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An initial examination of CCSBT observer program standard data fields and their ability to be collected using electronic monitoring (EM) technologies

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Summary

Electronic monitoring (EM) technologies are likely to form a major component of future fishery research and monitoring programs. This paper assesses the capability of EM technologies to collect at-sea observer data fields as listed in the CCSBT Scientific Observer Program Standards. This assessment draws upon the work undertaken by participants at the Western Central Pacific Fisheries Commission (WCPFC) Electronic Monitoring (Longline) Technical Standard Workshop (see, SPC, 2016; ESC22_BGD03). The capability of EM to collect each data field is assessed as available now (*EM Ready*) to possibly available in the future (*EM With Work*) to unavailable (*EM Not Likely*) and not applicable (*Not Assessed*), if this field was not examined at the WCPFC technical standard workshop (i.e. unique CCSBT data field). The table also has space to include information on the scientific use at current and intended (i.e. 10%) levels of at-sea observer coverage and whether the field is used for compliance. It is recommended that the CCSBT Compliance Committee form an EM working group, similar to WCPFC, to develop appropriate standards for EM. This will also allow an assessment of what data collection tools can be used to satisfy the scientific needs of CCSBT.

Use of EM in CCSBT longline fisheries

Background

The purpose of this paper is to provide information for the Extended Scientific Committee to provide advice to CCSBT on the orderly introduction of electronic monitoring (EM) into the data acquisition processes of CCSBT. This paper provides an overview of electronic monitoring (EM) technologies and their capability to collect at-sea observer data fields as listed in the CCSBT Scientific Observer Program Standards. The assessment of EM's capability to collect these fields draws upon the work undertaken by participants at the Western Central Pacific Fisheries Commission (WCPFC) Electronic Monitoring (Longline) Technical Standard Workshop (see, SPC, 2016, ESC22_BGD03) held in June 2016. SPC (2016) is an addendum to a wider piece of work that explores the role of EM, amongst other data collection methods, in serving the scientific and compliance data needs of the WCPFC.

EM systems and their implementation in Australia

EM systems consist of a combination of video cameras, sensors and software that collects and transmits fisheries data in an automated manner that is closed to external or manual input (Dunn and Knuckey 2013). On the vessel, it consists of a central computer combined with several gear sensors and video cameras that are capable of monitoring and recording fishing activities (McElderry 2008; Ruiz et al., 2015). The recordings can be independently reviewed and verified later onshore for both scientific and compliance purposes. Internationally, EM has been proven to be a reliable and accurate method to independently verify catch composition on board longline vessels and monitor interactions with protected species and the use of bycatch mitigation devices (Ames et al., 2007; McElderry, 2008; Piasente et al., 2012; Stanley et al., 2015).

In Australia, EM has been used in three Commonwealth fisheries: the Eastern Tuna Billfish Fishery (ETBF), Western Tuna and Billfish Fishery (WTBF) and Gillnet Hook and Trap (GHAT) sector of the Southern Eastern Scalefish and Shark Fishery (SESSF) since 1 July 2015. Under the current program, AFMA uses EM to validate fishery logbook information through auditing a minimum of 10 percent of shots from each vessel. This includes reviewing catch composition, the number of discards and interactions with protected species, as well as the use of bycatch mitigation devices (AFMA 2015).

EM capability to collect data recorded by at-sea observers

The effectiveness of EM as a data collection tool is heavily dependent on the national and international data requirements for the fishery. International data requirements for CCSBT member states as they relate to at-sea observers are outlined in the CCSBT Scientific Observer Program Standards. If consideration is being given to the application of EM technologies for the collection of some fisheries monitoring data it is critical to ensure that: (i) EM (or an alternative data collection tool) has the ability to collect this information; and (ii) data continuity, veracity and precision is not compromised.

Table 1 outlines the CCSBT at-sea observer longline data fields required to be collected by CCSBT member states along with a description of each data field and expert judgement from the WCPFC technical standard workshop on the ability of current versions of EM to collect these longline data fields (see, SPC, 2016, ESC22_BGD03). The capability is assessed as available now (*EM Ready*) to possibly available in the future (*EM With Work*) to unavailable (*EM Not Likely*) and not applicable (*Not Assessed*) if this field was not examined at the WCPFC technical standard workshop (i.e. unique CCSBT data field). The table also has space to include information on the scientific use at current and intended (i.e. 10%) levels of at-sea observer coverage and whether the field is used for compliance.

Results suggest that EM can collect accurate catch composition data in longline fisheries as the catch is brought on board serially (Ames et al., 2005; McElderry 2008; McElderry et al., 2010). It has also been shown to be effective in recording spatial and temporal data on setting and hauling operations (Piasente and others 2012). The capacity of EM to provide accurate data on discards, biological information (e.g. species length) and explicit gear attributes (e.g. hook type and size) requires further development. It is likely to be highly reliant on appropriate camera placement, length grids equipped in the hauling station and the ability and cooperation of the crew to adopt changes to catch handling procedures, which will vary at an individual vessel and fishery level. Collection of data on the deployment and performance of mitigation devices and/or measures, will require appropriate camera placement and/or vessel lighting. EM is not yet considered ready for the collection of biological samples (e.g. otoliths), species weight or data on the sex of most teleost species.

