Guidance on electronic monitoring for observer programs to comply with ISSF Commitments

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1. BACKGROUND

The ISSF *Resolution to Establish Multi-Annual Commitments to Strengthen Purse Seine Vessel Conservation and Management Measures for Tuna* (Res. 12-03) includes a commitment for purse seine fishing vessels to have 100% observer coverage onboard, starting January 1, 2013. The resolution allows for electronic observers, if proven effective. The purpose of this document is to provide further guidance on the elements that would make electronic observers "effective."

ISSF has carried out tests of an electronic system during 8 trips onboard 3 purse seiners. This document uses lessons learned from those pilot tests. Refinements are likely as we gain more experience from EM systems. In particular, the ISSF tests used analog cameras that are sturdy but of relatively low resolution. Improvements in the near-term are very likely from the experience gained.

It is important to avoid the circumstance where vessels will simply install cameras on board and call that an electronic observer program. Electronic monitoring is much more than that. Careful thought needs to be given to the data that are collected, and ensuring that they are analyzed by an independent authority, such as the RFMO, the flag state or the licensing authority.

2. THE GENERAL FUNCTIONS OF OBSERVERS

Generally, the functions of observers in RFMOs can be divided into collecting catch-related information and other scientific data (science), and/or monitoring the implementation of conservation and management measures adopted by the RFMO or within a fishing licensing agreement (compliance).

Scientific activities usually include collecting the following:

a) Information on fishing activities (searching time, means of locating fish schools, visits to floating objects, vessel position, set time and duration, set type, etc);
b) Data on target tunas (total catch, species and size composition, discards);
c) Data on non-target species (species, sizes, numbers/weight, fate);
d) Information on the gear used (net length, depth, FADs deployed, etc.); and
e) Other scientific materials requested by the science committee of the RFMO (e.g., collecting tissue samples, tagging, etc.).

Much of the scientific data outlined above can also have potential use for compliance purposes, depending on each RFMO's decisions and fishery agreements. For example, the data on catches can enable the cross-checking of entries made to the skippers' logbooks. Also, the information on fishing activities can be used to determine if a set was made in contravention of a time/area closure or assert the amount of catch made within a specific EEZ.

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3. WAYS IN WHICH PURSE SEINE DATA ARE COLLECTED

Because of the large volumes of catch that can result in tuna purse seine sets and the speed with which the fish are put in the wells, some types of data are more accurate if collected in port, at the end of the fishing trip. This is done via port sampling and other means such as logbooks and cannery data. Port sampling is important in purse seine fisheries for two main purposes: Estimating size composition, and estimating the species composition in the catch (particularly for bigeye and yellowfin). But this depends on the situation. In areas where the fish are transshipped in port at the end of the trip, observers may actually provide a better opportunity to sample the catches during each set. For example, Anonymous (2010) reviews the systems that are in place in different ocean regions to estimate the species composition of the tuna caught. On the other hand, there are types of data that cannot be accurately obtained independently of the skipper's logbook after a trip ends, such as data on discards and other details about the fishing operations.

Other than validating compliance, the most useful duties that observers can perform are: (i) Recording information that skippers and crew are not well trained for are not used to recording (e.g., discards by species) or do not have time to do, and (ii) recording information that can help validate the information in the skippers logbook.

4. DATA TO BE RECORDED

Table 1 provides a summary of the different types of data that should be collected by observers in purse seine fisheries (see Anonymous 2012 for more details).

For most variables of interest, either human or electronic systems can provide useful information. Which of the two is more reliable depends on a number of factors. For example:

> ***Human***: Training, experience, health, coercion/corruption, etc. Also, the observer cannot be in all places at all times, which can be an important factor especially in large vessels.
> ***EM***: System specs, installation, placement, maintenance, tampering. The best systems need to be carefully tailored to the way the fishing operations are conducted on a particular vessel.

Table 1. Data types that can be collected by either human and electronic observers, or both.

Data Type	Human	EMS	Comments
Trip/Vessel			
Vessel ID (name, number, flag, etc)	Yes	Yes[1]	
Vessel info (speed, capacity, etc)	Yes	Yes[1]	
Net info (length, depth, mesh size)	Yes	Yes[1]	
Equipment (sonar, bird radar)	Yes	Yes[1]	
Departure/arrival (date, port)	Yes	Yes[2]	
Set			
Date	Yes	Yes[3]	
Set time (shooting, ringsUp, end set)	Yes	Yes[3]	
Set location	Yes	Yes[2]	
Set type (school, dolphin, drifting FAD, log, anchored FAD, whale shark, dead whale, baitboat)	Yes	Yes[4]	Although both human and EM may fail to correctly identify set type humans are less likely to.

