Agreement on the Conservation of Albatrosses and Petrels

ACAP SUMMARY ADVICE FOR REDUCING IMPACT OF PELAGIC LONGLINES ON SEABIRDS

Reviewed at the Eighth Meeting of the Advisory Committee

Punta del Este, Uruguay, 15 – 19 September 2014

Goal: Reduce the bycatch of seabirds to the lowest possible level.

SUMMARY

A combination of weighted branch lines, bird scaring lines and night setting are best practice mitigation in pelagic longline fisheries. These measures should be applied in areas where fishing effort overlaps with seabirds vulnerable to bycatch to reduce the incidental mortality to the lowest possible levels. Other factors such as safety, practicality and the characteristics of the fishery should also be recognised.

Currently, no single mitigation measure can reliably prevent the incidental mortality of seabirds in most pelagic longline fisheries. The most effective approach is to use the above measures in combination.

INTRODUCTION

The incidental mortality of seabirds, mostly albatrosses and petrels, in longline fisheries continues to be a serious global concern and was major reason for the establishment of the Agreement on the Conservation of Albatrosses and Petrels (ACAP). In longline fisheries seabirds are killed when they become hooked and drowned while foraging for baits on longline hooks as the gear is deployed. They also can become hooked as the gear is hauled; however, many of these seabirds can be released alive with careful handling. Although most mitigation measures are broadly applicable, the application and specifications of some will vary with local longlining methods and gear configurations. For example, most scientific literature on seabird bycatch mitigation in pelagic fisheries relates to larger vessels, with little research attention to smaller vessels and the gear configuration and methods of artisanal fleets; seabird bycatch mitigation advice is under development. ACAP has comprehensively reviewed the scientific literature dealing with seabird bycatch mitigation in pelagic fisheries and this document is a distillation of that review.

BEST PRACTICE MEASURES

1. Branch line weighting

Weights will shorten but not eliminate the zone behind the vessel in which birds can be caught. Branch lines should be weighted to sink the baited hooks rapidly out of the diving range of feeding seabirds. Weighted lines sink faster and more consistently, resulting in dramatic reductions in seabird attacks on baited hooks. Scientific studies have demonstrated that branch line weighting configurations with more mass close to the hook sinks the hooks most rapidly, reduces seabird attacks on baits and consequently is most likely to reduce mortalities. Studies of a range of weighting regimes, including regimes with weight at the hook, have shown no negative effect on target catch rates. Continued refinement of line weighting configurations (mass, number and position of weights and materials) with regard to effectively reducing seabird bycatch and safety concerns through controlled research and application in fisheries, is encouraged.

Line weighting has been shown to improve the effectiveness of night setting and bird scaring lines in reducing seabird bycatch. Of this combination that makes up this best practice mitigation, line weighting is integral to the fishing gear and has the advantage of being more consistently implemented and thus facilitates compliance and port monitoring. On this basis it is important to enhance the priority accorded to line weighting, providing certain pre-conditions can be met, inter alia:

a) weighting regime characteristics adequately specified;

b) safety issues adequately addressed;

c) issues relating to application to artisanal fisheries are taken into account.

Current recommended minimum standard for branch line weighting configurations are:

Greater than 45 g attached within 1 m of the hook or;

Greater than 60 g attached within 3.5 m of the hook or;

Greater than 98 g weight attached within 4 m of the hook.

Positioning weight farther than 4 m from the hook is not recommended.

The working group anticipates further research on line weighting and that these regimes may be revised in the future.

2. Night setting

Setting longlines at night, between nautical twilight and nautical dawn, is highly effective at reducing incidental mortality of seabirds because the majority of vulnerable seabirds are inactive at night.

3. Bird scaring lines

Properly designed and deployed bird scaring lines deter birds from sinking baits, thus dramatically reducing seabird attacks and related mortalities. A bird scaring line is a line that runs from a high point at the stern to a device or mechanism that creates drag at its terminus. As the vessel moves forward, drag lifts the section of line closest to the vessel from the water into the air. Brightly coloured streamers hanging from the aerial extent of the line scare birds from flying to and under the line preventing them from reaching the baited hooks. It is the aerial extent (out of water) section with suspended streamers that scares birds from the sinking baits.

