COORDINATION OF MITIGATION RESEARCH: REPORT OF THE FIRST MEETING OF THE SEABIRD BYCATCH WORKING GROUP, AGREEMENT ON THE CONSERVATION OF ALBATROSSES AND PETRELS

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Abstract

ACAP's Seabird Bycatch Working Group recently assessed the suitability of pelagic mitigation technologies for future research, and reviewed seabird bycatch mitigation measures for pelagic longline fishing to identify knowledge gaps. The products of this work are two tables (Tables 1 and 2), which have been endorsed by ACAP as representing the current best scientific advice. In assessing the suitability of mitigation measures for future research, each measure was assigned a priority ranking on a 5 point scale, according to criteria on potential effectiveness, practicality, and cost. Bird scaring lines, the bait setting capsule and side setting were ranked the highest priority for research. Weighted branchlines, the bait pod, smart hooks and circle hooks were high priorities; and blue dyed squid was of moderate priority. Research on technologies such as the underwater setting chute, night setting, line shooters, thawed bait, strategic offal discharge, blue-dyed fish, fish oil and bait casting machines, were considered a lower priority. The literature review of mitigation measures showed that some of the measures currently listed by some RFMOs would benefit from further development and testing.

Recent initiatives by two RFMOs to adopt a mitigation approach requiring fishers to select two measures, to be used in combination, from a 'menu' of seabird mitigation technical measures are commended. Such an approach is recommended for consideration by the IOTC. A review of the current exemption to Paragraph 4 of Resolution 06/04 that applies to surface longline vessels targeting swordfish utilising the "American longline system" and equipped with a line-throwing device is also recommended, noting that the efficacy of line shooters and bait casters is not supported by empirical data (Table 2)

Introduction

The Agreement on the Conservation of Albatrosses and Petrels (ACAP) held the first meeting of its Seabird Bycatch Working Group (SBWG) in Valdivia, Chile on 17-18 July 2007. This working group had been formed to advise the Agreement on actions that will assist in assessment, mitigation and reduction of negative interactions between fishing operations and albatrosses and petrels. The working group comprises representatives from ACAP's 11 Parties, together with invited experts with relevant technical or other expertise.

The meeting had a broad agenda and a full report can be found at www.acap.aq (AC3 Doc 14 Rev 4). This paper provides a summary of issues relating to bycatch mitigation that may be of use to the Indian Ocean Tuna Commission in developing research and management approaches to mitigate seabird bycatch its fisheries.

Review of Pelagic Longline Mitigation Measures

A primary focus of the SBWG meeting was to update information on current mitigation research for pelagic long-line fisheries. The SBWG was told of a number of new developments, which included a new demersal longline system developed in Chile, development of bird scaring lines for pelagic longline fisheries, an underwater bait-setting capsule, a bait pod and a smart hook that deny seabirds access to hooks during the setting process, safe leads that permit additional weight to be added to pelagic gear whilst improving the safety for fishers, the use of naturally occurring oils to deter seabirds from attending fishing operations, and the effectiveness of blue-dyed squid as a mitigation measure. The meeting also heard of new information on poorly known hook and line fisheries in Brazil, and mitigation research in Uruguay and Argentina. An update on BirdLife International's Albatross Task Force which is providing an international team of mitigation instructors to work with fishers and fisheries managers in global seabird bycatch 'hotspots' was also provided.

From this information the SBWG identified the need for a coordinated approach to mitigation research. The SBWG recognised the need to identify a suite of research initiatives that can together provide critical information to establish the relative effects of mitigation technologies on seabirds, target fish and all other taxa. This would permit substantial advances in the development of best management practices that are effective and acceptable (safe, cost effective and reasonable) to the fishing industry and to fishery managers. It was agreed that this could best be realized through a collaborative approach that pooled scarce resources (expertise, scientists and funding) and addressed appropriate seabird species and/or foraging guilds, fishery target species, and categories of fishing gear and vessels types. Collaboration might also include agreement on a common protocol for data collection and standardization of critical variables to be measured in mitigation research for pelagic fisheries.

The Working Group recognised that interactions with pelagic fisheries managed by RFMOs arguably constitute the largest conservation threat to seabirds in the southern oceans, and although several seabird avoidance measures have been trialed to varying degrees in pelagic fisheries, proven and accepted seabird avoidance measures require substantial improvement.

In order to progress the development of relevant mitigation research, the Working Group commenced on a process designed to develop a plan of research for pelagic longline fisheries, including identifying specific research experiments needed, principal investigators, best host locations, and possible funding sources. In approached this task in

two ways, in the light of new data provided to the working group and further expert opinion.

