.5 to 1 nm) from the area encircled then the presence of the FAD should be recorded. This information would allow the classification of the set type to be determined by the data analyst.

It is also desirable that the material used to construct encountered FADs be recorded as this influence the longevity of FADs and the assemblage associated. Recording of FAD dimensions including the depth of the submerged material is also highly desirable.

14. Mitigation Measures

Understanding the performance of mitigation measures work is a priority activity for most T-RFMOs. To facilitate analyses to inform t-RFMOs on performance the recording of the type of mitigation measures (if any) that were used on observer forms in addition to the fate of the animal would be beneficial.

15. Revision of draft standards

Revision of the standard data fields should occur after the upcoming ISSF workshop on standardizing purse seine cpue to ensure that the collection of data relevant for developing indices of abundance for use in stock assessment are appropriate and well defined.

## Other issues identified that are pertinent to the "Kobe Process" and bycatch

1. Observer Programs

The internationalization of tuna fisheries is resulting in observers from multiple programs working in many RFMOs (e.g. IATTC and Spanish observer working on vessels that cross into WCPFC jurisdictions). Presently, the observer programs in the EPO, Indian Ocean and Atlantic Ocean require that their observers have a University degree. In the WCPO different regional programs only require that they have completed a high school level education and that they can have the capability to write clear reports in English. The adoption of "competency based standards" for observers and observer training that are coherent within the t-RFMO's would avoid potential differences in observer qualifications and assist with ensuring consistency in data recording. Coherent standards within the RFMOs would also help ensure that observers are aware and capable of the specific data collection needs associated with each RFMO. The "Kobe process" provides the opportunity to develop these standards and could be included in agenda of future "Kobe" meetings

To avoid potential biases in observer data the "Kobe process" provides the opportunity for developing joint RFMO policy that "placement of observers on vessels should be based on scientific principals and not on the willingness of vessels to accept observers".

"Safety on board" vessels are an increasingly important issue for observers and Agencies/Organizations responsible for observer placement. Future "Kobe meetings" should promote that the RFMOs members provide safe and sanitary conditions to observers so these can perform their duties with the desired level of competence.

Current developments in electronic equipment should enhance the observer's duties. This includes current initiatives in on-board observer data processing (i.e. IRD-Sete system which can be used on "tablet" units) and the application of video camera technology to assist with the estimation of bycatch composition and biomass. The application of this technology should help reduce the burden of monitoring and free the observer to collect more scientific information. Pilot projects for such initiatives should continue as a matter of priority, with information shared between the t-RFMOs. The technology currently has limitations and until the technology is improved, the Sukarrieta II meeting cautioned against full-scale implementation until complete testing had been undertaken and adequate resources are allocated, including comprehensive technical support in all areas.

The preliminary review of t-RFMO observer training activities held during the Sukarrieta II meeting indicates that they are consistent across the RFMOs. A desired aspect of training, other than the obvious information about the fishery and species identification, should include instructions to observers on the different issues related to culture and what was called 'etiquette' onboard the vessels. Furthermore, as the captain/master determines the fishing strategy it is desirable that specific training/extension/outreach is provided to these persons on bycatch mitigation measures. As the observer is often viewed by the captain/master as a source of information on mitigation it is also desirable that observers are provided with suitable information that can be provided to fishing masters on mitigation measures.

2. Data Quality and Management

The Sukarrieta II meeting provided a rare opportunity for those responsible for data quality and management to discuss shared issues. A more regular meeting (eg 2 years) where t-RFMO data managers meet to maximise information sharing and system development would be highly beneficial to maintaining coherence between the data management systems of each t-RFMO. Similar harmonization meetings should be planned for longline observer programmes.

3. Environmental Variables

The environmental data collected by observers provides an additional source of independent data for the validation of Oceanic General Circulation Models (OGCM). Oceanographic institutions responsible for developing these models should be advised on the existence of these environmental data and the data made available to improve the OGCMs if requested.

## Observer Purse-Seine Data Harmonisation

Inter-operability in the data collected on bycatch on purse-seine vessels is required for undertaking global analyses on bycatch prevalence and mitigation methods beyond the most rudimentary level. Developing indices of abundance and interpreting catch per unit effort data derived from purse-seine fisheries is difficult due to the frequent and rapid changes in vessels and fishing equipment and strategies. The more detailed information that is collected on vessel and effort characteristics aids the standardisation of purse seine data. Standardising data forms across established observer programs is also difficult as many collect information beyond that required for t-RFMO/Country specific reasons. Consequently we do not focus this harmonization review on changes required to existing data forms. Instead we examine inter-operability between t-RFMOs observer data by listing the data fields collected by each t-RFMO and provide a qualitative evaluation of interoperability based on the similarity and level of detail reported in each t-RFMO. A ranking of 'HIGH' meaning most data fields and details are the same, 'INTERMEDIATE' meaning some similarity in data fields and detail and 'LOW' meaning little similarity in data fields and details that would result in restricted inter-operability. The Table below summarises this evaluation. The more detailed list of data fields is provided below this Table.

| **Data category** | **Rank** |
| --- | --- |
| Harmonisation of Effort Data | |
| Vessel Identification<br>*(Information to uniquely identify vessels)* | HIGH |
| Vessel Trip Information<br>*(Information to calculate trip duration, location and time)* | HIGH |
| Observer Information<br>*(Information to uniquely identify captain/fishing master)* | HIGH |
| Crew Information<br>*(Information to calculate crew number)* | HIGH |
| Vessel and Gear Attributes<br>*(Information to detail vessel specification and equipment)* | HIGH |
| Daily Activities<br>*(Information characterise vessel fishing and non-fishing activities during a trip allowing effort to be examined in finer resolution)* | INTERMEDIATE |
| School and Set Information<br>*(Information to characterise school type and detection method)* | HIGH |
| Harmonisation of catch data | |
| Catch Information<br>*(weight and or numbers of target and bycatch species)* | INTERMEDIATE |
| Length Information<br>*(weight and or numbers of target and bycatch species)* | LOW |
| Species of Special Interest<br>*(weight, length, fate and description of interaction)* | INTERMEDIATE |

# OBSERVER PURSE-SEINE DATA HARMONISATION

## Harmonisation of Effort Data

### Part 1. Vessel Identification

The current “Minimum Data-field Standards” specified by each of the t-RFMOs are outlined in the Table below. However, if each t-RFMO fully participates in the TUVI database then the TUVI number is all that is required to uniquely identify vessels for inter-operability.

| IATTC | IOTC & ICCAT (IRD IEO AZTI) | WCPFC |
|---|---|---|
| **Full Name of Vessel**<br>**Vessel Code (provided by IATTC)**<br>**Vessel Flag (provided by IATTC)** | **Name of Vessel** (before embarkation)<br>**Vessel Code** (number given to observer before embarkment by IRD)<br>**Vessel Owner/Company** | **Full Name of vessel** (including any numbers).<br>**Flag State Registration Number** (sourced from the vessel papers).<br>**International Radio Call Sign** (ICRS; issued to the vessel by the flag State in accordance with IMO regulations).<br>**Vessel Owner/Company**<br>**Hull markings consistent with CMM 2004-03**.<br>**WCPFC identification number (WIN) markings consistent with CMM 2004-03**.<br>**WIN format for markings consistent with CMM 2004-03.** |

**Part 2. Vessel Trip Information**

The current "Minimum Data-field Standards" specified by each of the t-RFMOs are outlined in the Table below. Currently IAATC define a purse-seine vessel trip differently to the other t-RFMOs with a trip concluding at 20 days and/or when at least 50% of the catch is unloaded. The clear reporting of when a trip commences and concludes is required to reduce the potential for inappropriate representation of trip data when inter-t-RFMO comparisons are undertaken.

| IATTC | IOTC & ICCAT (IRD IEO AZTI) | WCPFC |
|---|---|---|
| **Trip Number (unique 4-digit number assigned by IATTC)**<br>**Date (YYMMDD) of departure from port**.<br>**Name of the port of departure**<br>**Date (YYMMDD) of return to port**<br>**Name of the port of return** | **Date and time of departure from port with observer**<br>**Name of the port of departure with observer**<br>**Date and time of return to port with observer**<br>**Name of the port of return with observer** | **Date and time of departure from port**.<br>**Name of the port and country of departure**<br>**Date and time of return to port**<br>**Name of the port and country of return** |

**Part 3. Observer Information**

The current “Minimum Data-field Standards” specified by each of the t-RFMOs are outlined in the Table below. The most important data are those that identify the duration of the observers trip and information that can be used to uniquely identify the observer for the purpose of interoperability. The creation of a joint t-RFMO observer register may be an efficient way to achieve the “unique observer identity” (ie similar principal to TUVI).

| IATTC | IOTC & ICCAT (IRD IEO AZTI) | WCPFC |
|---|---|---|
| **Observer name** (First and Last name)<br>**Observer code** (provided by IATTC) | **Observer Name** (First and Last Name) | **Observer name** (First name(s) First and Last name Last – no abbreviations or initials)<br>**Nationality of observer** (Passport Country)<br>**Name of Observer Programme** -country and or organization<br>**Date, time and location of embarkation**<br>**Date, time and location of disembarkation** |

**Part 4. Crew Information**

The current “Minimum Data-field Standards” specified by each of the t-RFMOs are outlined in the Table below. The most important data are those that identify the total crew number and uniquely identify the captain/fishing master. The creation of a joint t-RFMO captain/fishing master register may be an efficient way to achieve the “unique observer identity” (ie similar principal to TUVI).

| IATTC | IOTC & ICCAT (IRD IEO AZTI) | WCPFC |
|---|---|---|
| **Name of fishing captain** 1 (Last name(s) and First name)<br>**Name of fishing captain 2** (Last name(s) and First name)<br>**Date (YYMMDD) for change of captain (if occurred)**<br>**Captain 1 code (provided by IATTC)**<br>**Captain 1 code (provided by IATTC)** | | **Name of captain** (First name(s) First and Last name Last – no abbreviations or initials)<br>**Nationality of captain and type of Identification document** (e.g. Passport nationality of the captain).<br>**Name of fishing master** (First name(s) First and Last name Last – no abbreviations or initials).<br>**Nationality of fishing master and type of Identification document**<br>**Total number of other crew and nationalities** (eg. 8 Philippines 6 Samoans 4 Taiwanese)<br>**Total number of Crew** (total number of persons on the vessel excluding the observer). |