Data Type	Human	EMS	Comments
Other info (strong currents, malfunction)	Yes	Maybe	Skippers logbook may be a better source. For EM, it is plausible that data available from onboard electronics can be dumped
Begin/end brailing	Yes	Yes[4]	
FAD			
FAD description (materials, dimensions, hanging structure)	Maybe	Maybe[5]	Skippers logbook may be a better source
FAD ID (marking, number)	Maybe	No	Skippers logbook may be a better source
Disposition (deployed, retrieved, left in water)	Yes	Maybe[5]	
Fishing effort			
Vessel (position, speed, bearing)	Yes	Yes[2]	
Crew (search activities)	Yes	Maybe[5]	
Retained catch in a set			
Total catch	Yes	Yes[2]	
Tuna catch by species and size	Yes	Probably[5]	Port sampling may perform better.
Bycatch by species and size	Yes	Probably[5]	
Discarded catch in a set			
Tuna discards by species (in weight)	Yes	Probably[5]	
Turtle discards and disposition by species(alive, dead)	Yes	Probably[5]	
Shark discards and disposition by species(alive, dead)	Yes	Probably[5]	
Billfish discards and disposition by species(alive, dead)	Yes	Probably[5]	
Other discards	Yes	Maybe[5]	

[1] Can be recorded by EM provider upon system installation or from other sources

[2] EM system requires GPS capability

[3] EM system requires equipment (hydraulics, speed) sensors (cameras add value)

[4] EM system requires equipment (hydraulics, speed) sensors and high resolution cameras

[5] EM system requires high resolution cameras to be placed in several places (e.g. above and below deck)

5. System requirements

As can be inferred from Table 1, there are some activities that a 100% electronic system cannot accomplish, compared to an experienced human observer. However, most of the required tasks can be achieved if the right equipment is used and there is close alignment between the EM system set up and vessel catch handling operations. Also, it should be borne in mind that a human observer cannot be present in all critical spaces onboard the vessel at all times, while an EM system potentially could. Therefore, there are tradeoffs between the two.

An EM system should record both sensor and image data. Sensors should include vessel position (GPS), hydraulic pressure, drum rotation, and well deck conveyors and work deck movements, recording at a high sample frequency (faster than the reboot cycle of the EMS computer, e.g. every 10 seconds) for the entire time the vessel is at sea. High sensor sample rates are important to verify the integrity of the data set and to provide high resolution information on sensor patterns. Imagery should follow the specifications outlined below and record for the time while fishing operations and catch processing is taking place. The most complete EM systems would also include integration with electronic catch reporting systems and real time system status reporting (similar to VMS).

In terms of cameras, ensuring that the following areas/operations are viewed would perform best on a large-scale purse seiner. Not all purse seiners are the same, and not all fishing operations are the same, so the cameras should be tailored to each vessel's operations. In some cases, vessels may need to standardize certain catch handling operations to ensure they are adequately covered by cameras if the EMS is to be effective. Also, one camera may serve to cover several of the activities below, depending on the image resolution, field of view, frame rates, and positioning of the camera.

- Port side of the vessel: To view fishing activity, speed boats, FADs, objects, whale sharks, etc.
- Brailer: To quantify catch (by counting brailer operations, measuring brailer fullness and knowing brailer size)
- Hopper: To view the area where fish are brailed into the hopper for sorting; may allow for estimation of species composition.
- Deck: A view of the deck facing the stern, to view handling of large bycatch species, discards, live releases, etc.
- Chute/conveyor belt: View(s) of the fish as the move along the chute or conveyor towards the wells, to possibly measure species composition and size. This can also be used to add on to the quantification of the catch by the brailer and to estimate size composition when vessels load the catch directly to the deck and not through the hopper.
- End of chute/conveyor or discard hatch, to view discards of small fish or undesired species.

6. Determining effectiveness

There are many vendors of the different components/systems. Given this, it is recommended that any EM system be subjected to a test to determine its effectiveness in terms of fulfilling various tasks (Table 1). See for example Ruiz et al. (2012) for such a comparison. The tests should be conducted by placing an experienced observer onboard the same trip as the EM system and comparing the results. This comparison should be rigorous, and carried out by a research institute experienced in observer programs. The results of this comparison should be documented, such as on a document submitted to the relevant RFMO science meeting.

7. Analyses and reports

Recording images onboard the vessel is probably the easiest part of an observer program. An observer program requires analyses of the information collected at sea and producing data files and reports that can be used to compile information across entire fleets, through time. In the case of EM systems, the data recorded should be viewed and analyzed by experienced human observers in the same research institutes or organizations that run regular observer programs.

8. Concluding remarks

A limited number of tests have been conducted with EM systems on board tropical tuna purse seiners. There are a number of limitations that are likely to be solved through changes in equipment (e.g. high resolution cameras, more cameras, etc.) and adapting fishing operations to make them better suited for electronic monitoring. In conjunction with port sampling for species identification and confirmation, EM systems will be valuable to gather target species catch statistics when these data are not collected, or when they are poorly collected. Taking into account the relative infancy of EM usage in these fisheries, it would be prudent to maintain a reasonable level (say, 10%) of human coverage on trips equipped with EMS. This will allow for continuous monitoring of the systems and recommendations for improvements.

Where EM is not sufficient to cover all aspects of observer data, it can be an important adjunct to a human for whom the burden of collecting data to meet all RFMO (and national) scientific and monitoring requirements is reaching levels that are difficult for a single person to handle effectively.

As more tests of various EM systems are conducted in the future, this document will be amended and revised.

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