1. An assessment of the suitability of pelagic mitigation technologies for future research and application was carried out**.** Mitigation measures were grouped as primary, secondary, or other, and a priority ranking for future research assigned on a 5 point scale. Primary measures were those considered likely to be effective without other mitigation measures, and secondary measures were those considered useful for deployment with other measures, but unlikely to significantly reduce bycatch if used in isolation. The results of this assessment are shown in Table 1, together with details of the criteria used for assessment.

2. Seabird bycatch mitigation measures for pelagic longline fishing were reviewed and knowledge gaps identified. The review was based on published literature and expert opinion. The results of the review are shown in Table 2.

Tables 1 and 2 have been endorsed by ACAP as representing the current best scientific advice. The IOTC and its Members are encouraged to use these materials to guide the development of policy and practice within fisheries under their jurisdiction.

Priorities for Research

It was assessed that from a global research perspective, bird scaring lines, the bait setting capsule and side setting were the highest priority for research. Weighted branchlines, the bait pod, smart hooks and circle hooks were high priorities; and blue dyed squid was of moderate priority. Research on technologies such as the underwater setting chute, night setting, line shooters, thawed bait, strategic offal discharge, blue-dyed fish, fish oil and bait casting machines, were considered a lower priority and were not discussed further. With respect to night setting, the Working Group acknowledged the effectiveness of this mitigation measure, but believed further research on this was not needed.

The Working Group agreed that seabird bycatch mitigation research should best be carried out in locations where seabird interactions with pelagic gear are most intense, as it is these locations that would yield the most useful research outcomes. Locations where aggressive species are most abundant and overlap with fisheries include the pelagic fisheries of Chile in winter, Uruguay and Brazil from May through September, and in South Africa in winter. BirdLife International reported that Albatross Task Force personnel are either in place or will soon be in place in Chile, Brazil, Uruguay, South Africa and Namibia and are available to collaborate in seabird bycatch mitigation research programs.

Specific Research Projects Identified

A couple of specific research projects were identified that may be of relevance for IOTC pelagic longline fisheries. Australia has led the development of the bait setting capsule, a

device designed to deliver baited hooks to a depth beyond the access of foraging seabirds at the stern of a pelagic longline vessel (SBWG1/Paper 3). Graham Robertson has funding to develop a prototype and carry pilot research to demonstrate the efficient performance of the prototype capsule. Pending a positive outcome of pilot research, Dr. Robertson is seeking funding to carry out comprehensive research to determine the relative performance of the bait setting capsule, side setting and conventional stern setting. A location to stage this research effort has not been established at this stage.

The United States is developing plans to develop a streamer line system for pelagic longline fisheries and to trial the streamer line system in two "worst case" southern hemisphere, pelagic fisheries. Funding is in place to carry out this research. Trials will compare the relative efficiency of the streamer line designed to a control of no deterrent and to a second mitigation technology to be determined. The host locations will include South Africa and either Brazil, Chile or Uruguay. Work is scheduled to be completed in 2009.

New Zealand and Australia have procured "safe lead", a new product which promises to eliminate safety issues related to weighted branchlines. It is planned to pilot-level test these weights in 2007 within Australian and New Zealand fisheries.

Regional Fishery Management Organizations (RFMOs)

The working group noted and welcomed the new initiatives by RFMOs to improve the implementation of mitigation measures for seabirds. In particular, it commended the approach requiring fishers to select two measures, to be used in combination, from a 'menu' of seabird mitigation technical measures. This approach had been developed within the WCPFC and was now under consideration by the IATTC. Both RFMOs provide mitigation options for individual vessels in a column A – column B format, where vessels must select one primary or mandatory technical measure from Column A and one or more secondary or complementary mitigation technical measures from Column B, when fishing in specified areas where seabirds are at risk. An example of this approach is set out in Appendix 1, Further information can be found at (Conservation and Management Measure 2006-02, Attachment G, Report of WCPFC Third Regular Session, 11-15 December, 2006, http://www.wcpfc.int/;)

The Working Group further noted that based on its review of the current applicability of seabird mitigation measures in pelagic longline fisheries (Table 2), some of the measures currently listed by WCPFC and/or IATTC would benefit from further development and testing. Important issues include:

a) resolving inconsistencies in the recommendations of WCPFC and IATTC in respect of streamer lines;
b) the need to better define side-setting methods and to test them in higher latitude fisheries, especially those with diving seabirds and a diversity of albatross species;
c) the inappropriateness of using bait casting as a recommended mitigation measure; and

d) that current underwater setting techniques are not yet suitable for recommending for general application.