Bird scaring lines should be the lightest practical strong fine line. Lines should be attached to the vessel with a barrel swivel to minimise rotation of the line from torque created as it is dragged behind the vessel.

Towed objects, applied to increase drag, and with it bird scaring line aerial extent, are prone to tangling with float lines leading to lost bird scaring lines, interruptions in vessel operations and in some cases lost fishing gear. Alternatives, such as adding short streamers to the in-water portion of the line, can enhance drag while minimising tangles with float lines. Weak links (breakaways) should be incorporated into the in-water portion of the line safety and operational problems should lines become tangled.

Given operational differences in pelagic longline fisheries due to vessel size and gear type, bird scaring lines specifications have been divided into recommendations for vessels greater than 35 metres and those less than 35 metres.

3. a) Recommendations for vessels >35 m total length

Simultaneous use of two bird scaring lines, one on each side of the sinking longline, provide maximum protection from bird attacks under a variety of wind conditions and are recommended as best practice for larger vessels.

Bird scaring lines should include the following specifications:

Bird scaring lines should be deployed to maximise the aerial extent. Aerial extent is a function of vessel speed, height of the attachment point to the vessel, drag, and weight of bird scaring line materials.

Vessels should deploy bird scaring lines with a minimum aerial extent of 100 m. To achieve a minimum aerial extent bird scaring lines line should be attached to the vessel such that it is suspended from a point a minimum of about 8 m above the water at the stern.

Streamers should be: brightly coloured, a mix of long and short streamers, placed at intervals of no more than 5 m, and long streamers attached to the line with swivels that prevent streamers from wrapping around the line. All streamers should reach the sea-surface in calm conditions.

Baited hooks shall be deployed within the area bounded by the two bird scaring lines. Bait-casting machines shall be adjusted so as to land baited hooks within the area bounded by the bird scaring lines.

If large vessels use only one bird scaring line, the bird scaring line should be deployed

windward of sinking baits. If baited hooks are set outboard of the wake, the bird scaring line attachment point to the vessel shall be positioned several meters outboard of the side of the vessel that baits are deployed. This position is best achieved using a purpose build davit (tori pole) located as close to the stern and as far aft as practical. Proper outboard positioning also minimises the likelihood of bird scaring lines tangling on float lines.

3. b) Recommendations for vessels <35 m total length

A single bird scaring line using either long and short streamers, or short streamers only, has been found effective on smaller vessels.

Streamers should be brightly coloured. Short streamers (>1 m) should be placed at 1 m intervals along the length of the aerial extent. Two designs have been shown to be effective: a mixed design that includes long streamers placed at 5 m intervals over the first 55 m of the bird scaring line and a design that does not include long streamers.

Vessels should deploy bird scaring lines with a minimum aerial extent 75 m. To achieve a minimum aerial extent bird scaring lines line should be attached to the vessel such that it is suspended from a point a minimum of about 7 m above the water at the stern.

OTHER CONSIDERATIONS

Area and seasonal closures: The temporary closure of important foraging areas (e.g. areas adjacent to important seabird colonies during the breeding season when large numbers of aggressively feeding seabirds are present) to fishing will eliminate incidental mortality of seabirds in that area.

Mainline tension: Setting mainline, branch lines and baited hooks into propeller turbulence (wake) slows sink rates and should be avoided.

Live vs. dead bait: Use of live bait should be avoided. Individual live baits can remain near the water surface for extended periods (e.g. up to 120 seconds), thus increasing the likelihood of seabird captures.

Bait hooking position: Baits hooked in either the head (fish), or tail (fish and squid), sink significantly faster than baits hooked in the mid-back or upper mantle (squid).

