Agreement on the Conservation of Albatrosses and Petrels

Fourth Meeting of Seabird Bycatch Working Group

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AC5 Annex 6 Review of seabird bycatch mitigation measures for pelagic longline fisheries

Secretariat

ANNEX 6 REVIEW OF SEABIRD BYCATCH MITIGATION MEASURES FOR PELAGIC LONGLINE FISHERIES.

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; Jiménez et al 2009.	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 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 with 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 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 only 1 m forward of the stern, which is likely to reduce effectiveness.

Measure	Scientific evidence for effectiveness in pelagic fisheries	Caveats /Notes	Need for combination	Research needs	Minimum standards
Single bird scaring lines - conventional configuration	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. 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 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 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 line 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
Single bird scaring line - Light configuration	Yokota et al. 2008 considered light lines to be more effective in reducing bait take by Laysan albatrosses than conventional bird scaring lines. A similar study conducted by Brouwer et al. 2008 in New Zealand contained confounding effects and inadequate description of	Evidence for effectiveness in Yokota et al (2008) is unconvincing because of small number of sets (18), no seabirds were caught in one experiment, and although a significant difference was detected in a 2nd experiment, the confidence limits around the mean values of both treatments overlapped extensively.		Thorough comparative experimental assessment of light and conventional bird scaring lines against Southern Ocean seabird assemblages of diving seabirds and albatrosses urgently needed. Research must be based on larger sample sizes and more transparent methodologies.	Use of this measure is not recommended at this time.

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	methodologies; these concerns preclude confident conclusions to be drawn from this study.				
Paired bird scaring line – conventional configuration	Two streamer lines best in crosswinds to maximise protection of baited hooks (Melvin et al. 2004). Hybrid tori lines (with long and short streamers) were more effective than short tori lines (only short streamers) in deterring diving seabirds (white-chinned petrels) (Melvin et.al., 2010.	Potentially increased likelihood of entanglement - see above. Development of a towed device to prevent tangling with fishing gear essential to improve adoption and compliance. Diving species increase vulnerability of surface foragers (albatrosses) due to secondary interactions.	Effectiveness increased when combined with other measures. Essential to use with weighted branch lines and night setting	Development and trialling of paired streamer line systems for pelagic fisheries. Essential research addresses effectiveness with respect to both primary and secondary interactions.	Current minimum standards for pelagic fisheries are based on CCAMLR Conservation Measure 25-02 Research still in progress. Current optimal tori line configuration for Japanese high seas vessels involves mix of short & long streamers to reduce drag needed to maintain a 100 m aerial extent. Long streamers to extend from 10 m to 50 from the stern. A “sweeper” streamer extending to the water on the port tori line forward of the stern protects the area forward of the zone where the baits typically land in the water during line setting.

Measure	Scientific evidence for effectiveness in pelagic fisheries	Caveats /Notes	Need for combination	Research needs	Minimum standards
Weighted branch lines	Brothers 1991; Boggs 2001; Sakai et al. 2001; Brothers et al. 2001; Anderson & McArdle 2002; Gilman et al. 2003a, Hu et al. 2005.	Critical measure, essential to use in all pelagic longline fisheries with seabird interactions. 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. Factors such as swivel weights, mainline tension, bait hooking position, bait size and life status, deployment position (effect of propeller turbulence) all affect sink rate and need to be quantified.	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. Australian requirements currently being re-assessed.
Blue dyed bait	Boggs 2001; Brothers 1991; Gilman et al. 2003a; Minami & Kiyota 2001; Minami & Kiyota 2004; Lydon & Starr 2005. Cocking et al. 2008.	New data suggests only effective with squid bait (Cocking et al. 2008). 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 minimum 20 minutes)

Measure	Scientific evidence for effectiveness in pelagic fisheries	Caveats /Notes	Need for combination	Research needs	Minimum standards
Line shooter and mainline tension	Robertson et al (2010).	Robertson et al (2010).showed that mainline set into propeller turbulence with a line shooter without tension astern (e.g. slack) as in deep setting significantly slows the sink rates of hooks. Use of a line shooter to set gear deep cannot be considered a mitigation measure.			Use of this measure is not recommended as a mitigation measure.
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.		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	Not recommended for general application	Design problems to overcome	Not yet established

Measure	Scientific evidence for effectiveness in pelagic fisheries	Caveats /Notes	Need for combination	Research needs	Minimum standards
		& Wise 2005)			
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.
Bait life status	Trebilco et al 2010; Robertson et al (submitted)	Live fish bait sinks significantly slower than dead bait (fish and squid), increasing the exposure of baits to seabirds. Use of live bait is associated with higher seabird bycatch rates.	Live bait is not a mitigation measure.	.	Use of live bait is not a mitigation measure.
Thawing bait status	Brothers 1991; Duckworth 1995; Klaer & Polacheck; Brothers et al 1999; Robertson & van den Hoff 2010.	Baits cannot be separated from others in frozen blocks of bait, and hooks cannot be inserted in baits, unless baits are partially thawed (it is not	Not a mitigation measure		Not recommended as a mitigation measure.