**Part 4. Vessel and Gear Attributes**

The current "Minimum Data-field Standards" specified by each of the t-RFMOs are outlined in the Table below. The characteristics of the vessel and gear assist with standardizing effort and the over-riding principal for data collection should be to maximize the detail to the better the standardization. If the t-RFMOs fully participate in TUVI then much of the required information could be collected during registration and stored in the TUVI database.

| IATTC | IOTC & ICCAT (IRD IEO AZTI) | WCPFC |
|---|---|---|
| **Vessel Attributes** | | |
| **Capacity** (provided by IATTC)<br>**Number of Speedboats** (the number that are functional)<br>**Bow Thruster** (yes/no, equipped & operable)<br>**Helicopter** (yes/no, equipped)<br>**Ring stripper** (yes/no, equipped & used)<br>**Number of screws** (number of propellers powering the vessel)<br>**Power Block Diameter** (inches)<br>**Inflatatble Raft** (yes/no, equipped & operable for dolphin rescue)<br>**High Intensity Floodlights** (yes/no, equipped & operable and capable of producing 140,000 lumens)<br>**Diver** | **Date of construction**<br>**Overall Length**<br>**Hull Length**<br>**Width**<br>**Draft**<br>**Number of wells**<br>**Well capacity (tons)**<br>**Fuel tank capacity (cubic meters)**<br>**Main engine power (HP)**<br>**Maximum speed (knt)**<br>**Searching speed**<br>**Number of skiffs**<br>**Number of nets**<br>**Number of speedboats**<br>**Number of fixed binoculars**<br>**Number of binoculars**<br>**Number of Radio buoys onboard (beginning of the trip )**<br>**Radio direction finder Ryokuseisha**<br>**Radio direction finder 400 for Argos buoys**<br>**Trigger and location system for GPS buoys**<br>**Location system for SERPE (Ariane 2) buoys** | **Vessel cruising speed** (defined as the speed the vessel travel, which allows it to optimize its fuel usage but also gets the vessel along at a good speed).<br>**Vessel fish hold capacity** (The total maximum amounts in metric Tons (mT.) that the vessel freezers, wells and other fish storage areas on a vessel can hold).<br>**Length** (taken from the vessel plans or from other paper work that indicates the LOA).<br>**Tonnage** (specify unit. The vessel may be registered using Gross Tonnage (GT) or in (GRT) this will be indicated on the vessel registration papers).<br>**Engine power** (Specify unit. Usually be found in the vessel plans or from the engineer).<br>**Number of onboard support vessels** (How many vessels on board other than the net skiff, i.e. speedboats light boats, tow boats).<br>**Aircraft Make/Model,/Colour/Call- sign/Registration** |

| Gear Attributes | | |
|---|---|---|
| **Maximum depth of net** (observer estimated in fathoms)<br>**Maximum depth of net** (observer estimated by reporting no. of panels)<br>**Maximum length of net** (observer estimated in fathoms)<br>**Net mesh size** (inches, measured by observer)<br>**Dolphin Safety Panel Depth** (observer estimated in fathoms)<br>**Dolphin Safety Panel Depth** (observer estimated by reporting no. of panels)<br>**Dolphin Safety Panel length** (observer estimated in fathoms)<br>**Dolphin Safety Panel mesh size** (inches, measured by observer) | **Depth of net**<br>**Length of net**<br>**Weight of bottom chain** | **Maximum depth of net** (obtained from engineer)<br>**Maximum length of net** (obtained from engineer)<br>**Net mesh size** (measured by observer)<br>**Brailer(s) capacity sizes** (recorded in MT) |
| **Vessel electronics (preference for make(s) and model(s) to be specified for each piece of equipment** | | |
| **Sonar** (yes/no, used to locate schools during cruise)<br>**Bird Radar** (yes/no, equipped & operable) | **Compass/autopilot**<br>**Distance recorder**<br>**Navigation Radar**<br>**Bird Radar**<br>**Ecohsounder**<br>**Sonar**<br>**VHF & BLU Radio**<br>**Satellite**<br>**GPS**<br>**Sea Temperature Meter**<br>**VMS**<br>**Othe**r (specify) | **Radars**<br>**Depth Sounder**<br>**Global Positioning System (GPS)**<br>**Track Plotter**<br>**Weather Facsimile**<br>**Sea Surface Temperature (SST) gauge**<br>**Sonar**<br>**Radio/ Satellite Buoys**<br>**Doppler Current Meter**<br>**Expendable Bathythermograph (XBT)**<br>**Fishery information services**<br>**Satellite Communications Services** (Phone/Fax/Email numbers, and record Satellite numbers)<br>**Vessel Monitoring System** (Indicate the type of systems used on a vessel). |

**Part 5. Daily Activities**

The t-RFMOs require that a log/journal of daily activities is completed by the observer. This information is required to characterise effort data at resolutions finer than the trip (eg. set level). For inter-operability date, time, duration and location of activities is required. Activities can be classified into those that describe: the set; searching; transiting; FAD maintenance, deployment and retrieval; drifting; seamount; transshipment; and other non-fishing activities (such as breakdowns, sheltering from bad weather). There is considerable variation in the detail currently collected under these headings by each of the t-RFMOs but fishing activities can be clearly determined which is the critical requirement.

When floating objects are encountered the details for collection specified by each t-RFMO also vary, however information is collected on the type and detection method, and if the object is a FAD information is collected on its origin, construction and attachment materials, disposal, associated electronics/markers and size. The information collected by each t-RFMO appears sufficient to differentiate floating objects into FAD and non FAD and catergorize differences in FADs providing an intermediate level interoperability between t-RFMOs.

The current "Minimum Data-field Standards" specified by each of the t-RFMOs are outlined in the Table below.

| IATTC | IOTC & ICCAT (IRD IEO AZTI) | WCPFC |
|---|---|---|
| **Time of Sunrise and Sunset**<br>**On effort** (Yes/No whether on or near bridge to observe vessel operations)<br>**Date of a particular event/activity** (ships time)<br>**Time of event/activity** (ships time)<br>**Latitude and longitude of activity** (record position of each activity)<br>**Searching method**<br>**Sighting method**<br>**Bearing from Ship to sighting** (in degrees)<br>**Distance from ship to sighting** (nearest 10th nautical mile)<br>**Vessel speed** (search and run events)<br>**Water temperature** (every set)<br>**Weather** (cloud cover, beaufort No, visibility for every search or run) | **Date of the day** (day/month/year)<br>**Daily Activity data form number** (one data sheet per day and number sequentially)<br>**Morning distance** (from distance counter (eg GPS) at beginning of day)<br>**Evening distance** (from distance counter (eg GPS) at end of day)<br>**Ocean**<br>**Time of activity** (GMT)<br>**Latitude** (to minute), **longitude** (to minute) and **Quadrant**<br>**Boat activity code**<br>**Activity around the boat code**<br>**Boat speed** (knots -2 digits)<br>**Sea surface temperature** (1/10 degree – max 3 digit)<br>**Wind speed** (table 4) | **Date and time of start of daily activities** (both ships time and UTC recorded)<br>**Time of activity** (Record ships time for each activity)<br>**Latitude and longitude of activity** (record position of each activity)<br>**Numbers of school sighted per day** (How many free or associated schools of fish were sighted during the day) |

| | | |
|---|---|---|
| **Aerial Assistance** (yes or no if helicopter or plane used)<br>**Catch per set** (metric tons) for YFT, SKJ, Others (with codes)<br>**Wells used** (well number catch was loaded in) | **Reason why no fishing undertaken**<br>**Distance from vessel to sighting** | |
| **Activities codes provided are** | **Activities codes provided are** | **Activities codes provided are** |
| *To describe the set* | *To describe the set* | *To describe the set* |
| End set<br>Mammal set<br>Unassociated tuna set<br>Floating object set | Start of set (skiff on water) (<br>End of set (retrieve skiff) | Set<br>Setting on FAD<br>Net cleaning set |
| *To describe searching* | *To describe searching* | *To describe searching* |
| The vessel is searching<br>Log sighted | Searching (general)<br>Searching exclusively for floating objects<br>End of searching | Searching<br>Investigate free school<br>Investigate floating object<br>Helicopter takes off to search<br>Helicopter returned from search |
| *To describe transiting* | *To describe transiting* | *To describe transiting* |
| Departed from a port<br>Arrived at a port<br>Depart at sea<br>Arrive at sea<br>Running to another area or to a port (no crew member is looking for signs of fish for 5 mins or more) | Transit (steaming)<br>Transit to favourable oceanographic area<br>Boat arriving on favourable oceanographic area)<br>Steaming at night towards an object<br>Continued steaming towards favourable area and write what the observed system is | Transit |
| *To describe other non fishing activities* | *To describe other non fishing activities* | *To describe other non fishing activities* |
| | Breakdown at sea<br>Bad weather (sheltering with engine on)<br>In Port | No fishing - Breakdown<br>No fishing - Bad weather<br>In port<br>No fishing - Other reason |
| *To describe FAD activities* | *To describe FAD activities* | *To describe FAD activities* |

