UPDATE FROM THE ICCAT SCRS/SC-STATS SUBGROUP ON EMS

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3rd Workshop of an EMS in the EPO

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ICCAT CICTA CICAA

SCRS EMS Subgroup - Background

- In 2019 ICCAT, established Recs 19-02 and 19-05 (pertaining to tropical tunas and billfishes):

The Permanent Working Group for the Improvement of ICCAT Statistics and Conservation Measures (PWG), in cooperation with the SCRS, shall work to develop recommendations on the following issues for consideration at the 2021 annual meeting of the Commission:

*a) **Minimum standard for an electronic monitoring** system such as:*

(i) the minimum specification of the recording equipment (e.g. resolution. recording time capacity, data storage type, data protection)

(ii) the number of cameras to be installed at which points on board

*b) **What shall be recorded***

*c) **Data analysis standards**, e.g., converting video footage into actionable data by the use of artificial intelligence*

*d) **Data to be analyzed**, e.g., species, length, estimated weight, fishing operation details*

*e) **Reporting format** to the Secretariat*

*In 2020 **CPCs are encouraged to conduct trials** on electronic monitoring and report the results back to the PWG and the SCRS in 2021 for their review.*

- **This request started to be addressed by the Billfishes Species Group in 2021** (BILL meeting, March 2021)

Previous work – purse seine fisheries

- Previous recommendations from ICCAT SCRS on EMS, specifically with regards to Purse Seine fisheries to be voluntarily implemented and complement human observers:

SCRS Report (2016 and 2017) – General Recommendations and Responses to Commissions' request:

- *The SCRS reiterates also its recommendation from 2016 on Electronic Monitoring Systems (EMS) which are already being used by some tropical tuna purse seine vessels. Noting that EMS can complement physical observer programmes and also collect other data that would be useful to the SCRS, the Committee considers that it would be useful to ensure that the different systems available conform to harmonized installation, data collection and reporting protocols, so as to ensure compatibility. The Committee recommends that tropical tuna purse seine fleets or CPCs wishing to voluntarily implement EMS follow the guidelines described in Ruiz et al. 2017. This source of information would help improve current coverage of observer data in tropical tuna fisheries.*

https://www.iccat.int/Documents/CVSP/CV073_2017/n_2/CV073020818.pdf

Standards for data collection and integration with current data flow (PS):

- Before the trip: instalation, certification, audits
- During the trip: data collection
- After the trip: data traceability and analysis

Creation of the SCRS EMS Subgroup

- The work for **longline and other fisheries in ICCAT was more delayed** and in 2021 there were no specific Recommendations from the SCRS on longline or other fisheries.

- In the 2021 a **Subgroup was established to start addressing this request** (which has now been expanded as a Subgroup of the SC-STATS)

- **2021:**
  - Most work was a compilation of **previous works focusing EMS in comparison with human observers (mostly LL fisheries)**.
  - Agreed that **other fisheries (e.g.; gillnets) also need to be addressed, but would be left for a later stage**;
  - Each paper assigned a "reviewer" to extract information and present/discuss within the group**, for establishing a series of initial SCRS Recommendations**

Main conclusions from the 2021 revision work

https://www.iccat.int/Documents/CVSP/CV078_2021/n_10/CV078100005.pdf

- EM systems **hold promise for resolving some problems with data gaps in fisheries monitoring, but it cannot substitute for a human observer.** As such, integrated EM systems are likely to be **used as a complement rather than a replacement** at-sea observer programs.

- One limitation is that the **cameras record only what is in their field of view and cannot prioritize** among elements in the images they are recording.
  - However, one advantage is that the images can be reviewed multiple times for data extraction

- It is important to also note that **at-sea observers can perform other tasks not covered by EM Systems, such as biological sampling**

Main conclusions from the 2021 revision work

- EM systems need to address the **challenges associated with processing and analyzing very large volumes of data that will result**, which are different to the challenges encountered when dealing with human observers and their data
    - It is possible that **improvements in artificial intelligence, machine learning/deep learning algorithms**, hardware and software can mitigate some of the current limitations with data collection and analysis

- Integrated EM systems must be able to **meet both national and international requirements to ensure data collection, continuity, veracity and precision** are not compromised, **and that scientists have the required data to ensure they can continue to provide accurate scientific advice to managers.**

Recommendations (adopted in 2021)

- The Subgroup agreed that there is a need for a **separation of scientific vs compliance objectives/data**, noting that many EM systems to date have been implemented mainly for compliance or mixed purposes

- The Subgroup agreed that for scientific purposes, it is important to **assure that EM systems can record and collect needed scientific data (e.g., species ID, sizes, sex on elasmobranchs, discards, etc) and not only compliance data**.

