Agreement on the Conservation of Albatrosses and Petrels

Seventh Meeting of the Seabird Bycatch Working Group

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Examination of the benefits and limitations of e-monitoring in relation to seabird bycatch and mitigation

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SUMMARY

At SBWG6 the Working Group highlighted the importance of considering electronic-monitoring (EM) as an additional or complementary tool to the use of observer programmes. The Working Group recommended that intersessionally a small number of individuals continue to examine the benefits and limitations of EM, and that this investigation should focus specifically on seabird bycatch. This intersessional work should include the investigation and development of best practice guidelines concerning the design, development, implementation and evaluation of EM systems, and the results of which should be reported at SBWG7.

AC9 endorsed an intersessional investigation of the benefits and limitations of EM concerning seabird bycatch and mitigation, and through this process the development of best practice guidelines for seabird bycatch and mitigation. The result of the analysis by the intersessional group is in this document.

1. DISCUSSION

At SBWG6 the Working Group highlighted the importance of considering electronic-monitoring (EM) as an additional or complementary tool to the use of observer programmes. The Working Group tasked a small group to examine intersessionally the benefits and limitations of EM, specifically as it relates to seabird bycatch.

In undertaking this analysis, it is appropriate to first consider the context in which EM might be used. Prior to the development of EM systems fisheries data was collected by a number of methods. In general, onboard observers collected scientific data to aid the development and management of the fishery; fisheries inspectors collected data to verify if fishers were complying with relevant management measures; and ships' officers were responsible for maintaining log books for both internal and external management purposes. EM has the potential to collect much of the data currently collected by observers and inspectors and can be used to verify the accuracy of logbook data. It has the capacity to collect data for 100% of the fishing effort, is transparent and is less likely to be subject to intimidation or corruption. Inherent in this statement is that independent reviewers evaluate the data/footage collected by EM systems. However, one key limitation of EM is that it cannot currently collect biological data. In a study conducted for the Western and Central Pacific Fisheries Commission (WCPFC), it was found that:

"…*72% of the CMM (Conservation Management Measure) compliance and/or reporting obligations could be supported by either E-R (electronic reporting), or E-M (electronic monitoring), or both*", Dunn and Knuckey. 2013, WCPFC10-2013-16_Rev1.

Another pertinent consideration is that to adequately characterise statistically rare events, such as seabird bycatch, it is necessary to have high levels of observer coverage. The WCPFC estimated that at least 20% observer coverage was required for its fishery (WCPFC SC2 Report p?). While some domestic fisheries achieve, or even exceed this level of coverage, the high seas fisheries managed by the tuna RFMOs currently only require a minimum of 5% observer coverage of their longline fleets. In comparison, many EM systems have the capacity to collect a wide range of data on 100% of the fishing effort (Annex A).

Secondly, it should be recognised that there are a large number of EM systems in use in fisheries around the world, having different design parameters and capacities. Some systems may only collect video footage for a limited period of the fishing operation (e.g. between the set and haul), while others operate 24 hours a day for the entire duration of the fishing trip. New EM systems are continually being implemented across a wide range of fisheries and it is beyond the resources of this intersessional group to examine all of them.

Thirdly, it is necessary to define the scope of this analysis in relation to the data to be collected. A primary outcome for the Agreement in fostering the development and deployment of EM is to ensure that fishers comply with the seabird conservation management measures (CMM) adopted by the relevant fisheries management authorities. Many of these CMMs are based on ACAP's best practice advice for minimising seabird bycatch in longline fisheries. The SBWG has already identified the minimum data fields necessary to analyse the effectiveness of these mitigation measures, (SBWG4 Report, Annex 8 - highlighted in bold in Annex B). Consequently, for the purpose of this study, it was decided that the analysis be restricted to these data fields.

The application of EM in longline artisanal fisheries is not discussed, given the diversity of these fisheries and the resources required to undertake such a study.

2. ANALYSIS

An analysis is provided below of the capacity of EM to provide the minimum bycatch data considered by the SBWG to be critical to categorise seabird bycatch events. Best practice is identified, where possible, and areas identified where further research is required. A cost analysis has not been undertaken due to the wide range of variables between EM systems and between fisheries.

An overarching recommendation for all EM data is that it be analysed by independent reviewers and stored in a manner that avoids tampering and provides safe storage for subsequent review.