Offal and discard discharge management: Seabirds are attracted to discards, offal and used baits. Used baits should be retained during line hauling. Ideally offal and used baits should be discharged on the side of the vessel opposite of line hauling. Offal and discards should not be discharged during line setting. All hooks should be removed and retained on board before discards are discharged from the vessel.

Side-setting with line weighting and bird curtain: Research results indicate that side-setting was more effective than other simultaneously trialled mitigation measures, including setting chutes and blue-dyed bait, in a single pilot scale trial (14 days; Gilman *et al.,* 2003). It should be noted that these tests were conducted in the North Pacific with an assemblage of surface-feeding seabirds. This method requires testing in the Southern Ocean with deeper-diving species and at a larger spatial scale. Preliminary trials suggest that this method is operationally feasible on larger vessels (Yokota and Kiyota, 2006).

Side-setting **must** be used in combination with ACAP best practice recommendations for line weighting in order to increase sink rates forward of the vessel's stern, and hooks should be cast well forward of the setting position, but close to the hull of the vessel, to allow hooks time to sink as far as possible before they reach the stern. Bird curtains, a horizontal pole with vertical streamers, positioned aft of the setting station, may deter birds from flying close to the side of the vessel. The combined use of side-setting, line weighting and a bird curtain should be considered as a single measure.

NEW TECHNOLOGIES

New technologies that set or release baited hooks at depth (underwater setting device) or disarm hooks to specific depths, which have the potential to prevent seabird access to baits, are currently under development and undergoing sea trials.

MITIGATION TECHNOLOGIES THAT ARE NOT RECOMMENDED

Line shooters: There is no experimental evidence that line shooters reduce seabird bycatch in pelagic longline fisheries; therefore, they should not be considered a seabird bycatch mitigation option.

Olfactory deterrents: Olfactory deterrents (fish oils) have not been demonstrated to prevent or reduce seabird mortalities in pelagic longline fisheries.

Hook size and design: Changes to hook size and design may reduce the chance of seabird mortality in longline fisheries, but have not been sufficiently researched.

Blue dyed bait: Blue dyed squid bait has been insufficiently researched and cannot be recommended.

Bait thaw status: In practical terms the thaw status of baits has no effect on the sink rate of baited hooks set on weighted lines.

Agreement on the Conservation of Albatrosses and Petrels

ACAP REVIEW OF SEABIRD BYCATCH MITIGATION MEASURES FOR PELAGIC LONGLINE FISHERIES

Reviewed at the Eighth Meeting of the Advisory Committee

Punta del Este, Uruguay, 15 – 19 September 2014

Weighted branch lines, bird scaring lines and night setting are best practice mitigation in pelagic longline fisheries. ACAP-SBWG has comprehensively reviewed the scientific literature dealing with seabird bycatch mitigation in pelagic fisheries and this document is a distillation of that review.

BEST PRACTICE MEASURES
1. Branchline weighting
2. Night setting
3. a) Bird scaring lines for vessels > 35m in total length
b) Bird scaring lines for vessels <35m in total length
OTHER CONSIDERATIONS
4. Side setting with line weighting and bird curtain
5. Blue dyed bait
6. Line shooter
7. Bait caster
8. Underwater setting chute
9. Management of offal discharge
10. Live bait
11. Bait thaw status
12. Area closures
13. Haul Mitigation

BEST PRACTICE MEASURES

1. Branchline weighting

Scientific evidence for effectiveness in pelagic fisheries

PROVEN AND RECOMMENDED. Should be used in combination with night setting and bird scaring lines. Brothers 1991; Boggs 2001; Sakai *et al*. 2001; Brothers *et al*. 2001; Anderson & McArdle 2002; Gilman *et al*. 2003a, Hu *et al*. 2005; Melvin *et al*. In Press; Melvin *et al.* 2011.