  - The collection of **some type of data seems to be more difficult at present** (e.g.; sex on elasmobranchs, condition of discards).

  - In some cases it may be possible to **place additional cameras in specific locations** of the vessels to collect such data, **and/or there may be software solutions**

Recommendations (adopted in 2021)

- The Subgroup agreed that there **may be the need for more field trials** for CPCs to compare the quality of data obtained with EM Systems vs human observers.
  - Could consider **starting with smaller scale studies and trials** in particular fisheries, and then **scale up as needed and possible**
  - Those trials should **ensure that ICCAT observer data requirements are collected by EM**
  - Field trials could be conducted **immediately after preliminary data standards are adopted, to confirm that the standards address the minimum requirement, and make adjustments if needed**

2022 work – Started in early 2022 and is ongoing (Ongoing work - to be Reported to SC-STATS in late Sep)

- **Subgroup main objectives for 2022:**
  - Comparison of what can be obtained with human observers versus EMS (using ST-09 data forms);
  - Any adaptations that may be needed for EMS to collect needed data
  - Propose minimum standards (mostly focusing on the technical aspects, such as as nº and location of cameras, etc)

Ongoing work – 2022: ST-09 – FISHING DATA

ST-09A DATA FIELDS			Possible to collect by human observers?	Possible to collected by EMS?	Notes
Fishing operations & fleets	Fish. Oper. (FO)	FO group ID	Not applicable	Not applicable	Coding variable applied post-processing
	Fleet attributes	Flag of Vessel (cod)	Yes	Yes	Obtained from EMS instalation ID
		Base port/zone	Yes	Yes	Obtained from EMS instalation ID
		Vessel (size class)	Yes	Yes	Obtained from EMS instalation ID
Temporal attributes	Year, month/trimester	Year	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard
		T. Period (ID)	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard
Geographical attributes	Resolution and position (Lat, Lon)	Square type (cod)	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard
		Lat (centroid) (± dd.ddd)	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard
		Lon (centroid) (± dd.ddd)	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard
Effort attributes	All fishing gears	Gear group (cod)	Yes	Yes	
		Nº vessels	Not applicable	Not applicable	Grouping variable applied post-processing
		Nº Fish. Oper. (observed)	Not applicable	Not applicable	Grouping variable applied post-processing
		Fish Oper. Type (cod)	Yes	Yes	
		School type (cod)	Not applicable to LL	Not applicable to LL	Not applicable to LL
	Longline (LL) only	LL type	Yes	Yes	Possible with additional info from logbooks or the skiper. Should also be possible to detect the LL type/configuration with a camera recording the deployment
		Nº hooks (total)	Yes	Yes	Migth be possible to get from logbooks. Could also count at deployment, as hooks/floats are seen with a deployment camera (but could be time consuming to count all hooks)
		No. hooks (observed)	Yes	Yes	
		Hook type (main)	Yes	Possible	Possible but need integration with additional info from logbooks or the skiper
		Set depth (hooks per basket)	Yes	Yes	Need to put cameras during deployment to count hooks between floats. Will also allow for total set effort (n hooks). Note that HBF migth not be the best proxy for depth of setting
Mitigation measures (MM) on bycatch species	Seabirds	MM 1	Yes	Yes	Possible for EMS to detect some MM, like for example Tori line, night setting or painted bait.
		MM 2	Yes	Yes	Possible for EMS to detect some MM, like for example Tori line, night setting or painted bait.
	Other bycatch	MM 3	Yes	Yes	Possible for EMS to detect some MM, like for example Tori line, night setting or painted bait.
	Additional notes	Description (MM)	Yes	Yes	Optional field in ST-09. Possible to add information with any complimentary information