| | | |
|---|---|---|
| | Deploy or modify floating object<br>Retrieve a floating object belonging to the boat<br>Retrieve a floating object not belonging to the boat<br>Retrieve the object | Deploy - raft, FAD or payao<br>Deploy locating buoy<br>Servicing FAD or floating object<br>Retrieve - raft, FAD or payao<br>Retrieve locating buoy<br>Investigate floating object using sonar/sounder<br>Vessel drifting beside FAD attracting fish away from FAD before carrying out a Set<br>Vessel setting close to FAD (specify estimated distance)<br>Vessel using lights of boat or light boat to attract fish from FAD during night |
| *To describe drifting activities* | *To describe drifting activities* | *To describe drifting activities* |
| The vessel is drifting | Drifting at night with engine shutdown<br>Drifting close to school or floating object | No fishing - Drifting at day's end<br>No fishing - Drifting with floating object<br>Drifting -With fish aggregating lights |
| *To describe seamount activities* | *To describe seamount activities* | *To describe seamount activities* |
| | At anchor on seamount | |
| *To describe transshipping activities* | *To describe transshipping activities* | *To describe transshipping activities* |
| | Transshippment at sea | Transshipping or bunkering |
| *To describe other activities* | *To describe other activities* | *To describe other activities* |
| | Other | |
| | *To describe activities around the boat* | |
| | Alone in the area<br>In a group of boats with other purse seiner visible on radar and:<br>1. Same fishing gear and flag<br>2. Different fishing gear but same flag<br>3. Same fishing gear but different flag<br>4. Different fishing gear and flag | |

| When the activity is associated with a floating object or the sighting of a floating object the following information is also collected | | |
|---|---|---|
| **Type of Floating Object** | **Type of Floating Object*****means I am not sure if this is a non FAD category | **Type of Floating Object** |
| *To describe Non-FAD floating Objects* | *To describe Non-FAD floating Objects* | *To describe Non-FAD floating Objects* |
| Non FAD<br>Tree<br>Dead animal | Tree (or branch)<br>Palm of coconut/palm tree<br>Dead animal<br>Box, drum or large board<br>Rope, cable<br>Net or piece of net<br>Plastic Object<br>Metal object<br>Artificial object (without locating beacon)***<br>Experimental object***<br>Drifting Raft or buoy*** | Tree or log (natural, free floating)<br>Dead Animal<br>Manmade object (Non FAD) |
| *To described FADs* | *To described FADs* | *To described FADs* |
| FAD<br>Artificial light for attracting fish<br>Construction material<br>Chain / cable / rings<br>Cane / bamboo<br>Bait container / bait<br>Cord / rope<br>Floats / corks<br>Net material<br>Sacks / bags<br>Planks / pallets / plywood<br>Metal drum / plastic drum<br>PVC or other plastic tubes | Drifting raft (line and net) with beacon/buoy<br>DCP anchored (purpose of attracting fish)<br>Tuna boat (or skiff)<br>Support boat (supply)<br>Bundled straw<br>Dead animal with beacon/buoy<br>Manmade object (box, drum, board, rope, cable, net (or piece), plastic) with a beacon/buoy | Manmade object (Drifting FAD)<br>Anchored Raft Fad or Payao<br>Anchored Tree or Logs<br>Tree or logs (converted into FAD)<br>Debris ( flotsam bunched together)<br>Construction material<br>Logs, trees, debris tied together<br>Timber/planks/pallets/spool<br>PVC or plastic tubing<br>Plastic drums<br>Plastic sheeting<br>Metal drums<br>Philippines design drum FAD |

| | | |
|---|---|---|
| Plastic sheeting | | Bamboo/cane<br>Floats/cork<br>Other<br>Attachments<br>Chain, cable rings, weights<br>Chord/rope<br>Netting hanging underneath FAD<br>Bait containers<br>Sacking/Bagging<br>Coconut fronds/tree branches<br>Other |
| Other<br>Unknown | | Other |
| **How Floating Object is detected** | **How Floating Object is detected** | **How Floating Object is detected** |
| *By Visual Observation* | *By Visual Observation* | *By Visual Observation* |
| Visual - the object itself<br>Visual – Flag, Buoy, cork, etc<br>Lights<br>Visual - birds | | Seen from vessel by crew<br>Helicopter report<br>Lights<br>Flock of Birds sighted from vessel<br>Discovered in pursed net |
| *By Electronic/Remote Observation* | *By Electronic/Remote Observation* | *By Electronic/Remote Observation* |

| | | |
|---|---|---|
| Radio transmitter / beeper<br>Radar reflector<br>Radar<br>Satellite | Radio direction finder (Radiogoniomètre)<br>Satellite with various additions<br>Radiogoniomètre + GPS<br>GPS Serpe<br>Satellite + échosondeur indéterminé<br>Satellite sans échosondeur<br>Satellite + sonar<br>Satellite + échosondeur Zunibal<br>Satellite + échosondeur Satlink<br>Satellite + échosondeur Nautical<br>Satellite + échosondeur autre (à préciser dans les notes) | Found using vessel radio buoy<br>Bird radar<br>Sonar / depth sounder<br>Information from other vessel<br>Navigation Radar<br>Anchored (GPS)<br>Marked with GPS buoy |
| *Other Method* | *Other Method* | *Other Method* |
| | | Being deployed (so not detected) |
| Other | Autre type (à préciser dans les notes) | Other ( please specify in comments) |
| Unknown | | Unknown |
| **IF a FAD then the following is also collected** | | |
| **Origin of the FAD** | **Origin of the FAD** | **Origin of the FAD** (** PIRFO addition) |
| Your vessel – this trip<br>Your vessel – previous trip | Belonging to this boat or the company | Your Vessel |
| Other vessel– owner consent<br>Other vessel– no owner consent | Belonging to another boat or another company | Other vessel's- with permission<br>Other vessel's- without permission<br>Other vessel's- consent unknown** |
| | Drifting Object found | Drifting and found by your vessel |
| | Seeded | Deployed by FAD auxiliary vessel |
| | Other | Other (describe) |
| Unknown | Unknown | Unknown (describe) |
| **Disposal of the FAD** | **Disposal of the FAD** | **Disposal of the FAD** |

| | | |
|---|---|---|
| | Attach a beacon/buoy | Deploy - raft, FAD or payao<br>Deploy radio buoy |
| Left in water with description of FAD component (as above) | Left in water<br>Remain in water with the same beacon/buoy<br>Replace the beacon/buoy | Manmade object (Drifting FAD)- changed<br>Servicing FAD or floating object<br>Retrieve radio buoy |
| Removed | Retrieve on vessel<br>Destroyed<br>Sink | Retrieve - raft, FAD or payao |
| | Other | |
| **Electronics associated with FAD** | **Electronics associated with FAD** | **Electronics associated with FAD** |
| Direction to the object | | Radio buoy (with identification) |
| | | Radio buoy -unidentified |
| Geographic position of the object | | GPS buoy (with identification) |
| | | GPS buoy - unidentified |
| Tuna quantity | | Sounder buoy (with identification) |
| Tuna species | | Sounder buoy - unidentified |
| | | Light buoy |
| Water Temperature | | Other (describe) |
| | | |
| | | Unknown (describe in comments) |
| **Estimated size of FAD** | **Estimated size of FAD** | **Estimated size of FAD** |
| Simple Diagram of FAD to be drawn indicating dimensions. | | Simple Diagram of FAD to be drawn indicating dimensions. |
| Dimensions (in m) | | |
| Netting hanging from the object (yes/no/unknown), estimated area of hanging netting ($m^2$), predominant mesh size (inches) | | Record depth of Netting and or other materials hanging from FAD |
| Tag number | | FAD Markings or numbers |
| Maximum depth of object (m) | | |

| | | |
|---|---|---|
| | | Describe condition of the FAD when first and any attachments. |
| | | Describe any changes or additions to the FAD by the vessel. |
| **Other Data** | **Other Data** | **Other Data** |
| Bait container refilled (yes/no/unknown) | | |
| Fauna entrapped | | |
| Water clarity (clear/turbid/very turbid) | | |
| % epibiota | | |
| | Describe fate/staus of species associated with FAD<br>Caught and alive<br>Caught and dead<br>free | |

**Part 6 School and Set Information**

Each of the t-RFMOs currently collects information on how the school was detected (with categories under the sub-headings of by observation and by the use of electronics), the type of school, and reasons why a set did not occur or was only partially completed. The level of detail varies between t-RFMOs, however the essential information to define school type which is required for inter-operability is collected by all t-RFMOs. WCPFC may wish to include a data category for breakdowns that occur during a set to allow differentiation of these malfunctions. Preferred definitions of school type are outlined in the preceding sections of this document. The current "Minimum Data-field Standards" specified by each of the t-RFMOs are outlined in the Table below.

| IATTC | IOTC & ICCAT (IRD IEO AZTI) | WCPFC |
|---|---|---|
| **Method of detection of school** (How the vessel first detected the fish) Codes are: | **Method of detection of school** (How the vessel first detected the fish) Codes are: | **Method of detection of school** (How the vessel first detected the fish) Codes are: |
| *By Observation* | *By Observation* | *By Observation* |
| Birds sighted<br>Mammal sighted<br>Other cue sighted<br>Splashes sighted<br>Breezer sighted<br>Log sighted<br>Chase | School (no precision on type of school)<br>Naked Eye<br>Binoculars<br>Breezer (Balbaya), Finner/Jumper/Splasher (Sardara ou Saut), Boiler/Meatball/Foamer/Smoker (Brisant ou rouge)<br>Birds<br>Object no beacon<br>Dead animal<br>Small cetacean (dolphin, pilot whale)<br>Big cetacean (sperm whale)<br>Whale (eg Baleine)<br>Whale shark<br>Shark<br>School that have escaped from previous set<br>Boat school<br>Fishing on seamount | Seen from vessel<br>Seen from helicopter |