In particular, the Working Group recommended that its advice on current best practice mitigation, including the application of combinations of measures (Table 2) be provided to the IOTC and other relevant RFMOs.

Recommendations

It is recommended that IOTC:

1. Adopt a management approach where vessels are required to select one primary or mandatory technical measure and one or more secondary or complementary mitigation technical measures, when fishing in specified areas where seabirds are at risk, similar to the column A – column B format adopted by the WCPFC and under consideration by the IATTC;
2. Review the current exemption to Paragraph 4 of Resolution 06/04 that applies to surface longline vessels, targeting swordfish, utilising the "American longline system" and equipped with a line-throwing device, noting that the efficacy of line shooters and bait casters is not supported by empirical data (Table 2);

3. Strongly encourages Members to collaborate on implementing the research initiatives outlined in Table 1.

Table 1. Assessment of the suitability of pelagic mitigation technologies for future research and application. Rankings have been assigned on a 5 point scale, where 5 is the highest ranking. See below for details of the criteria used for assessment.

Mitigation	Effective surface feeding birds	Effective diving birds	Practical	Safe	Cost Capital	Cost Ops	DWF/ Dom	Compliance	Future Research Priority
Primary									
Streamer lines	4	3	4	4	5	5	5/5	1	5
Weighted branchlines	4	3	5	1	4	4	5/5	5	4
Underwater Setting									
Chute	2	1	2	3	2	5	1/5	1	1
Bait setting capsule	5	4*	4	4	2	5	5/5	3	5
Bait Pod / Smart hooks	5	4*	3	4*	4	4	5/5	1	4
Night Setting	4	3	5	4	5	3*	5/5	3	1
Secondary									
Circle Hooks	?	?	5	5	5	5	5/5	5	4
Bait placement/casting	2*	2*	5	3	4	4	5/5	1	1
Line shooter?	2	2	5	4	4	4	5/5	1	1
Thawed bait	2	2	3	5	5	5	5/5	1	1
Strategic offal discharge	2	2	3	5	5	5	5/5	1	1
Other									
Side Setting	2*	2*	3	4	4	5	5/5	5	5
Blue Dyed Squid	3	3	3	5	5	4	5/5	1	3
Blue Dyed Fish	1	1	3	5	5	4	5/5	1	1
Fish Oil	1	4	2	4	4	3	5/5	1	2

Each mitigation method was grouped as primary, secondary, or other. Primary measures were those considered likely to be effective without other mitigation measures, and secondary measures were those considered useful for deployment with other measures, but may not significantly reducing bycatch if used in isolation. Side setting, blue-dyed fish and squid bait, and fish oil were regarded as possible candidates for primary mitigation but were considered separately due to their early stage of development and/or limited research results to date. Acoustic alarms, water jets, time-area closures, and artificial lures/bait were not considered. Each was assigned a priority ranking for future research based on the scientific literature and individual experience using the following criteria:

- Effectiveness on surface foraging seabirds
- Effectiveness on diving seabirds
- Practical use on the vessel
- Safe use on the vessel
- Capital Cost – costs for purchase of a specific technology
- Operational Cost – costs related to vessel operations (lost fishing time)
- Applicability to distant water fleets and domestic fleets
- Compliance – the ability to monitor use and performance

Each method was ranked for each criterion on a relative scale of 1 to 5, with 1 being the lowest ranking and 5 being the highest. Considering the ranking for each criterion, each mitigation method was ranked in a similar way resulting in a prioritized list of mitigation methods to focus future research.

Table 2. Review of seabird bycatch mitigation measures for Pelagic Longline Fishing and identification of knowledge gaps