PRELIMINARY ONGOING WORK - NOT YET ADOPTED BY SC-STATS AND SCRS

Ongoing work – 2022: ST-09 – CATCH DATA

ST-09B DATA FIELDS			Collected by human observers?	Collected by EMS?	Notes
Catch composition by fishing operation	Fish. Oper. (FO)	FO group ID	Not applicable	Not applicable	Coding variable applied post-processing
	Species (attributes)	Species (cod)	Yes	Yes	EMS could have problems with identification of bycatch that are not brought onboard, and in those cases higher level taxa ID is likely needed. As a standard, the EMS system should have one camera for the retained species and another for the area close to the vessel in cases they cut the line for discarding. For the retained catch EMS systems record video that can be seen many times, while human observers have the advantadge of being able to look into detailed taxonomic caracteristics if needed.
		Targeted (Y/N)?	Yes	Possible	Possible but need integration with additional info from logbooks or the skiper
	Catches (retained)	Weight (kg)	Yes	Possible in some cases	Both HO and EMS could only do in vessels that have scales to weigth individual specimens. Most vessels don't have these onboard (some large LL only). If the vessles have scales, could put cameras facing the scales. Or there might be a way to conect the scales to the EMS directly
		Product type (cod)	Yes	Possible in some cases	Both HO and EMS could only do in vessels that have scales to weigth individual specimens. Most vessels don't have these onboard (some large LL only). If the vessles have scales, could put cameras facing the scales.
		Number (catch number)	Yes	Yes	
	Discards (Number)	Dead (DD)	Yes	Possible in some cases	Important to be collected (even for some management recomendations and compliance issues). The EMS would need cameras or other systems in specific positions to determine specimen condition at release. Need video and not only still images. Requires review of all relevant video footage to get total numbers
		Alive (DL)	Yes	Possible in some cases	Important to be collected (even for some management recomendations and compliance issues). The EMS would need cameras or other systems in specific positions to determine specimen condition at release. Need video and not only still images. Requires review of all relevant video footage to get total numbers
		Unknown	Yes	Yes	Important to be collected (even for some management recomendations and compliance issues). The EMS would need cameras or other systems in specific positions to determine specimen condition at release.
	Sampling (data)	Nº sampled	Yes	Yes	

PRELIMINARY ONGOING WORK - NOT YET ADOPTED BY SC-STATS AND SCRS

Ongoing work – 2022: ST-09 – BIOLOGICAL DATA

ST-09C DATA FIELDS			Collected by human observers?	Collected by EMS?	Notes
Specimens & fishing operations (FO)	Specimen Identifier	Unique specimen ID	Not applicable	Not applicable	Coding variable applied post-processing
		FO group ID	Not applicable	Not applicable	Coding variable applied post-processing
		Species (cod)	Yes	Yes	
Biological data (observed)	Sex	Sex (cod)	Yes	Possible in some cases	With observers it is possible for elasmos (externally) and bony fishes when they are eviscerated; With EMS might be possible for elasmobranchs with specific specimen position by the crew and cameras
	Size	Length (cm)	Yes	Yes	Possible if the crew positions the specimens in front of a specific camera for measurements. Need for calibrated areas
		Size class type (cod)	Yes	Yes	
	Weight	Weight (kg)	Yes	Possible in some cases but need adaptations	Both HO and EMS can only do in vessels that have scales to weigth individual specimens. Most vessels don't have these onboard (some large LL only). If the vessels have scales the HO can take weights directly. For EMS migth be possible to put cameras facing the scales, or there might be a way to conect the scales to the EMS directly
		Product type (cod)	Yes	Possible in some cases but need adaptations	Both HO and EMS could only do in vessels that have scales to weigth individual specimens. Most vessels don't have these onboard (some large LL only). If the vessles have scales, could put cameras facing the scales. Or there might be a way to conect the scales to the EMS directly
	Samples obtained (Y/N)	Genetics (YN)?	Yes	No	Collection of samples by HO depends on the logistics onboard, specific studies objectives, etc
		Otoliths (YN)?	Yes	No	Collection of samples by HO depends on the logistics onboard, specific studies objectives, etc
		Stomach (YN)?	Yes	No	Collection of samples by HO depends on the logistics onboard, specific studies objectives, etc
		Gonads (YN)?	Yes	No	Collection of samples by HO depends on the logistics onboard, specific studies objectives, etc
Release attributes and others	Condition (external injuries)	Released (YN)?	Yes	Possible in some cases	The operation is visualized by seeing the surrounding water. If the catch is not hoisted but part of the body is seen, it is sometimes possible to reach the level of the genus (e.g., Alopias, Sphyrna). Also in leatherback turtles. In other species (e.g., hardsheel turtles, other fishes), if they are not hoisted to remove the hook it is more complicated to reach the species or even genus. Depends also on the cleanliness of the cameras and the release maneuver.
		Injuries (scale)	Possible in some cases	Possible in some cases	Inuries from depredation or from the fishing process can be seen sometimes. But if the specimens are released in the water it migth be difficult for both HO and EMS
	Others	Tag number	Yes	No	
		Notes	Yes	Yes	Any additional notes can be input both by HO and EMS visualization