| | | |
|---|---|---|
| | Fishing on drop off of continental shelf | |
| *Using Electronics* | *Using Electronics* | *Using Electronics* |
| | Bird Radar<br>Normal Radar<br>Echosounder<br>Object with beacon<br>GPS buoy<br>GPS buoy with echosounder<br>Dead animal with a beacon) | Marked with beacon<br>Bird radar<br>Sonar / depth sounder<br>Anchored FAD / payao (recorded) |
| *Other Method* | *Other Method* | *Other Method* |
| | No system<br>Other tuna boat<br>Supply vessel<br>Other (specify) | Info. from other vessel |
| **Type of school association** | **Type of school association** | **Type of school association** (Noting that fish feeding on bait fish with no floating objects around is considered unassociated). Codes are: |
| Unassociated tuna set | Free school | Unassociated<br>Feeding on Baitfish |
| Floating object set<br>Live Whale set<br>Dolphin set | School object<br>Whale set<br>Whale shark set | Drifting log, debris or dead animal<br>Drifting raft, FAD or payao<br>Anchored raft, FAD or payao<br>Live whale<br>Live whale shark<br>Other floating object (please specify) |
| Accidental set | | No tuna associated |

| **Malfunction** | **Malfunction** | |
|---|---|---|
| Roll-up<br>Main engine failure<br>Main vessel hydraulic failure<br>Skiff failure (mechanical or hydraulic)<br>Speed boat failure<br>Winch failure (mechanical)<br>Power block failure<br>Bow thruster failure<br>Ripped net (not caused by roll-up)<br>Broken purse cable<br>Fouled or broken bunchline<br>Fouled or broken corkline<br>Broken leadline<br>Broken skiff towline<br>Broken vang guy line<br>Broken topping winch cable<br>Webbing in the rings<br>Webbing caught on the stern<br>Other | Unknown<br>Fish escape by diving<br>Fish escape as travelling to quick<br>Current to strong<br>Too many fish<br>Net damage<br>Winch failure<br>Bad weather<br>Whale escape and school follow<br>Other (specify) | |
| **Reason no set** | **Reason no set** | |
| Tuna separated from the dolphin school<br>Dolphin running to a rain squall<br>Other reason<br>Voluntary aborted set | Nothing to report<br>Captains decision<br>1. School to small<br>2. Fish to small<br>3. Company decision<br>School behaviour<br>1. Moving to quick<br>2. Fish dive before making set<br>3. Too deep | |

| | | |
|---|---|---|
| | Other<br>1. Sighting without fish<br>2. Strong current<br>3. Mechanical failure<br>4. Another boat is setting on the school | |

## Harmonisation of catch data

### Part 7 Catch Information

Each of the t-RFMO require that the observer estimate the weight of the catch and/or numbers of bycatch species. The weight categories differ between the t-RFMOs and this places restriction on the inter-operability of the data collected. Information on whether the catch is retained or discarded is collected by each t-RFMO and although there are differences in the levels of detail the information is reasonably coherent allowing for inter-t-RFMOs comparison. The current "Minimum Data-field Standards" specified by each of the t-RFMOs are outlined in the Table below.

| IATTC | IOTC & ICCAT (IRD IEO AZTI) | WCPFC |
|---|---|---|
| **Trip number, Set number, Date**<br>**Let go time** (time when the skiff, with the net attached, hits the water)<br>**Ringsup time** (the time when all the purse rings break the surface of the water)<br>**Endset time** (the time when the skiff is secured on deck after completing the set)<br>**Tunaset or logset**<br>**Evidence of strong currents during set & how determined**<br>**Malfunctions during the set** (rime occurred, time repair completed, delay in the set) | **Set number**<br>**Date**<br>**Daily Activity data form number and activity number**<br>**Captains estimate of school size before commencement of set (if possible per species and mean weight of each species)**<br>**Time of set start – skiff launched**<br>**Rings up time**<br>**End of set (skiff on board)**<br>**Thickness of the school**<br>**Mean depth of school**<br>**Depth at shallowest part of school**<br>**Sonar used during setting**<br>**Supply vessel part of setting – supply name**<br>**Speed & direction of current at 10m depth**<br>**Maximum depth of net when in closed** | **Observer's record of date and time of start of set** (usually recorded when the pelican hook is released and net skiff slides in to the water taking the net with it)<br>**Observers record of date and time of end of set** (Record when the net skiff is hauled on board after the set)<br>**Vessel's record of date and time of start of set** (Record what time and date the vessel has entered in the Log sheet for the same set)<br>**Retained catch and Discards, by species** (Record all species that are retained using the FAO codes. |
| IATTC collects catch in metric tons with fileds for YFT, SKJ, Other (spp code) and well numbers specified where catch | IRD form request an estimate from the Captain/Fishing master for total catch of YFT, SKJ, BET and all school and | |

| | | |
|---|---|---|
| loaded | average weight for each species | |
| | IRD request Species code, weight category, total weight and well number of retained tuna<br><br>For discard tuna IRD requests species code, weight category, discard code (see below) total weight, weather landed on deck<br><br>For bycatch, IRD request species code, fate code, discard code, total weight, total number and for sharks and billfish average weight and/or average size | PIRFO forms request an estimated breakdown down of total tuna catch (MT) by % in the following categories SKJ, YFT<9kgs, YFT>9Kgs, BET<9kgs, BET>9Kgs and number for YFT>9Kgs and BET>9Kgs). |
| | IRD weight categories as follows for YFT, BET, ALB (<3Kg, 3-10Kg, 11-30Kg, 3-30Kg, 31-50Kg, 11-50Kg, >50Kg, >10Kg)<br><br>IRD weight categories as follows for SKJ, BLT, FRI, FRZ, LTA, KAW (<1.8Kg, >1.8Kg, 1.8-4Kg, 1.8-6Kg, 4-6Kg, 4-8Kg, 6-8Kg, >8Kg) | An estimate of the catch by fate code is also requested for target tuna and bycatch according to the following codes: |
| *For retained catch* | *For retained catch* | *For retained catch* |
| Human consumption<br>Mixed (some catch consumed, some discarded) | retained (in well)<br>Partially kept (shark fin, dry fish etc)<br>Crew consumption | Retained – whole weight<br>Retained – headed and gutted (billfish only)<br>Retained – gilled and gutted (kept for sale)<br>Retained – partial (eg. fillet, loin)<br>Retained trunk – fins retained(shark only)<br>Discarded trunk – fins retained (shark only)<br>Retained – crew consumption<br>Retained – other reason (specify) |
| *For discarded catch* | *For discarded catch* | *For discarded catch* |

| | | |
|---|---|---|
| Discarded<br>Species/size undesirable for market<br>Catch lost due to ripped sack<br>Vessel full<br>Well limitation (wells not ready to receive fish)<br>Condition undesirable for market<br>Other | Discard in sea alive<br>Discard in sea dead<br>Wrong size<br>Wrong species<br>Wells full<br>Damage fish<br>Other (specify) | Discarded – too small (tuna only)<br>Discarded – unwanted species<br>Discarded – gear damage (tuna only)<br>Discarded – vessel fully loaded<br>Discarded – shark damage<br>Discarded – whale damage<br>Discarded – poor quality<br>Discarded species of special interest – alive<br>Discarded species of special interest - dead<br>Discarded species of special interest – unknown condition<br>Discarded - other reason (specify) |
| | | **Tag recovery information** |

**Part 8 Length Information**

IATTC currently do not require length measurements to be undertaken on the vessel and have implemented port sampling for these data. The diversity of unloading locations for the IATTC is believed to be low and the traceability of tuna catch high. Consequently length based information collected in port can be related back to the set. The traceability of catch in the WCPFC is more complex due to the occurrence of well sorting and high diversity of unloading locations and observers are required to undertake length measurements on the vessel. This includes measurement of discarded species and those of special interest which provides the opportunity to raise the catch data into finer resolution size increments. This is not possible for discarded species in the IATTC and inter-operability with the IATTC is poor for this data field. The current “Minimum Data-field Standards” specified by each of the t-RFMOs are outlined in the Table below.

| IATTC | IOTC & ICCAT (IRD IEO AZTI) | WCPFC |
|---|---|---|
| | | **Species code** (FAO). |
| | One column per species – check form for details | **Length measurement code** (as per the measurement methods given in the codes)<br>Upper jaw to fork in tail<br>Upper jaw to second dorsal fin<br>Lower jaw to fork in tail<br>Pectoral fin to fork in tail<br>Pectoral fin to second dorsal fin<br>Total length (for sharks) |
| **Tuna**<br>**Metric Tons captured by species code & size category**<br>(small <2.5kg; medium 2.5-15 kg; large >25kg; Total)<br>**Billfish by species and number**<br>Post-orbital Length (cm, up to 12 individuals)<br>Collective number of individuals by category small <90cm; medium 90-150cm; large >150cm; Total) | **Discarded tuna**<br>Estimate species composition from 100 to 150 randomly selected individuals then measure 10-20 (nearest cm) for each species<br>For other discards species<br>All species length, sex, weight (if precision scales available), picture (if first time seen) to be reported but a priority for sharks, billfish and atlantic bonito. | **Length (cm)** |

**Part 9 Species of Special Interest**

The information collected by the t-RFMOs provides for some inter-operability between the datasets. General information describing the type of interaction and set details along with information on the species and fate when landed on the deck and when released is collected (with level of detail varying between t-RFMO). The IATTC, IOTC and ICCAT also collect specific information on turtle interaction. The current "Minimum Data-field Standards" specified by each of the t-RFMOs are outlined in the Table below.