Recommended Best Practice Advice

EM systems should have as an integral design feature that data is analysed by independent reviewers and is stored in a manner that avoids external tampering and provides safe storage for subsequent review.

2.1. Temporal and Spatial Data

There are seven temporal and spatial data fields identified as minimum requirements by the SBWG. These are: date gear deployed; start time of gear deployment; end time of gear deployment; latitude at beginning of gear deployment; longitude at beginning of gear deployment; latitude at beginning of gear retrieval; and longitude at beginning of gear retrieval. Collection of this data would enable a reliable assessment to be undertaken of whether night setting was used as a seabird bycatch mitigation measure.

A review conducted by Piasente et al for the Australian Fisheries Management Authority (AFMA) on the use of EM in the Australian eastern tuna and billfish fishery found that:

> *"The comprehensive and continuous sensor data set (GPS, rotation and hydraulic pressure sensors every 10 seconds) is a key strength of EM systems. EM data interpretation provided very good temporal and spatial information on gear setting and hauling activities, aligning very closely with observer data: over 90% of set start times were within 15 minutes and over 80% were within 500m. These results suggest that sensor data could reliably be used to monitor the temporal and spatial elements of fishing effort and be used to audit the accuracy of corresponding logbook records."* (Piasente *et al.*, 2011. p.35).

Recommended Best Practice Advice (for EM use in longline fishing operations)

In order to collect the day, time, and location of the deployment and retrieval of fishing gear, the following sensors should be incorporated into the EM system:

1. Rotation and hydraulic pressure sensors capable of reporting activation/deactivation of the winch at 10 second intervals should be fitted to winches used to deploy and retrieve fishing gear.
2. Date and latitude and longitude information should be recorded from a GPS at 1-5 minute intervals throughout the period that fishing gear is being deployed or retrieved.

2.2. Fishing Operation and Fishing Gear

Data is required on the total number of hooks deployed (to estimate bycatch rates), and mass of added weight, branchline length and distance between weight and the hook (to determine compliance). Studies have shown that data on the number of hooks deployed/retrieved can be obtained through the appropriate placement of a camera on the fishing vessel.

> *The IPHC case study has shown the efficacy of EM technologies for fisheries management, both for quantifying fishing effort and catch composition for most species. All the methods examined for quantifying longline-fishing effort showed some level of bias, however the biases encountered were not meaningful. Moreover, the sea sampler and video analyst retrieval hook count differences were minimal with small standard errors. Even with the effect of large snarls and poor weather, the hook counts remained relatively consistent*.” Ames 2005, p.51

No information was found on the use of EM to assess the mass of added weight, the branchline length, or the distance between the weight and the hook. The inclusion of a scale in the setting and/or hauling area could be one means of allowing some of this data to be collected. Further research is recommended to identify means of collecting this data using e-monitoring.

Recommended Best Practice Advice

A camera should be fitted in the setting and/or haul area that provides a clear view of hooks as they are set and/or retrieved. Winch sensors should be installed to ensure that all setting and hauling events are recorded by the video equipment.

2.3. Mitigation Measure

Data is required on whether tori lines are used, the number of tori lines deployed and the aerial coverage achieved in metres. Studies have shown that aft-viewing cameras can be used to reliably monitor the use of tori-lines and a range of other seabird bycatch mitigation measures (Piasente *et al*., 2011); however, the sighting and maintenance of these cameras is of critical importance with regard to the quality of the data obtained. Further research and/or guidelines are required on the use of video imagery to accurately determine the aerial coverage of the streamers.

> *"In general, the aft camera view of the vessels' setting operation was shown to be reliable for monitoring the use of tori-lines (see Figure 14). This is similar to the findings in Ames et al. (2005), assessment of the applications of EM to monitor compliance of seabird avoidance devices. However, it was shown not possible to determine whether tori line deployment met AFMA's regulations, further guidelines on how to do that using image data are needed."* Piasente *et al*., 2011. p. 33.

Recommended Best Practice Advice

A camera/s should be fitted such that it has a clear and unobstructed view of the stern of the vessel that provides a clear view of tori lines once they are deployed. Footage from this camera should be reviewed to verify tori line deployment during the set and ideally, whether the details of the tori line meets appropriate specifications. Where other seabird bycatch mitigation measures are being used e.g. side-setting, bird curtain etc cameras should be fitted in a location that provides a clear, unobstructed view of their deployment and/or use.