Discussion Points

Electronic monitoring has the potential to both increase the quantity of data currently collected for many of the fields in the CCSBT Scientific Observer Program Standards (with the clear exception of biological sampling), as well as improve the accuracy of logbook records if concurrently used as a compliance tool. For example, in the Australian ETBF, EM is used for both scientific and compliance purposes, with preliminary results suggesting an increase in the accuracy of logbook reporting in the first year following EM implementation (Noriega et al., in prep).

EM has the capability to be integrated into existing research and monitoring programs in a variety of ways. For example, as a tool to: (i) monitor particular data fields; or (ii) audit vessel logbooks to ensure reported data is verified and complete (e.g. Stanley and others 2015, AFMA, 2015). The latter is how EM is currently employed in the Australian ETBF and British Columbia groundfish hook-and-line fishery.

When considering the implementation of EM it is important that states consider the issue of data continuity and its implications for scientific analyses and subsequent management decision-making. This is in respect to at-sea observer data fields that are either no longer being collected or will be collected solely using EM in the future. This can affect scientific analyses that have previously used either at-sea observer or logbook data. For example, in the Australian ETBF, the number of discarded target and non-target species reported in the logbook significantly increased following the implementation of EM, with ramifications for scientific analyses using logbook data (Noriega et al., in prep). It is therefore important that states consider the scientific and compliance application of each data field to assess how relevant analyses may be impacted by changes in the way data is (or is no longer) collected.

Assessments in data continuity should ideally be undertaken as part of a wider review of EM and the development of standards to ensure appropriate systems are in place both nationally and regionally for data coordination, storage and security. This will support and accommodate those states that have commenced or are expected to commence implementation of a range of EM technologies in their fisheries.

Progressing EM within CCSBT

ESC22 may consider recommending that the CCSBT Compliance Committee form an EM Working Group to develop *"Standards for electronic monitoring programs within CCSBT".* The ESC would contribute to this EM Working Group by providing advice on the consequences of EM for scientific data collection.

The proposed EM Working Group liaise and collaborate with its equivalent group within the WCPFC to exchange information on the application of EM in tuna fisheries. Opportunities to collaborate with the IOTC should also be explored.

ESC22 may consider requesting further analyses (to be presented at ESC23 or ESC24) describing how EM and other potential technologies may complement existing fisheries monitoring tools and programs to satisfy the scientific data needs of CCSBT. This would include analyses on the impact of data continuity.

Table 1: The capability of EM to collect data fields from CCSBT scientific observer program standards

WCPFC EM/ER Working Group Assessment				**Scientific Data Use**		**Compliance Data Use**
Observer Longline data fields		*Description*	*Could this field be collected by EM?*	*Main scientific use at current levels of observer coverage*	*Main scientific use at 10% level of observer coverage*	*Main compliance use at current levels of observer coverage?*
Details of the observed vessel and gear	Vessel's name	Name of vessel	Not Assessed			
	Vessel's call-sign	Call sign of vessel	EM Not Likely			
	Vessel's flag country	Country the vessel is flagged to	EM Not Likely			
	Name of the captain	Name of captain on vessel	EM Not Likely			
	Name of the fishing master	Name of fishing master	EM Not Likely			
	Year vessel built	Year vessel built	Not Assessed			
	Engine brake power	Engine brake power (kw/hp)	Not Assessed			
	Overall length	Length in metres of vessel	Not Assessed			
	Gross tonnage	Gross tonnage (tonnes)	Not Assessed			
	Number of people in crew	Number of people in crew (all staff, excluding observers)	EM Not Likely			

	Total freezer capacity	Total freezer capacity (cubic metres)	Not Assessed			
	Fuel capacity	Fuel capacity (tonnes)	Not Assessed			
	Instrumentation and electronic fishing equipment	(Y/N to a range of instruments)	EM Not Likely			
	Mainline material	Mainline material (nylon, cotton thread, other)	EM Not Likely			
	Buoyline material	Buoyline material (nylon, cotton thread, other)	EM Not Likely			
	Branchline material	Branchline material (nylon, cotton thread, type of trace, other)	EM Not Likely			
	Date and time start of set	Translatable to 24 hour clock, UTC	EM Ready			
	Date and time end of set	Translatable to 24 hour clock, UTC	EM Ready			
	Date and time at start of retrieval	Translatable to 24 hour clock, UTC	EM Ready			
	Date and time at end of retrieval	Translatable to 24 hour clock, UTC	EM Ready			
	Location at start of set	Latitude+N/S and longitude+E/W to a minute of accuracy	EM Ready			
	Wind speed	Wind speed (with unit) and direction (N, NNE, NE, etc.) of the operation	Not Assessed			