| IATTC | IOTC & ICCAT (IRD IEO AZTI) | WCPFC |
|---|---|---|
| *General Information* | *General Information* | *General Information* |
| **Trip Number** | **Set number** | **Type of interaction** (eg. caught on line - tangled in net, swimming around outside of net, etc). |
| **Set Number** | | **Date and time of interaction** (ship date & time) |
| | | **Latitude and longitude of interaction** |
| **Species** (using code table or specified) | | **Species FAO code of marine reptile, marine mammal, or seabird**. |
| *Landed on deck* | *Landed on deck* | *Landed on deck* |
| **Rays and Manta Rays**<br>**Estimated number of individuals by species code & size category** (small <90cm; medium 90-150cm; large >150cm; Total) and **Density** (Small, Medium, Large, Total)<br>**Other Big and Medium Fish**<br>**Code & Estimated number of individuals by species code & size category** (small <30cm; medium 30-60cm; large >60cm; Total) and **Density** (Small, Medium, Large, Total)<br>**Seabird species code & number**<br>**Other Fish, invertebrates, other fauna species code, number & density**<br>**Sharks by species and number**<br>Length (cm, up to 12 individuals)<br>Collective number of individuals by category small <90cm; medium 90-150cm; large >150cm; Total)<br>**Cetaceans by species** | All species length, sex, weight (if precision scales available), picture (if first time seen) to be reported but a priority for sharks, billfish and atlantic bonito. | **Length** (cm) |

| | | |
|---|---|---|
| Length (cm) and girth (cm)<br>Fetus length (cm) | | |
| | | **Length measurement code** (as above for codes) |
| **Sharks**<br>Sex (Male/Female/Unknown)<br>**Cetaceans**<br>Sex (Male/Female) | | **Gender** (Male/Female/Indeterminate/Unknown) |
| | | **Estimated shark fin weight by species** |
| | | **Estimated shark carcass weight by species** |
| | | **Condition when landed on deck** (Codes are:) |
| **Cetaceans**<br>Lactating (yes/no)<br>Fetus & its sex | | Alive but unable to describe condition<br>Alive and healthy.<br>Alive, but injured or distressed.<br>Alive, but unlikely to live.<br>Entangled, okay.<br>Entangled, injured.<br>Hooked, externally, injured.<br>Hooked, externally, injured.<br>Hooked, unknown, injured.<br>Dead<br>Entangled, dead<br>Hooked, externally, dead.<br>Hooked, internally, dead.<br>Hooked, internally, dead.<br>Condition unknown.<br>Entangled, unknown condition.<br>Hooked, externally, condition unknown<br>Hooked, internally, condition unknown.<br>Hooked, unknown, condition unknown. |
| **Tuna**<br>**Code & Metric Tons discard to sea by category** (small <2.5kg; medium 2.5-15 kg; large >25kg; Total) plus reason (as above for codes)<br>**Sharks** | **Condition when released** (same codes as above) | **Condition when released** (same codes as above) |

| | | |
|---|---|---|
| Fate (human consumption, discarded, released alive, other , unknown)<br>**Billfish**<br>Fate (human consumption, discarded, released alive, other , unknown | | |
| | **Whaleshark and cetaceans**<br>Escape from net<br>Released from net alive<br>Released but dead<br>Other (specify) | |
| | | **Tag recovery information** |
| | | **Tag release information** |
| | | *Interactions with Vessel or Gear only* |
| | | **Vessel's activity during interaction** (PIRFO options are: setting, hauling, searching, transiting, other) |
| | | **Condition of species observed at start of interaction** (as above) |
| | | **Condition of species observed at end of interaction** (as above) |
| | | **Description of interaction** |
| | | **Number of animals sighted** |
| **Turtles** | **Turtles** | |
| **Species**<br>Olive Ridley<br>Leatherback<br>Hawksbill<br>Loggerhead<br>Unidentified | | |
| **Activity**<br>Alive & immobile<br>Swimming<br>Copulating | | |

| | | |
|---|---|---|
| Feeding<br>Dead<br>Other/Unkown | | |
| **Number of turtles**<br>Various sighting<br>One group of multiple turtles<br>Found trapped/entangled in floating object<br>Passed alive through the power block | | |
| **Association**<br>Marine mammals<br>Tuna (breezer)<br>Unassociated<br>Other<br>Floating object<br>Distance of the association (m) | | |
| **Condition upon leaving the Turtle**<br>Entangled alive in flotsam<br>Previously dead<br>Released unharmed<br>Light injuries<br>Grave injuries<br>Killed<br>Escaped/evaded net<br>Consumed<br>Not involved in set<br>Other/Unknown | Tangled but alive<br>Tangled but dead<br>Free | |

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# Appendix 1

## Technical meeting of experts from tuna purse seine fisheries observer programs

## 5-9 March 2012, Sukarrieta, Spain ("Sukarrieta II")

# Technical meeting of experts from tuna purse seine fisheries observer programs
# 5-9 March 2012, Sukarrieta, Spain ("Sukarrieta II")

## Introduction: *(Presentation Day 1- Intro)*

The so-called "Kobe Process", a series of joint meetings of members of tuna RFMOs, has identified a number of issues that can be advanced globally because they are common to all RFMOs. This Workshop dealt broadly with harmonizing and improving the data collected through observer programs in tropical tuna purse seine fisheries, which account for a substantial part of the global catch of tunas. While the Workshop was not formally set up under the Kobe Process, it was closely aligned with the Kobe Process objectives. Funding for the participation of experts in the Workshop (see list of attendees) was made available by the International Seafood Sustainability Foundation (ISSF). The Workshop was chaired by Dr. Martin Hall (IATTC).

## Objectives:

- ✓ to harmonize data collection systems across oceans
- ✓ to set minimum data standards and data fields
- ✓ to improve data quality and completeness
- ✓ to improve bycatch estimation
- ✓ to assist with the identification of factors that cause or increase bycatch
- ✓ to improve research on bycatch mitigation, stock assessment and other topics
- ✓ to evaluate the performance of mitigation methods
- ✓ to facilitate comparative studies

## ATTENDEES:

| Participant | Email | Organization | relevant t-RFMO |
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## Background:

The second Kobe meeting of the tuna RFMOs established a joint technical working group on bycatch with the first 12 month work-plan for this group approved at the third Kobe meeting in July 2011. Included in this work-plan is the "harmonization of data" with the intended purpose of identifying the minimum data standards and data fields that should be collected across all RFMOs with a view to allowing interoperability. Harmonization of data across tuna RFMOs is desired to allow for more comprehensive reporting on the status of bycatch species, to assist with the identification of factors that cause or increase bycatch, and to evaluate the performance of mitigation methods. At the same time, improvements in quality of the data collection should help stock assessments and other functions of t-RFMOs. The Sukarrieta II meeting provides the first opportunity to progress towards completion of this task for purse-seine fisheries. In establishing the minimum standards it is recognized that these should maximize the detail recorded (where practical) so that data users can aggregate information to suit the questions asked.

## TRIP, GEAR and VESSEL DATA: *(Presentation Day 1- Net Characteristics)*

There are differences in the definition of trip between t-RFMOs. WCPFC/IOTC/ICCAT define the conclusion of a trip when unloading occurs (regardless of % unloaded) whereas IATTC define a trip as 20 days and or at least 50% unloaded. It is difficult for IATTC to adopt a different definition because the current one has been adopted in a multilateral agreement, and the change should require a revision of the agreement. Users should be aware of the different criteria, which results in more trips, and shorter average trip duration for WCPFC/IOTC and ICCAT when compared to IATTC.

When coverage is less than 100%, caution must be used to avoid the shortening of trips with observers using the definition. A comparison of the duration of observed and unobserved trips may help verify that this bias is not present.

IATTC are also able to assign a trip number at commencement as they have a central role in coordinating observer activities. This is not currently the situation for the other t-RFMOs. For WCPFC the number is assigned which is a combination of the observer_code + year + sequential_trip_number_of_observer. French and Spanish observer programs include landing_date + boat_code

## Vessel Characteristics

Vessel characteristics strongly influence the catch of purse seine vessels. Transfer of vessels between flags and t-RFMOs occurs and the ability to track vessel movement is necessary to assist with standardization of effort, tracking of performance with regard to bycatches, and characterizing tuna fisheries. Each t-RFMO currently has vessel registers of various forms. There is already a list of authorized vessels for all t-RFMOs, that includes a unique vessel identifier (TUVI). Although TUVI is dependent on the amount of common vessel information collected by each t-RFMO, the group suggests that all t-RFMOs use and give priority to the TUVI code (available at http://www.tuna-org.org/vesselpos.htm). Observers need a simple system that allows them to accurately provide vessel number.

The characteristics currently in use are listed in ***Appendix 1*** that compares the variables recorded by all observer programs. It is recommended that especial attention be paid to changes in electronic systems used in the fishing operations. Complete records of brands and models used are needed to have adequate knowledge of the specifications of each system. This applies to radars, echo sounders, sonars, etc. The minimum standard characteristics suggested are identified in column Minimum Standard from ***Appendix 1***, but a dynamic approach is needed, including periodic reviews, so that technological advances are closely tracked.

It is suggested that a complete survey of the fleets produces a database with details of vessels and gear, especially the variables that are not available to observers. Most of the variables of interest are listed in the IATTC **Purse Seine Description Form**, and the **Purse Seine Detection Equipment Form**, both available from IATTC website (http://www.iattc.org/Downloads.htm). ***(Appendix 2 & Appendix 3)***

## Vessel Captain/Fishing Master Name

The experience of vessel captain/fishing master strongly influences the fishing strategy adopted and catch of purse seine vessels. It is suggested that the t-RFMOs collaborate to establish a standardized register of vessel captain/fishing masters where each captain/master has a unique identifier, preferably a passport or ID number given the many spellings used for the same individual. As the captain/master determines the fishing strategy it is also recommended that specific training/extension/outreach is provided to these persons on bycatch mitigation measures (e.g. IATTC and ISSF skipper workshops).

## Vessel Capacity

Vessel capacity is currently recorded using metric tons or cubic meters. It is suggested that cubic meter be used as the standard for vessel capacity and that it be included in the vessel registry. The development of a conversion method from metric tons to cubic meters is suggested to facilitate the use of historical data. How wells are used in each trip (e.g. sealed, for non-tuna species) should be included in the details that observers record.

## Vessel Nets

There are differences in the nets used by vessels that are likely to influence the presence and quantity of bycatch. Information on net characteristics is desirable for both standardization of information and for identifying net types that may increase or decrease bycatches. Producing a catalog of purse seine designs, and associate the different types with the corresponding vessels is suggested (established from port or manufacturers data). Details to be included in the catalog are provided in the draft IATTC form **(Appendix 2).** Observers currently estimate net size and depth. This information would be used to validate the catalog information and to identify when alterations to vessel nets are made.