2.4. Seabird Bycatch

Data on species identification, number of each species captured, the type of interaction, disposition and description of condition/viability of the animal upon release (if released alive) is required.

Species identification and number of species captured. Studies have shown that video imagery can be used to identify the species of seabirds. However, identification of the species and number of birds caught is difficult to determine with a high level of accuracy. Seabirds may be accidentally or deliberately shaken from, or cut off the branchline before they are hauled on board, making it difficult to detect by either an observer, or by an EM system.. To aid the accurate identification of species caught and brought onboard, ACAP's seabird identification guide recommends that a feather or muscle sample be collected for post-trip analysis.

Type of interaction, disposition and condition of animal. A number of studies have shown that video imagery can be used to collect this data, although the assessment of the condition of the animal is likely to be less accurate than with an onboard observer. It is important that clear onboard handling practices be defined, to improve the likelihood of the survival of seabirds brought onboard alive, as well as to improve the quality of the data captured by the video equipment.

> *"In this study, hook removal and disentangling for the majority of interactions took place in the camera view, making it possible to determine hooking location and life status. The level of activity during this procedure and upon release also provided some indication of release condition. However, in comparison to observers, there are obvious limitations assessing the extent of injury and survivability of captured protected species from EM imagery. To help detect interactions and assess life status, clear onboard handling practices need to be defined (i.e. handled in clear view of the camera) and complied with by crew for onboard cameras to be a feasible replacement for the monitoring of protected species interactions."* Piasente *et al*., 2011. p. 36.

Recommended Best Practice Advice

Seabirds brought onboard the vessel alive should be handled in accordance with ACAP's 'Hook Removal from Seabirds' advice. Dead seabirds should be photographed in accordance with the protocols detailed in ACAP's 'Seabird Bycatch Identification Guide'. Where possible, a feather or muscle sample should also be taken for post-trip analysis, using the protocols detailed in ACAP's 'Seabird Bycatch Identification Guide'.

Annex A. Relative Capacity of Monitoring Systems to Collect Minimum Recommended Data

Category	Variables	Observer	% time	EM	% time
Temporal	**Date gear deployed**	**Yes**	**When on duty**	**Yes**	**100%**
	Start time of gear deployment	**Yes**	**When on duty**	**Yes**	**100%**
	End time of gear deployment	**Yes**	**When on duty**	**Yes**	**100%**
	Date gear retrieved			Yes (?)	100% (?)
	Start time of gear retrieval			Yes (?)	100% (?)
	End time of gear retrieval			Yes (?)	100% (?)
Spatial	**Latitude at beginning of gear deployment**	**Yes**	**When on duty**	**Yes**	**100%**
	Longitude at beginning of gear deployment	**Yes**	**When on duty**	**Yes**	**100%**
	Latitude at beginning of gear retrieval	**Yes**	**When on duty**	**Yes**	**100%**
	Longitude at beginning of gear retrieval	**Yes**	**When on duty**	**Yes**	**100%**
	Latitude at end of gear retrieval			Yes (?)	100% (?)
	Longitude at end of gear retrieval			Yes (?)	100% (?)
Physical and environmental	Sea state (Beaufort Scale)				
	Moon phase				
	Wind strength and direction				
	Depth fished (average/target depth)				
	Cloud cover (important for night setting)				
Fishing operation	Unique vessel identifier				
	Unique observer identifier				
	Vessel length				
	Setting speed (knots)				
	Total number of hooks deployed	**Yes**	**When on duty**	**Yes**	**100%**

Category	Variables	Observer	% time	EM	% time
	Total number of hooks observed (crucial for calculating seabird bycatch levels)[1]	**Yes**	**When on duty**	**Yes**	**100%**
	Target species[2]				
	Bait species				
	Composition of bait used (%)				
	Bait status (live/fresh/frozen/thawed/whole/cut)				
	Mass of added weight (describe size and position of weight, e.g. 60g 2m from the hook)	**Yes**	**When on duty**	**Possibly**	**100%**
Fishing gear	Groundline/mainline length[3]				
	Branchline/ganglion length	**Yes**	**When on duty**	**Possibly**	**100%**
	Distance between weight and hook on ganglion (when used)	**Yes**	**When on duty**	**Possibly**	**100%**
	Distance between branchlines				
	Line setter used (Y/N)				
	Line setter speed (knots)				
	Hook size				
	Hook type				
Catch	Total catch, actual or estimated (number and/or weight)				
	Catch by species (number and/or weight)				
Mitigation measure	**Tori line used (yes/no)**	**Yes**	**When on duty**	**Yes**	**100%**
	Side of tori line deployment (port or starboard or both)				
	Number of tori lines used	**Yes**	**When on duty**	**Yes**	**100%**