Comprehensive catch, effort and environmental information for each set	Time of wind measurement	Time of wind measurement for operation (e.g. noon, start of set etc.)	Not Assessed	
	Sea surface temperature	(In degrees Celsius, to 1 decimal place) at start of set	Not Assessed	
	Target species	Intended target species	EM Ready	
	Location at end of set	Latitude+N/S and longitude+E/W to a minute of accuracy	EM Ready	
	Direction of line set	(e.g. straight, curved, u-shaped)	Not Assessed	
	Mainline length	Length of mainline actually used in kilometres	EM Ready	
	Branchline length	Length of branchline actually used in metres	EM Not Likely	
	Buoyline length	Length of buoyline actually used in metres	EM Not Likely	
	Shallowest hook depth	Intended depth of the shallowest hook in metres	EM Not Likely	
	Deepest hook depth	Intended depth of the deepest hook in metres	EM Not Likely	
	Type of hooks	What type of hook is used in set	EM Not Likely	
	Number of hooks	Total number of hooks used in set	EM Ready	
	Number of baskets	Total number of baskets used in set	EM Ready	
	Line weights	Are line weights used (Y/N)	EM With Work	
	Mass of line weights	Mass of added line weight (where applicable)	EM Not Likely	

Distance between weight and hook	The distance from where the bottom of the weight is attached on the branch line to the eye of the hook (where applicable)	EM With Work
Number of tori lines	Number of tori lines used (where applicable)	EM With Work
Aerial coverage of tori line	Estimate of the aerial coverage achieved by tori lines in metres	Not Assessed
Night setting	Night setting with minimal deck lighting (Y/N)	EM Ready
Dyed bait	Use of dyed bait (Y/N)	EM With Work
Management of offal discharge	Details about management of offal	EM With Work
Underwater setting chute	Use of underwater setting chute (Y/N)	EM With Work
Side setting	Use of side setting (Y/N)	EM With Work
Haul mitigation	Use of branchline/snood haulers; brickle curtain or water cannon (Y/N)	EM With Work
Other mitigation methods	Other mitigation measures for seabirds used	EM With Work
Distance between baskets, beacons, buoys or floats	Distance between baskets, beacons, buoys or floats as is appropriate to the operation in metres	EM Not Likely
Percentage of bait used	Percentage of bait by bait categories that were Fish, Squid, Artificial, and Other	EM Ready
Bait status	Bait Status (Alive/Dead)	EM Ready

	Total number of species caught	Total number by species of SBT, and other tuna and tuna-like species caught, retained or discarded	EM Ready			
	Total processed weight	Total processed weight (kg) and processed State by species of SBT and all other species caught	EM Not Likely			
Observed catch information (NB: this is the part of the catch observed by the observer during the hauling process)	Date & time start of the observation period	Translatable to 24 hour clock, UTC	EM Ready			
	Date & time end of the observation period	Translatable to 24 hour clock, UTC	EM Ready			
	Number of hooks observed	Number of hooks observed	EM Ready			
	Total number species caught and retained	Total number by species of all species caught and retained during the observer period	EM Ready			
	Total processed weight (kg)	Total processed weight (kg) by species and processed state of all species caught and retained during the observed period	EM Not Likely			
	Total number and weight	Total number and weight when possible (whole weight in kilometres) by species of all species caught but discarded during the observed period and life status	EM Not Likely	EM Ready		

Biological measurements of individual fish. Biological measurements are only required for SBT, but where possible, effort should be made to measure other species	Species	FAO code of species caught	EM Ready			
	Life status category	Use condition codes (dead and damaged, dead and undamaged, alive and vigorous and unknown) to indicate status when caught.	EM Ready			
	Length of fish	For SBT, fork length measured on straight length, rounded up to the centimetre	EM With Work			
	Length unit	Unit of measurement	EM With Work			
	Length code	Code the type of measurement used (fork length, eye fork, etc.)	EM With Work			
	Length, lower jaw-fork length	Lower jaw-fork length	EM With Work			
	Whole weight (kgs)	This is the measured weight (kgs) before processing as opposed to a calculated whole weight	EM Not Likely			
	Processed weight (kgs)	This is the measured weight (kgs) after processing	EM Not Likely			
	Processed state	Processed state as per processing codes identified in the CCSBT CDS Resolution	EM Not Likely			
	Sex	Sex the species if possible	EM With Work			
	Samples taken	Specifying: (i) a unique identification number given to the sample; (ii) the type of samples taking, including: whole specimen or samples of otoliths, scales, vertebrae, stomach, muscle, tissue, gonads, feathers, bird bands etc.; (iii) any additional details that may explain the capture of the sample (e.g. for	EM Not Likely			

		seabirds the specific mitigation at the time of capture).				

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