## Fishing Location Information

Vessels are often provided with advice on where to fish through 3rd party analyses of real-time oceanography which is then relayed to the vessel. It is suggested that information on the means used to help the decision-making process to select fishing location is recorded by observers with the highest level of detail possible, and that it is treated as confidential.

Detection equipment: it is suggested that observers collect at least make and model information as operational details can be obtained from manufacturer. It is also important to record whether the equipment is used. *The* ***Purse Seine Detection Form*** from IATTC **(Appendix 3)** attempts to improve the knowledge of the specifications of the equipment used.

## OBSERVER PROGRAMS: (Ghana Observer Program Presentation)

Given the development of the fisheries towards vessels that move between ocean areas, it is highly desirable that coherent competency-based standards for observers are applied across all t-RFMOs.

Placement of observers on vessels should be based on a scientific sampling design, and not on the willingness of vessels to accept observers. . When coverages are less than 100%, it is necessary to control for biases in observer placement by comparing observed and unobserved trips with regards to duration, catch rates, species composition, etc., to verify that there are no changes in vessel activity or fishers behavior in the presence of the observer.

It is suggested that placement meetings that specify the roles, obligations and responsibilities of observers and vessel staff should be adopted by all t-RFMO as this helps ensure the collection of higher quality information. The exchange of information used in the current placement meetings by the different t-RFMOs will help in adding consistency and completing the list of issues addressed. This is particularly important for vessels that may fish across the jurisdictions of t-RFMOs.

Feedback to fishers about the observer's roll and duties – Placement information: It is very important that the programs staffs informs the captain/crew about the observer duties and obligations. Some of the programs have documents describing this process, and it is suggested that the procedures are shared by all, to improve them by selecting the best points from each program. Pacific on a trip where requirements may differ. The form used by IATTC in the placements is attached **(Observer Placement Forms - Appendix 4)**

## 1. Observer Selection – Qualifications.

a. Screening procedures

The screening procedures are determined by the human resources available in each region, given the pay, duration of trips, etc. Obviously, if the requirements are too stringent they may restrict the numbers too much. Some programs require a degree in biology or equivalent, while others cannot find candidates with these qualifications.

b. Selection of vessels / Sampling coverage.

If the vessels are selected on the bases of willingness to carry an observer, of space available, or on their port of departure or other logistic constraints, the samples may be biased, and meeting a mandated coverage level in these circumstances is not statistically acceptable.

c. Observer gear.

The lists of observer gear used by all programs are quite similar. A laser measuring device of low cost that can be used by a single individual and that would allow to measure even large individuals (up to 2 – 3 m developed by some scientists from Central America was shown as a potentially useful and affordable instrument to add in the future. ***(Video 1 and Video 2)***

## 2. Observer Training: (*Presentation Day 2* IATTC-AIDCP Suka II Altamirano Presentation) and (PIRFO Training)

The objective of this section was to identify common elements of training that can be shared as well as common problems derived from the different schemes. The training is affected by the functions of the observer, and if enforcement, control, functions are required, it should adjust to them.

A special subject that needs to be added to observer training programs in the future is the recognition of the different mitigation measures being used by the vessels.

Training materials

A discussion of training materials available to share led to the idea of developing a centralized place to put new materials as they are being developed. With observers becoming more commonly used across t-RFMO boundaries, their training should allow them to perform in the different areas needed with a satisfactory level of competency.

Feedback from observers

It is very important that the programs maintain a mechanism to receive feedback from the observers, as a way to track the difficulty of providing the information requested, conflicts to achieve competing goals, etc.

Mitigation measures used

The observers need to become familiar with the different types of mitigation measures and equipment being used, and this must be included in the reports.

## <u>OBSERVER COVERAGE</u>: **(Presentation Day 3- Observer Coverage)**

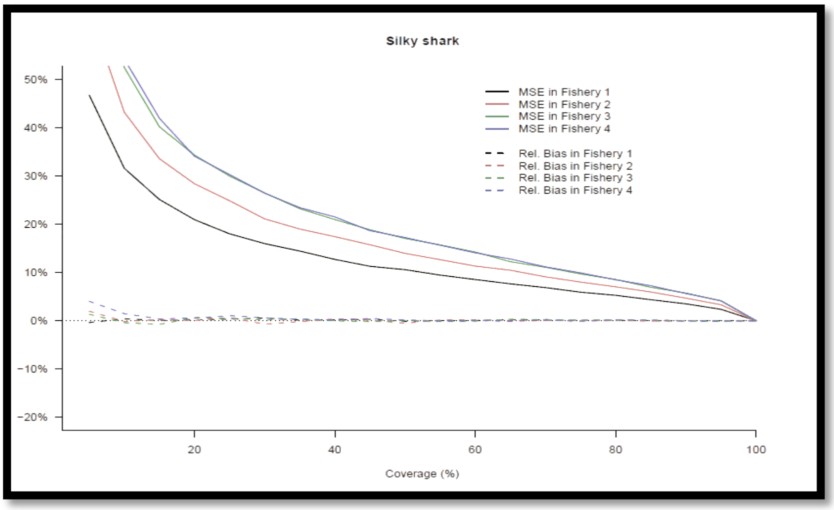
Observers in tuna boats have several potential functions:

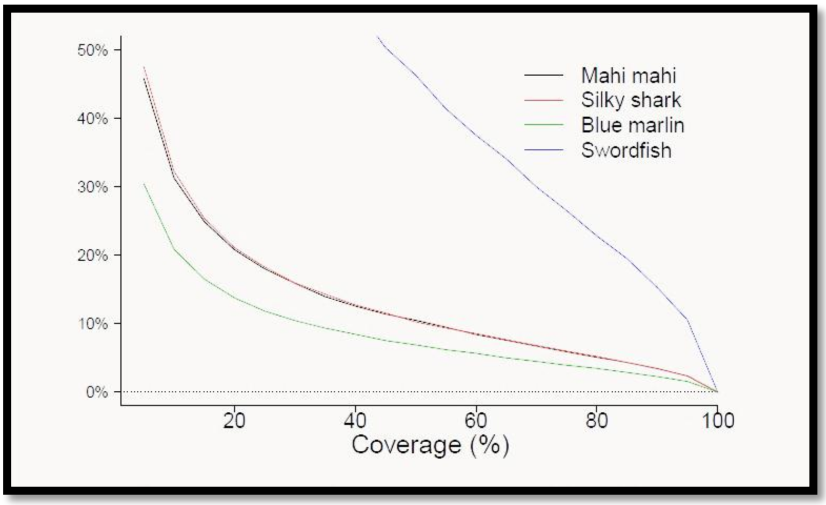
- ✓ fisheries data collection
- ✓ bycatch estimation
- ✓ identification of factors causing bycatch
- ✓ enforcement purposes

Of especial interest for this group are the first three. The experience from the tuna-dolphin program showed that observer data and communication with fishers were the critical factors to identify and reduce dolphin mortality. From this point of view, since bycatches are affected by a large number of factors and large sample sizes are needed to separate the effects of different factors, the higher the observer coverage the better.

From the point of view of bycatch estimation, a number of studies (*Lawson, 1997; Hall, 1999; Lennert-Cody, 2001; Babcock et al., 2003; Lawson, 2006a; Sánchez et al., 2007; Amandè et al., 2010b)* **(References 1-7)** show that biases and precision are at reasonable levels with coverages of around 20%. When coverages are below this level, it is especially important to ensure that proper statistical designs are used in the placing of observers, and that stratifications based on characteristics of vessel, gear and other factors are used to maximize the returns from the costs of sampling.

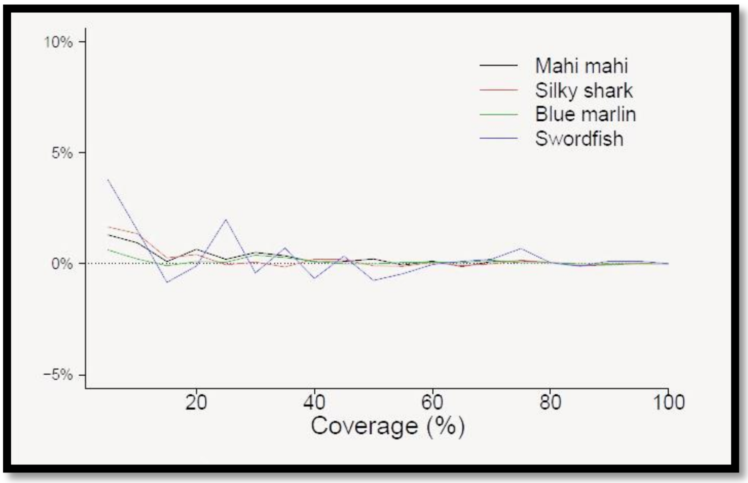
The following figures, from Amande et al., 2010, and Hall, 1999, illustrate the typical shapes of the curves showing biases or variance versus observer coverage.