Category	Variables	Observer	% time	EM	% time
	Length of tori line (m)				
	Aerial coverage achieved (m)	**Yes**	**When on duty**	**Yes**	**100%**
	Attachment height (m above water line)				
	Number of streamers				
	Distance between streamers				
	Dumping of bait/offal (yes/no; also describe if dumping of offal took place during setting and hauling and whether offal was dumped on the opposite side of the hauling bay)				
	Deck lighting astern of the vessel (yes/no)				
	Bait caster used (yes/no)				
	Other mitigation measures used (provide details)				
Seabird Bycatch	**Species identification**	**Yes**	**When on duty**	**Possibly**	**100%**
	Number of each species captured	**Yes**	**When on duty**	**Possibly**	**100%**
	Type of interaction (hooking/entanglement)	**Yes**	**When on duty**	**Yes**	**100%**
	Disposition (dead/alive/injured)	**Yes**	**When on duty**	**Possibly**	**100%**
	Description of condition/viability of animal upon release (if released alive)	**Yes**	**When on duty**	**No**	**-**
Other	Seabird abundance counts				

ANNEX B: Recommended data to be collected from longline fisheries

Recommended data to be collected from longline fisheries (adapted from Dietrich *et al*. 2007, FAO 2009 and Anderson *et al*. 2010). These data will be recorded for each set and haul observed. Data considered critical for assessing seabird bycatch are highlighted in bold.

Category	Variables
Temporal	**Date gear deployed** **Start time of gear deployment** **End time of gear deployment** Date gear retrieved Start time of gear retrieval End time of gear retrieval
Spatial	**Latitude at beginning of gear deployment** **Longitude at beginning of gear deployment** **Latitude at beginning of gear retrieval** **Longitude at beginning of gear retrieval** Latitude at end of gear retrieval Longitude at end of gear retrieval
Physical and environmental	Sea state (Beaufort Scale) Moon phase Wind strength and direction Depth fished (average/target depth) Cloud cover (important for night setting)
Fishing operation	Unique vessel identifier Unique observer identifier Vessel length Setting speed (knots) **Total number of hooks deployed** **Total number of hooks observed (crucial for calculating seabird bycatch levels)**[1] Target species[2] Bait species Composition of bait used (%) Bait status (live/fresh/frozen/thawed/whole/cut) **Mass of added weight (describe size and position of weight, e.g. 60g 2m from the hook)**
Fishing gear	Groundline/mainline length[3] **Branchline/ganglion length** **Distance between weight and hook on ganglion (when used)** Distance between branchlines Line setter used (Y/N) Line setter speed (knots) Hook size Hook type

Category	Variables
Catch	Total catch, actual or estimated (number and/or weight) Catch by species (number and/or weight)
Mitigation measure	**Tori line used (yes/no)** Side of tori line deployment (port or starboard or both) **Number of tori lines used** Length of tori line (m) **Aerial coverage achieved (m)** Attachment height (m above water line) Number of streamers Distance between streamers Dumping of bait/offal (yes/no; also describe if dumping of offal took place during setting and hauling and whether offal was dumped on the opposite side of the hauling bay) Deck lighting astern of the vessel (yes/no) Bait caster used (yes/no) Other mitigation measures used (provide details)
Bycatch	**Species identification** **Number of each species captured** **Type of interaction (hooking/entanglement)** **Disposition (dead/alive/injured)** **Description of condition/viability of animal upon release (if released alive)**
Other	Seabird abundance counts

1 – Important to record the numbers of hooks observed specifically for seabirds. If the observer is in the factory or collecting information elsewhere they will miss seabirds being hauled aboard. Therefore, it is important to be able to relate the number of birds caught to the number of hooks observed.

2 – Target species may be derived in some programmes from the catch composition

3 – Groundline/mainline length is rarely an exact measurement, due to the length of the line. Instead it is either derived (by multiplying distance between floats by number of floats) estimated by the observer, or reported by the vessel.