Mitigation measure	Scientific evidence for effectiveness in pelagic fisheries	Caveats /Notes	Need for combination	Research needs	Minimum standards
Night setting	Duckworth 1995; Brothers et al. 1999; Gales et al 1998; Klaer & Polacheck 1998; Brothers et al. 1999; McNamara et al. 1999; Gilman et al. 2005; Baker & Wise 2005.	Less effective during full moon, under intensive deck lighting or in high latitude fisheries in summer. Less effective on nocturnal foragers e.g. White-chinned Petrels (Brothers et al. 1999; Cherel et al. 1996).	Recommend combination with bird scaring lines and/or weighted branch lines	Data on current time of sets by WCPFC fisheries. Effect of night sets on target catch for different fisheries.	Night defined as nautical dark to nautical dawn
Side setting	Brothers & Gilman 2006; Yokota & Kiyota 2006.	Only effective if hooks are sufficiently below the surface by the time they reach the stern of the vessel. In Hawaii, side-setting trials were conducted with bird curtain and 45-60g weighted swivels placed within 0.5m of hooks. Japanese research concludes must be used with other measures (Yokota & Kiyota 2006).	Must be combined with other measures. Successful Hawaii trials use bird curtain plus weighted branch lines. In Southern Hemisphere, strongly recommend use wth bird scaring lines until side-setting is tested in the region.	Currently untested in the Southern Ocean against seabird assemblages of diving seabirds and albatrosses - urgent need for research. In Japan, NRIFSF will continue testing in 2007.	In Hawaii, side setting is used in conjunction with a bird curtain and 45 weighted swivel within 1m of the baited hook. Clear definition of side setting is required. Hawaiian definition is a minimum of 1 m forward of the stern.
Single bird scaring line	Imber 1994; Uozomi & Takeuchi 1998; Brothers et al. 1999; Klaer & Polacheck 1998; McNamara et al. 1999; Boggs 2001; CCAMLR 2002; Minami & Kiyota 2004. Melvin 2003.	Effective only when streamers are positioned over sinking baits. In pelagic fisheries, baited hooks are unlikely to sink beyond the diving depths of diving seabirds within the 150 m zone of the bird scaring line, unless combined with other measures such as line weighting or underwater setting. Entanglement with fishing gear can lead to poor compliance by fishers and design issues need to be addressed. In crosswinds, bird scaring line must be deployed from the windward side to be effective.	Effectiveness increased when combined with other measures e.g. weighted branch lines and/or night setting	Optimal design for pelagic fisheries under development: refine to minimise tangling, optimise aerial extent and positioning, and ease hauling/retrieval. Two studies in progress developing optimal bird scaring lines for pelagic fisheries including Washington Sea Grant and Global Guardian Trust in Japan. Controlled studies demonstrating their effectiveness in pelagic fisheries remain very limited.	Current minimum standards for pelagic fisheries are based on CCAMLR Conservation Measure 25-02

Table 2 continued.

Mitigation measure	Scientific evidence for effectiveness in pelagic fisheries	Caveats /Notes	Need for combination	Research needs	Minimum standards
Paired bird scaring lines	Two streamer lines best in crosswinds to maximise protection of baited hooks (Melvin et al. 2004).	Potentially increased likelihood of entanglement - see above. Development of a towed device that keeps gear from crossing surface gear essential to improve adoption and compliance.	Effectiveness will be increased when combined with other measures. Recommend use with weighted branch lines and/or night setting	Development and trialling of paired bird scaring line systems for pelagic fisheries.	Current minimum standards for pelagic fisheries are based on CCAMLR Conservation Measure 25-02
Weighted branch lines	Brothers 1991; Boggs 2001; Sakai et al. 2001; Brothers et al. 2001; Anderson & McArdle 2002; Gilman et al. 2003a; Robertson 2003; Lokkeborg & Robertson 2002, Hu et al. 2005.	Supplementary measure. Weights will shorten but not eliminate the zone behind the vessel in which birds can be caught. Even in demersal fisheries where weights are much heavier, weights must be combined with other mitigation measures (e.g. CCAMLR Conservation Measure 25-02).	Must be combined with other measures e.g. bird scaring lines and/or night setting	Mass and position of weight both affect sink rate. Further research on weighting regimes needed. Testing of safe-leads in progress. Where possible, effect on target catch as well as seabird bycatch should be evaluated. Research on use of integrated-weight branch lines (wire trace) in pelagic fisheries also needs further exploration.	Global minimum standards not yet established. Requirements now vary by fishery and vessel. Hawaii minimum requirements are 45g less than 1 m from hook. Australia requires 60 or 100g located 3.5 or 4 m from the hook, respectively.
Blue dyed bait	Boggs 2001; Brothers 1991; Gilman et al. 2003a; Minami & Kiyota 2001; Minami & Kiyota 2004; Lydon & Starr 2005. Double and Cocking, in press.	New data suggests only effective with squid bait (Double & Cocking). Onboard dyeing requires labour and is difficult under stormy conditions. Results inconsistent across studies.	Must be combined with bird scaring lines or night setting	Need for tests in Southern Ocean.	Mix to standardized colour placard or specify (e.g. use 'Brilliant Blue' food dye (Colour Index 42090, also known as Food Additive number E133) mixed at 0.5% for a minimum of 20 minutes)

Table 2 continued.