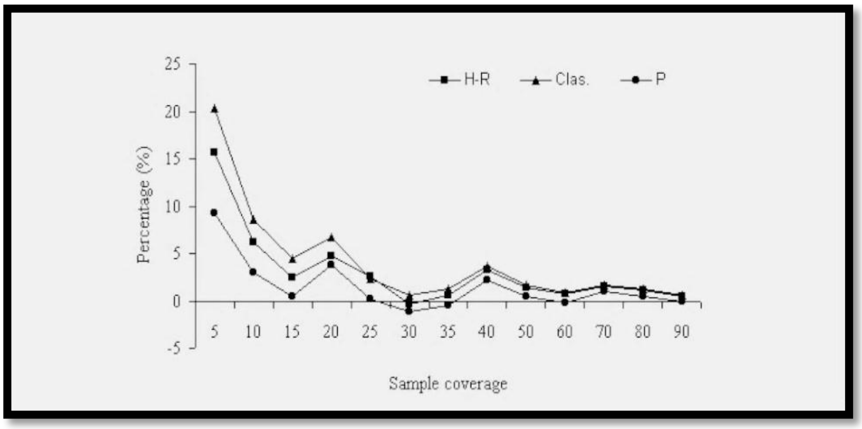


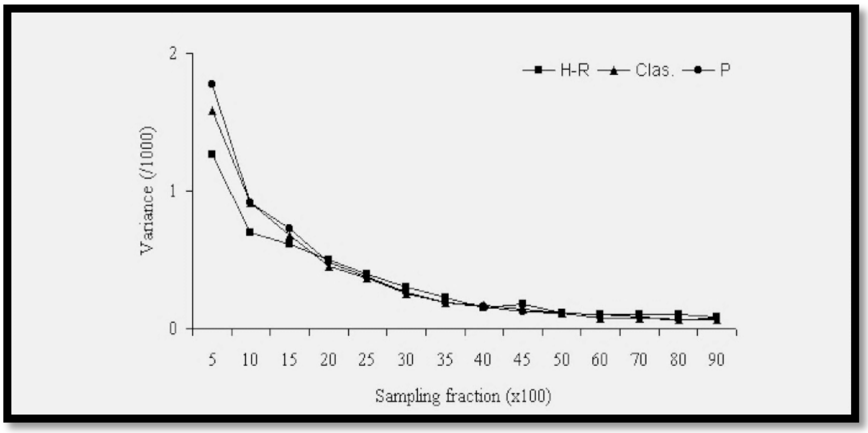

**Uncertainty in bycatch estimate as a function of sampling coverage**

**Bias in bycatch estimate as a function of sampling coverage**






**Relative Bias (%) in MPT ratio in the estimates of mortality of the eastern spinner dolphin H-R = Hartley-Ross formula, Class. =Classical formula, P. =Pascual formula.**




**Changes in variance with sampling coverage using mortality of eastern spinner dolphin per ton for a combined data set. Average of 1,000 similations. Bootstrap estimates M=100. True ratio =0.026. H-R = Hartley-Ross formula, Class. = Classical formula, P. = Pascual formula**

At present 100% observer coverage of purse seine effort is required by IATTC and WCPFC (noting that exceptions apply – e.g.  IATTC is only for vessels with greater than 363 MT capacity, WCPFC excludes archipelagic waters).  For ICCAT and IOTC the coverage is lower, but has been increasing in recent years, approaching 5% - 10%.  The IATTC has a 20yr time series of 100% observer coverage on purse-seine vessels that can be used in statistical simulations to help understand the biases and limitations of reduced coverage, if some assumptions are accepted to generalize the conclusions.

When coverages are less than 100%, it is necessary to control for biases in observer placement by comparing observed and unobserved trips with regards to duration, catch rates, species composition, etc., to verify that there are no changes in vessel activity or fishers behavior in the presence of the observer.

## **ELECTRONIC MONITORING**: *(Presentation Day 4 – Electronic monitoring)*

In some cases, difficulties may be encountered when trying to place observers onboard fishing vessels to achieve a target coverage (e.g. budget limitations, space availability for observers, safety reasons in some conflict zones). These situations and constraints encourage the search for alternative methods that may replace the observer (e.g. for safety reasons) or may supplement data collection, improving data coverage with an acceptable cost.

Electronic monitoring was identified as a possible complementary method to the present Spanish observer program in the Atlantic Ocean that would allow the collection of data that are unbiased and sufficiently precise. During December 2011 and March 2012 a pilot study was carried out to study the potential of this new system. Total tuna catch and bycatch data were collected simultaneously by cameras and observers onboard, and a data crosscheck was then performed. The group believes that this system has great potential in the future as an alternative or complement to observers. Fleets with low sampling coverage, such as the longline fleets or the purse seine fleet operating in the Indian Ocean where piracy is frequent could benefit from this alternative. Moreover, EM was also identified as a possible method for control and surveillance. In any case, EM is not viewed as a complete substitute of the observers. Some observers will always be necessary, since observers at this moment are able to collect detailed data that EM can't (e.g. length sampling, etc.). Besides, the group believes that observers play a major role in fisheries management, bycatch mitigation, and other activities, besides being an important link between scientists and fishers.

This pilot study is just the first step, and there are still many aspects to improve in the future, such as the quality of the images at some critical places like the conveyor belt that carries tuna to the wells, etc., the ability to produce size samples, etc.

## **SET TYPES**: *(Presentation Day 2 Set Types)*

A critical issue to achieve consistency in research, regulations, and especially in communication with the tuna fishers, is to use a harmonized classification of set types. Different researchers have combined and aggregated sets in different ways making the comparisons difficult. The dynamic nature of the fishery with constant innovations is another factor in complicating the descriptions. Finally, some set types are quite infrequent, so the statistical descriptions are insufficient, and the sources of heterogeneity cannot be separated in limited data sets.

In general terms, tuna purse seine fishers name the sets most frequently by what they encircle, sometimes by the cues that led to them. With this in mind, the following categories are suggested, accepting that future analyses may suggest modifications. Usage in different languages should be respected, as far as the definitions are kept consistent. The sets will be presented with a "Preferred notation" followed by synonyms.

1) **School sets** = **free school sets** = **unassociated sets**

A school of fish is captured by encircling it, so the target is the school itself through evidence in the surface. The name “Unassociated sets” is an artifact created by non-fishers that is of poor descriptive value, and alien to their language. In the eastern Pacific, fishers logbooks used a variety of names for sets on tuna schools, indicating the way the school had been detected (breezers, foamers, finners, jumpers, boilers, shiners, etc.). In recent years, the proportion of breezers is over 95% of the sets in this group, so it doesn’t appear worthwhile to split this category, It is possible that past data had some heterogeneity within this type, but in recent years, they seem to be more homogeneous. Perhaps the use of bird radars in the detection favors one type of “school”, or the different names have merged by increased communication among fleets, nationalities, etc. In other regions, the names of these sets come from the speed of the school, or some feeding characteristics. However, if there are differences in behavior (e.g. feeding, swimming, etc.), it may be of interest to the stock analysts.

## FLOATING OBJECT SETS:

Floating objects are currently recorded as sets within 1 nm of an object by IATTC and WCPFC – a definition that needs to be standardized because it was created as a response of management needs, and not from data analyses.

There are three main types of floating object sets:

**2) FAD sets** = **drifting FAD sets**

FADs are defined as: “Objects constructed and deployed or encountered and modified by the fishers to attract fish, and to facilitate their aggregation and capture, outfitted with a system to aid in their relocation.” The vast majority of the FAD sets encircles the FAD itself, and are preceded by an approach, an exploration, etc., so the nature of the set is well established. If the FAD is not encircled, it creates some ambiguity, and the t-RFMOs have defined sets on FADs as sets made within a mile from the FAD. This value is arbitrary, and there is not much research to substantiate it.

**3) Log sets**

In the early period of the fishery, the majority of the floating objects that attracted tuna were tree trunks or branches, and the fishers adopted the name “LOG” to call them. It has taken a more generic meaning, and it now comprises all encountered floating objects, including natural, man-made objects, etc., as far as they are not deployed or modified by human intervention. Tying together two natural objects or adding a buoy to a tree trunk turns a “LOG” into a “FAD”. The generic name LOG is retained because of fishers usage. The vast majority of LOG sets encircle the “Log”, but they are not always preceded by an approach the previous night, exploration, etc., as in FAD sets. The main difference with FAD sets is the randomness of the encounters leading to Log sets, and the fact that we have no measure of the time elapsed attracting fish prior to the sets.

**4) Payao sets** = **anchored FAD sets**

Coastal fishers from the Western Pacific developed a method to attract fish to moored objects that they called "payaos." Later on larger vessels, including purse seiners began to utilize these attractors to capture tunas and other species. This type of set is very frequent in the Western Pacific area around Papua-New Guinea, Philippines, etc., but it is very uncommon to non-existent in other ocean areas. Classifying these sets in subtypes may be needed for stratification purposes, since the group includes payaos anchored at depths ranging from very shallow to very deep, and at distances from land masses ranging from inside a lagoon to thousands of miles offshore. A matrix combining depths and distances to the coast may be a good system to classify them, and this system or any other selected may be applied at the time of analyzing the data. It is suggested that this question be explored as the database increases in size.

Other aggregate categories sometimes used include: drifting object sets (Log sets + FAD sets), or floating object sets (Log sets + FAD sets + Payao sets). In areas without payaos, the term floating object sets is used for the aggregation of Log and FAD sets.

Other aggregate categories sometimes used include:

Drifting object sets = (Log sets + FAD sets), or

Floating object sets = (Log sets + FAD sets + Payao sets).

In areas without payaos, the term floating object sets is used for the aggregation of Log and FAD sets.

## LIVE ANIMAL SETS

There are several types of these sets, and it is not always easy to determine if the tuna school was associated to the animal or if there are both attracted to a common stimulus such as a ball of bait. Except for the dolphin sets, all other types may not be known beforehand if the animal is not visible, and this may complicate management.

### 5) Dolphin sets

These are common only in the eastern Pacific. They involve almost exclusively yellowfin tuna that is captured in association with groups of hundreds or even thousands dolphins of the genera Stenella and occasionally Delphinus. There is a clear association, and the set is preceded by a chase of the dolphin herd, so there no confusion on the type of set.

### 6 ) Whale sets

Tuna schools are also captured in association with some species of whales. Even though it is possible that whale and school were both feeding in the same aggregation of food, without any association between them, it is not possible to establish which was the behavior preceding the observed actions. The group suggests maintaining the whale sets as a separate type until a research project or data analyses provide another answer. When the set doesn't encircle the whale, it is necessary to make a call with regards to the set type it is. If the whale has left the school during the setting process, whether by its own motivation or efforts by the vessel to avoid setting on the whale while capturing the tuna that is with it, then it should be still called a whale set.

### 7) Whale shark sets

In this case, the association is with a whale shark. Usually the sets are made very close or encircling the whale shark. The participants agreed that this type of set should not be combined with the whale sets because of differences in behavior. This type of set tends to occur in well-defined areas and seasons.