Measure	Scientific evidence for effectiveness in pelagic fisheries	Caveats /Notes	Need for combination	Research needs	Minimum standards
		practical for fishers to use fully frozen baits). Partially thawed baits sink at similar rates to fully thawed baits.			
Area closures	Avoiding fishing at peak areas and during periods of intense foraging activity has been used effectively to reduce bycatch in longline fisheries.	An important and effective management response, especially for high risk areas, and when other measures prove ineffective. There is a risk that temporal/spatial closures could displace fishing effort into neighbouring or other areas which may not be as well regulated, thus leading to increased incidental mortality elsewhere.	Must be combined with other measures, both in the specific areas when the fishing season is opened, and also in adjacent areas to ensure displacement of fishing effort does not merely lead to a spatial shift in the incidental mortality.	Further information about the seasonal variability in patterns of species abundance around fisheries.	No work done but highly recommended

REFERENCES

Anderson, S. and McArdle, B., 2002. Sink rate of baited hooks during deployment of a pelagic longline from a New Zealand fishing vessel. New Zealand Journal of Marine and Freshwater Research, 36: 185–195.

Baker, G.B., and Wise, B.S. 2005. The impact of pelagic longline fishing on the flesh-footed shearwater *Puffinus carneipes* in Eastern Australia. Biological Conservation, 126: 306–316.

Boggs, C.H., 2001. Deterring albatrosses from contacting baits during swordfish longline sets. In: Melvin, E., Parrish, J.K. (Eds), Seabird Bycatch: Trends, Roadblocks and Solutions. University of Alaska Sea Grant, Fairbanks, Alaska, pp. 79–94.

Brothers, N. and Gilman, E. 2006. Technical assistance for Hawaii-based pelagic longline vessels to modify deck design and fishing practices to side set. Prepared for the National marine Fisheries Service Pacific Islands Regional Office. Blue Ocean Institute, September 2006.

Brothers, N.P. 1991. Approaches to reducing albatross mortality and associated bait loss in the Japanese long-line fishery. Biological Conservation, 55: 255–268.

Brothers, N., Gales, R. and Reid, T. 1999. The influence of environmental variables and mitigation measures on seabird catch rates in the Japanese tuna longline fishery within the Australian Fishing Zone 1991-1995. Biological Conservation, 88: 85–101.

Brothers, N., Gales, R., and Reid, T., 2001. The effect of line weighting on the sink rate of pelagic tuna longline hooks, and its potential for minimising seabird mortalities. CCSBT-ERS/0111/53.

Brouwer, S. and Walker, N. 2008. Use of light streamer lines and line weighting on longline vessels and the implications for seabird bycatch. WCPFC Scientific Committee Fourth Regular Session, 11-22 August 2008 WCPFC-SC4-2008/EB-IP-3.

CCAMLR, 2002. Report of the working group on fish stock assessment. Report of the twenty-first meeting of the Scientific Committee of the Commission for the Conservation of Marine Living Resources. Commission for the Conservation of Marine Living Resources, Hobart.

Cherel, Y., Weimerskirch, H. and Duhamel., G 1996. Interactions between longline vessels and seabirds in Kerguelen Waters and a method to reduce seabird mortality. Biological Conservation, 75: 63–70.

Cocking, L.J., Double, M.C., Milburn, P.J. and Brando, V.E. 2008. Seabird bycatch mitigation and blue-dyed bait: A spectral and experimental assessment. Biological Conservation, 14: 1354–1364.

Duckworth, K., 1995. Analysis of factors which influence seabird bycatch in the Japanese southern bluefin tuna longline fishery in New Zealand waters, 1989–1993. New Zealand Fisheries Assessment Research Document 95/26.

Gales, R., Brothers, N. and Reid, T. 1998. Seabird mortality in the Japanese tuna longline fishery around Australia, 1988-1995. Biological Conservation, 86: 37–56.

Gilman, E., Brothers, N., Kobayashi, D. R., Martin, S., Cook, J., Ray, J., Ching, G., and Woods, B. 2003a. Performance assessment of underwater setting chutes, side setting, and blue-dyed bait to minimise seabird mortality in Hawaii longline tuna and swordfish fisheries. Final report. Western Pacific Regional Fishery Management Council. Honolulu, Hawaii, USA. 42pp.

Gilman, E., Boggs, C. and Brothers, N. 2003b. Performance assessment of an underwater setting chute to mitigate seabird bycatch in the Hawaii pelagic longline tuna fishery. Ocean and Coastal Management, 46: 985–1010.

Gilman, E., Brothers, N. and Kobayashi, D. 2005. Principles and approaches to abate seabird bycatch in longline fisheries. Fish and Fisheries, 6: 35–49.

Hu, F., Shiga, M., Yokota, K., Shiode, D., Tokai, T., Sakai, H., and Arimoto, T. 2005. Effects of specifications of branch line on sinking characteristics of hooks in Japanese tuna longline. Nippon Suisan Gakkaishi 71: 33–38.