Mitigation measure	Scientific evidence for effectiveness in pelagic fisheries	Caveats /Notes	Need for combination	Research needs	Minimum standards
Line shooter	Reduced bycatch of Northern Fulmar in trials of mitigation measures in North Sea, Lokkeborg & Robertson 2002; Lokkeborg 2003. Increased seabird bycatch in Alaska (Melvin et al. 2001).	Supplementary measure. No published data for pelagic fisheries. May enhance hook sink rates in some situations but unlikely to eliminate the zone behind the vessel in which birds can be caught. More data needed. Found ineffective in trials in North Pacific demersal longline fishery (Melvin et al. 2001).	Must be combined with other measures such as night setting and/or bird scaring lines or weighted branch lines	Data needed on effects on hook sink rates in pelagic fisheries.	Not established
Bait caster	Duckworth 1995; Klaer & Polacheck 1998.	Not a mitigation measure unless casting machines are available with the capability to control the distance at which baits are cast. This is necessary to allow accurate delivery of baits under a bird scaring line. Needs more development. Few commercially-available machines have this capability.	Not recommended as a mitigation measure.		
Underwater setting chute	Brothers 1991; Boggs 2001; Gilman et al. 2003a; Gilman et al. 2003b; Sakai et al. 2004; Lawrence et al. 2006.	For pelagic fisheries, existing equipment not yet sturdy enough for large vessels in rough seas. Problems with malfunctions and performance inconsistent (e.g. Gilman et al. 2003a and Australian trials cited in Baker & Wise 2005)	Not recommended for general application	Design problems to overcome	Not yet established

Table 2 continued.

Mitigation measure	Scientific evidence for effectiveness in pelagic fisheries	Caveats /Notes	Need for combination	Research needs	Minimum standards
Management of offal discharge	McNamara et al. 1999; Cherel et al. 1996.	Supplementary measure. Definition essential. Offal attracts birds to vessels and where practical should be eliminated or restricted to discharge when not setting or hauling. Strategic discharge during line setting can increase interactions and should be discouraged. Offal retention and/or incineration may be impractical on small vessels.	Must be combined with other measures.	Further information needed on opportunities and constraints in pelagic fisheries (long and short term).	Not yet established for pelagic fisheries. In CCAMLR demersal fisheries, discharge of offal is prohibited during line setting. During line hauling, storage of waste is encouraged, and if discharged must be discharged on the opposite side of the vessel to the hauling bay.
Thawing bait	Brothers 1991; Duckworth 1995; Klaer & Polacheck; Brothers et al 1999.	Supplementary measure. Must be combined with other measures. If lines are set early morning, full thawing of all bait may create practical difficulties.		Evaluate sink rate of partially thawed bait.	

Appendix 1

IATTC 75th Meeting, June 2007: DOCUMENT IATTC-75-07c

Appendix

MITIGATION MEASURES TO REDUCE SEABIRD BYCATCH

All industrial longline vessels would be required to use at least one of the measures listed below when fishing in the IATTC Area.

Mitigation measures	**Description**
Side setting	Side setting reduces the seabirds' ability to take the baited hooks.
Night setting with minimum deck lighting	Setting and retrieving the gear at night shifts fishing operations to a time when the seabirds are less active, and reduces the visibility of the bait.
Bird-scaring lines	A system of streamers is deployed to keep seabirds away from the area where the longline enters the water.
Weighted branch lines	Weighted lines sink the baited hooks more rapidly.
Bird curtains	Bird curtains keep the seabirds away from baited hooks.
Blue-dyed bait	Coloring bait reduces contrast with the water, making it more difficult for the seabirds to see.
Underwater setting devices	Devices such as line shooters, underwater chutes, and deep-setting capsules set the baited hooks deep enough to reduce the seabirds' access to the bait; several of these methods are under development.
Management of offal discharge	Fishermen avoid discarding offal while the longline is being set to reduce the attraction by seabirds or used to distract seabirds away from the longline while it is being set.

When fishing within the shaded area shown in Figure A-1, at least two measures would be required. The first must be one of the obligatory measures in section A of Table A-1; the others may be any of the complementary measures in section B of Table A-1 ((in combinations marked with an "x").

TABLE A-1. Combinations of mitigation measures to reduce seabird bycatch to be applied when fishing in the shaded areas in Figure A-1

	B. Complementary measures						
A. Obligatory measures	Side setting	Night setting	Bird-scaring lines	Weighted branch lines	Bird curtain	Blue-dyed bait	Offal discharge control
Side setting		x	x	x	x	x	x
Night setting with minimum deck lighting	x			x			x
Bird-scaring lines	x			x	x	x	x
Weighted branch lines	x	x	x		x	x	x