## OTHER TYPES OF SETS

### 8) Baitboat sets

These sets happen when a seiner fishes in association with a bait boat. The bait boat drifts or sails slowly, attracts a tuna school, and may keep it by chumming the water. They are left as a separate class because of the potential effect of chumming that makes it different from a regular floating object. Some consider this type as a floating object set. If the bait boat associated with a particular type of school prior to their association, that information would be of interest.

### 9) Seamount sets (References 8 - 9)

Sea mount sets are defined as sets within some distance from a sea mount. Different figures have been used for the distance (e.g. "5 miles from a known seamount"), but the research is insufficient and not conclusive on this respect. They have been considered as other set types, based on the composition of catches and bycatches, but the evidence needs to be reviewed, and it is suggested that a comparative data analysis, perhaps using data from all oceans be carried out to answer some of the basic questions: a) which seamounts affect catches or bycatches (e.g. are peaks shallower than x fathoms relevant to the purse seine fishery?, or, in other words, which seamounts are significant from the point of view of the tuna fisheries?); b) how far from the center of the seamount are the effects felt. The location of seamounts is not always clearly determined, and depth measurements are incomplete or lacking in some regions. On the other hand, some seamounts are routinely used by seiners, and are "claimed' by anchoring a support vessel on them. Seamounts are very common in the western Pacific and much less in the eastern Pacific, or Atlantic Oceans.

Other elements of bottom topography, such as ridges should also be a focus of attention.

### 10) Dead animal sets

It is possible that sets on dead animals have enough differences to separate them from the floating object sets. Scavengers on the remains may appear in these sets and not on sets on tree trunks or bamboo, etc. The type of species encountered dead covers a wide range, from sea lions, to whales, to terrestrial animals, and it is also possible that they may not be all equivalent (e.g. animals with a higher fat or oil content may be detected farther). However, the very low number of this type of sets makes the comparison difficult. The analysts will have to decide in each case, according to the objectives of the study whether to combine them with other types, or leave them out to avoid introducing heterogeneity in the data set.

## DIFFERENCES IN SET TYPE FREQUENCY BY OCEAN

***Appendix 6*****,** prepared after the meeting, shows a table of frequencies by set type in all oceans for the last 5 years, and maps at different scales showing the spatial distribution of set types. The maps have not been scaled to number of sets in each cell, but simply show the proportions of sets by type in them. There are differences between regions that must be explored.

## RESEARCH NEEDS ON THE CLASSIFICATION OF SET TYPES

The classification of sets suggested is an initial approach to delineating meaningful groupings of data. To aid aggregations it is suggested that analyses be undertaken to ascertain the differences in catch and assemblage composition between the difference set types within and across t-RFMOs. Ideally, the stratification will help in bycatch and CPUE estimation, separating units that are homogeneous internally. These comparisons are of a high priority because they may help identify behavioral or ecological characteristics of the species that may suggest bycatch mitigation actions.

## DATA QUALITY AND MANAGEMENT: *(Presentation Day 3 Flotsam)*

The programs compared their techniques and procedures to maintain data quality. It is suggested that these tools and algorithms be shared amongst all t-RFMOs to assist each other in achieving and maintaining a high standard of data quality. This is a high priority activity, and perhaps periodic meetings (e.g. every 2 years) would help maximize information-sharing, tracking of developments, and consolidate the collaboration among programs.

## ENVIRONMENTAL VARIABLES: *(Presentation Day 4-Environment and Presentation Day 4 -CRBM-OSCAR)*

There were discussions on the value of collecting environmental variables that were available from satellite data, and it is suggested that oceanographers be asked for advice on the subject. Some variable measurements may be of use to validate the outcome of global models or to fill the gaps when cloudiness prevents the satellites from producing readings. If the measurements are to be used, there should be a record of the instrument or system used to obtain it, to maintain adequate data quality. Of the variables of interest, some are useful for catchability studies (e.g. currents, wind strength that may cause set failures, etc.), while others may affect the rate of aggregation or the species assemblages under FADs (eddy activity, frontal conditions, thermocline depth, etc.). The correlation between FAD fishing and ocean currents and with eddy activity suggests that this is a major area of research, and we should make sure that observer records support the data needs for these studies.

Some useful tools for these studies mentioned include the OSCAR program **(http://podaac.jpl.nasa.gov** or **http://www.oscar.noaa.gov),** a drift model that has shown promising results to model FAD trajectories.

## DATA ON CATCHES AND BYCATCHES: **(Presentation Day 4 FADsfishery; Presentation Day 3 FADsByc** and **Presentation Day 4 BYC)**

## TREATMENT OF SKUNK SETS

One of the more common inconsistencies has been the treatment of skunk sets (Zero catch sets) in the different t-RFMOs. In some cases, Catch per set (CPS) based on all sets made regardless of their catch, is used, while others use Catch per Successful Set (CPSS), excluding the zeroes. The two variables have specific uses; catch per successful set informs on the sizes of fish schools, while CPS describes a likely average catch in a set. In spite of the preferences of different authors for one or the other, it is necessary to express them in a way that they can be converted from one unit to the other. Of course it needs to be clear whether information is presented as catch per set or catch per successful set, but that is not always the case.

## SPECIES IDENTIFICATION AND AGGREGATIONS

The correct identification of tunas and other species is one of the most important issues for research and management of tuna fisheries. The similarity between yellowfin and bigeye tunas causes problems for management and controversies on its significance. Observer training should be very solid on these issues. Sharing identification materials among programs should help, and a mechanism for this to take place is needed. We are fortunate to have good personal relations among the programs, so the willingness to cooperate exists, but there has been no systematic way to do it until this meeting.

Other species such as manta rays require, in some cases, closeness on the part of the observer, which is not always possible because of conflicting duties or physical distance (e.g. sea turtles released by a speedboat may be too far to identify the species). Efforts are required to try to identify to species all the individuals captured, at least the more vulnerable species.

Another potential source of inconsistency is the level of aggregation, and the groups generated. Rays sometimes means mobulid rays and pelagic rays, while in other cases they are kept separated. Clear statements should be made on the composition of groups such as “Other sharks”, “Unidentified sharks”, “Carcharinid sharks,” etc., to make sure that we separate individuals that could not be identified from rare species. In some cases, unidentified shark could be an individual that was not resolved to species, but if the Genus was identified, another program may include it in “Unidentified Carcharhinus”.

## ESTIMATION IN WEIGHTS OR NUMBERS

Bycatch estimates in weights and numbers are mixed in the literature, and they cannot be interconverted in most cases. In some cases weights are used because the numbers cannot be estimated. From the point of view of population dynamics, numbers are preferred for the larger, longer-lived species. Efforts should be made to achieve full comparability by presenting data in both forms, or by including conversion factors to match the tables.

The length or weight distribution of catches and bycatches are of paramount importance for stock assessment and to evaluate the impact of bycatches. IATTC collects these data grouped in 3 size bins (small, medium, large), while other programs utilize the observers at sea to sample the catch and obtain individual measures. Conflicts with other observer duties (e.g. compliance issues for IATTC) make this difficult, especially when the observer must remain on deck, and the catch is unloaded directly to the well deck. It would be highly desirable to obtain an adequate sample of size measurements at sea, and the development of instruments that allow the observers to perform this task, or of electronic means of sampling are another high priority.

When bycatch is expressed in weights for instance, some papers have included the whale sharks, while others leave then as a separate category. The vast majority of the whale sharks are released alive, but even a single individual would distort many of the statistics.

Triggerfishes and other small species are not always retained in the net, and the estimates are made most frequently in weights, but occasionally in numbers. Some bycatch tables include them, while others don't.

## REPORTING OF MITIGATION MEASURES USED

The observers should include in their data reports the use of mitigation measures and their effectiveness when possible. This is a very difficult task because there are a variety of options been used or tested in the oceans. Perhaps a code list identifying options could be prepared as a joint exercise by all attendees.

A document produced jointly by two associations of Spanish tuna boat owners, adopting a set of good practices to reduce bycatch was discussed **(Presentation Day 3 Good Practice)** in the framework of potential observer data requirements if there was a request by member governments for verification of adherence to the standards set.

## MINIMUM STANDARDS FOR DATA COLLECTION

**Appendix 1** identifies all variables that are suggested to be included as minimum standards for data collection. The list is clearly dynamic, and changes should be made when technology or operational changes are made. The appendix also includes the source of the information, to distinguish data that should be collected by **observers**, and others that could be obtained while the vessel is in port, or from official documents.

Also note that at the moment there is probably high correlation between data fields collected by observers. We should consider some analyses to determine genuinely redundant variables. Advice should also be available from SA developments in PS standardization.

## CONFIDENTIALITY AND RELEASE OF DATA TO RESEARCHERS

There are differences among commissions on the confidentiality of the data. In some, coastal nations are entitled to all data within their EEZs, while in others it is not the case. Since many countries are members of more than one commission, it would be desirable to harmonize the criteria used, but this may not be possible because of their conventions.

It is in the interest of the t-RFMOs to increase the research that may help improve management. With limited or no research staffs, the participation of outside researchers could help fill this gap. It would be useful to develop a simple form that could be used in all regions to request data for projects that are of interest to the t-RFMOs for stock assessments, ecosystem studies, bycatch mitigation, etc., and to facilitate comparative studies.

## LONGLINE DATA

Even though the workshop addressed purse seine programs, a brief discussion was held on the needs for longline observer programs that are increasing in several t-RFMO. It will be highly desirable to have consistent forms used in all programs ran in each ocean area, and across areas. It is a concern that the rapid development of programs may result in inconsistencies. As a first step to unify this data collection, forms prepared by IATTC staff in collaboration with gear experts from the Overseas Fishery Cooperation Foundation from Japan, and many others were offered as a starting point for discussion. These forms include a gear description form, forms for observer trips on longlines, and a hook catalog. All; these forms can be downloaded from IATTC's website http://www.iattc.org/Downloads.htm and (**SPC longline Terminal Gear)**

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