Imber, M.J., 1994. Report on a tuna long-lining fishing voyage aboard Southern Venture to observe seabird by-catch problems. Science & Research Series 65. Department of Conservation, Wellington, New Zealand.

Jiménez S, Domingo A, and Brazeiro A. 2009. Seabird bycatch in the Southwest Atlantic: interaction with the Uruguayan pelagic longline fishery. Polar Biology, 32: 187–196.

Klaer, N. and Polacheck, T. 1998. The influence of environmental factors and mitigation measures on by-catch rates of seabirds by Japanese longline fishing vessels in the Australian region. Emu, 98: 305–16.

Lawrence, E., Wise, B., Bromhead, D., Hindmarsh, S., Barry, S., Bensley, N. and Findlay, J. 2006. Analyses of AFMA seabird mitigation trials – 2001 to 2004. Bureau of Rural Sciences. Canberra.

Lokkeborg, S., 2003. Review and evaluation of three mitigation measures - bird-scaring line, underwater setting and line shooter - to reduce seabird bycatch in the north Atlantic longline fishery. Fisheries Research, 60: 11–16.

Lydon, G. and Starr, P., 2005. Effect of blue dyed bait on incidental seabird mortalities and fish catch rates on a commercial longliner fishing off East Cape, New Zealand. Unpublished Conservation Services Programme Report, Department of Conservation, New Zealand. 12p.

McNamara B, Torre L, and Kaaialii G. Hawaii longline seabird mortality mitigation project. Honolulu, HI, USA: Western Pacific Regional Fishery Management Council, 1999.

Melvin, E. F., Guy, T. J. and Reid, L. B. 2010. Shrink and Defend: A Comparison of Two Streamer Line designs in the 2009 South Africa Tuna Fishery. Third Meeting of the Seabird Bycatch Working Group, ACAP, SBWG-3 Doc 13.rev1.

Melvin, E. F., Sullivan, B., Robertson, G. and Wienecke, B. 2004. A review of the effectiveness of streamer lines as a seabird bycatch mitigation technique in longline fisheries and CCAMLR streamer line requirements. CCAMLR Science, 11: 189–201.

Melvin, E.F. 2003. Streamer lines to reduce seabird bycatch in longline fisheries. Washington Sea Grant Program, WSG-AS 00-33.

Melvin, E.F., Parrish, J.K., Dietrich, K.S. and Hamel, O.S. 2001. Solutions to seabird bycatch in Alaska's demersal longline fisheries. Project A/FP-7, WSG-AS 01-01, Washington Sea Grant.

Minami, H. and Kiyota, M. 2001. Effect of blue-dyed bait on reducing incidental take of seabirds. CCSBT-ERS/0111/61. 7pp.

Minami, H. and Kiyota, M., 2004 . Effect of blue-dyed bait and tori-pole streamer on reduction of incidental take of seabirds in the Japanese southern bluefin tuna longline fisheries. CCSBT-ERS/0402/08.

Robertson, G., Candy, S.G. and Wienecke, B. 2010. Effect of line shooter and mainline tension on the sink rates of pelagic longlines and implications for seabird interactions. Aquatic Conservation: Marine and Freshwater Ecosystems DOI: 10.1002/aqc.1100.

Robertson, G., and van den Hoff, J. 2010. Static water trials oo the sink rates of baited hooks to improve understanding of sink rates estimated at sea. Report to the Third meeting of the Seabird Bycatch Working Group of ACAP.

Robertson, G., Candy, S. G., Wienecke, B., and Lawton, K. submitted, 2010. Experimental determinations of factors affecting the sink rates of baited hooks to minimise seabird mortality in pelagic longline fisheries.

Sakai, H., Fuxiang, H., and Arimoto, T., 2004. Underwater setting device for preventing incidental catches of seabirds in tuna longline fishing, CCSBT-ERS/0402/Info06.

Sakai, H., Hu, F., and Arimoto, T. 2001. Basic study on prevention of incidental catch of seabirds in tuna longline. CCSBT-ERS/0111/62.

Trebilco, R., Gales, R., Lawrence, E., Alderman, R., Robertson, G. and Baker, G.B. 2010 (in press). Seabird bycatch in the Eastern Australian Tuna and Billfish pelagic longline fishery: temporal, spatial and biological influences. Aquatic Conservation: Marine and Freshwater Ecosystems.

Uozomi, Y. and Takeuchi, Y. 1998. Influence of tori pole on incidental catch rate of seabirds by Japanese southern bluefin tuna longline fishery in high seas. CCSBT-WRS/9806/9 revised. 5pp.

Yokota, K. and Kiyota, M. 2006. Preliminary report of side-setting experiments in a large sized longline vessel. WCPFC-SC2-2006/EB WP-15. Paper submitted to the Second meeting of the WCPFC Ecosystem and Bycatch SWG. Manila, 10th August 2006

Yokota, K., Minami, H. and Kiyota, M. 2008. Direct comparison of seabird avoidance effect between two types of tori-lines in experimental longline operations. WCPFC Scientific Committee Fourth Regular Session, 11-22 August 2008 WCPFC-SC4-2008/EB-WP-7.