PRELIMINARY ONGOING WORK - NOT YET ADOPTED BY SC-STATS AND SCRS

Ongoing work – 2022: Start defining technical standards

1) Standards for onboard EM system technology, including equipment and camera system requirements, installation and maintenance;
2) Standards for data storage requirements;
3) Standards for data review and transmission to ICCAT;
4) Standards for data protection and potential privacy issues

PRELIMINARY ONGOING WORK - NOT YET ADOPTED BY SC-STATS AND SCRS

Ongoing work – 2022: Examples of some items being discussed

1) Standards for onboard EM system technology, including equipment and camera system requirements, installation and maintenance;
   - Resist rough conditions at-sea with minimum human intervention
   - Include a GPS receiver (or VMS) for recording locations, speed, etc.
   - Battery backups
   - Security to access configuration and against any manual data manipulation
   - Cameras placed to provide clear, unobstructed views of the areas covered
   - Sufficient resolution to cover the actions
   - Recording of video or still photographs (both can be valid options?)
   - Linked/controlled by sensors to activate and stop the system

PRELIMINARY ONGOING WORK - NOT YET ADOPTED BY SC-STATS AND SCRS

Ongoing work – 2022: Examples of some items being discussed

2) Standards for data storage requirements;

- Sufficient hard drives/memory adequate for the specific trip durations of each national program (LL fisheries vary greatly in duration, from a few days to several months).
- Return/exchange of hard drives after each trip for data extraction.

3) Standards for data review and transmission to ICCAT:

- Should achieve observer coverages required by ICCAT.
- EM systems should be used to complement, but not replace, human observers. A minimum coverage with human observers should still be maintained.
- Possible need to train EM analysts (improve and harmonize data extraction)
- Reporting in ICCAT ST-09 forms, that might need some adaptations.

PRELIMINARY ONGOING WORK - NOT YET ADOPTED BY SC-STATS AND SCRS

Ongoing work – 2022: Examples of some items being discussed

4) Data protection and potential privacy issues.

- ICCAT Rules and Procedures for the Protection, Access to, and Dissemination of Data.

PRELIMINARY ONGOING WORK - NOT YET ADOPTED BY SC-STATS AND SCRS

Ongoing work – 2022: Example of a possible 4-camera system for pelagic LL

- PRELIMINARY ONGOING WORK
- NOT YET SEEN OR ADOPTED BY SC-STATS AND SCRS

Camera location	Action covered	Possible data collected
Aft of the boat	Setting operation	Set position, date, time
		Total number of hooks; hooks between floats
		Bait type/species
		Bait ratio (%)
		Some MM (painted bait, tori lines, line weight)
Work deck	Catch at hauling	Species ID/composition
		Specimen sizes
		Condition (dead/alive)
		Fate (retained/discarded)
		Predators observed
	Discarding (if hauled before discarded)	Discards by set
		Discards ID/composition
Processing area	Catch while processing	Species ID/composition
		Total catch by set
		Specimen sizes
		Sex
		Weights?
		Product type (fresh/processed)
Surrounding water area	Discarding (if discarded in the water)	Discards by set
		Discards ID/composition
		Condition of discards?

Next steps (ongoing work in 2022)

- **In 2022 we aim to finalize work on:**
  - ST-09 form data fields
  - Technical specifications of minimum standards (nº of cameras and location, etc)

- **Provide updates** on the status of the work to ICCAT Commission EMS WG and receive feedback

- **The final recommendations from the Subgroup will be presented to the SCRS/SC-STATS in September 2022.**

- **ICCAT Commission discusses SCRS recommendations at the ICCAT annual meeting – Nov 2022**

Thank you

Questions?