Caveats /Notes

Weights will shorten but not eliminate the zone behind the vessel in which birds can be caught. Branch lines should be weighted to sink the baited hooks rapidly out of the diving range of feeding seabirds. Weighted lines sink faster and more consistently, resulting in dramatic reductions in seabird attacks on baited hooks. Scientific studies have demonstrated that branch line weighting configurations with more mass close to the hook sinks the hooks most rapidly (Gianuca *et al.* 2011; Robertson *et al.* 2013), reduces seabird attacks on baits (Jiménez *et al*. 2013; Gianuca *et al*. 2011) and consequently is most likely to reduce mortalities (Jiménez *et al*. 2013). Studies of a range of weighting regimes, including regimes with weight at the hook, have shown no negative effect on target catch rates (Jiménez *et al*. 2013; Robertson *et al*. 2013; Gianuca *et al*. 2013). Continued refinement of line weighting configurations (mass, number and position of weights and materials) with regard to effectively reducing seabird bycatch and safety concerns through controlled research and application in fisheries, is encouraged.

Line weighting has been shown to improve the effectiveness of night setting and bird scaring lines in reducing seabird bycatch. Of this combination that makes up this best practice mitigation, line weighting is integral to the fishing gear and has the advantage of being more consistently implemented and thus facilitates compliance and port monitoring. On this basis it is important to enhance the priority accorded to line weighting, providing certain pre-conditions can be met, inter alia:

a) weighting regime characteristics adequately specified;
b) safety issues adequately addressed;
c) issues relating to application to artisanal fisheries are taken into account.

Need for combination

Should be combined with bird scaring lines and night setting

Research needs

Continue work to identify branch line weighting configurations (mass, placement, shape, number of leads and materials) that are effective at reducing seabird bycatch rates. Studies should include evaluations of the effects of branch line weighting on the catch rate of pelagic fishes and provide data that allow evaluation of the relative safety and practicality attributes of various weighting configurations. Studies evaluating the response of seabirds (mortality rates and attack rates) and fishes (catch rates of target and non-target species) to weights

(of varying mass) positioned at the hook (hook weights) and the safety attributes of hook weights are the highest priority for research.

Minimum standards

Current minimum standards for branchline weighting configurations are:

Greater than 45 g attached within 1 m of the hook or;

Greater than 60 g attached within 3.5 m of the hook or;

Greater than 98 g weight attached within 4 m of the hook.

Positioning weight farther than 4 m from the hook is not recommended.

These regimes have been adopted in the Hawaiian (45 g at 1 m) and Australian (60 g at 3.5 m and 98 g at 4 m) pelagic longline fisheries and latter two regimes have been adopted by the Western and Central Pacific Fishing Commission (the WCPFC provisions also include the option of branch lines being configured with weights of 45 g to 60 g within 1 m of the hook). NB. The 98 g weights specified in the Australian fishery pertain to the line weighting experiment of Robertson *et al*. 2010. The commercially available leaded swivels used in the experiment weighed 98 g (not 100 g).

Implementation monitoring

Coastal state fisheries (vessels <35 m total length): Line weights crimped into branch lines technically very difficult to remove at sea. Inspection before departure from port of all gear bins on vessels considered an acceptable form of implementation monitoring.

Distant water fisheries (vessels >35 m total length): Technically possible to remove and/or re-configure gear at sea. Implementation monitoring by monitoring line sets using appropriate methods (e.g., observer inspection of line setting operations; video surveillance; at-sea compliance checks). Video surveillance conditional on mainline setter being fitted with motion sensors to trigger cameras.

2. Night setting

Scientific evidence for effectiveness in pelagic fisheries

PROVEN AND RECOMMENDED. Should be used in combination with weighted branch lines and bird scaring lines. 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.

Caveats /Notes

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).

Need for combination

Should be used in combination with bird scaring lines and weighted branch lines.

Research needs

Determine effectiveness of bird scaring lines and branchline weighting at night by characterising seabird behaviour at night using thermal or night vision technologies.

Minimum standards

Night defined as between nautical twilight and nautical dawn.

Implementation monitoring

Requires VMS (satellite transmitter) or fishery observers. Vessel speed and direction vary between transiting, line setting, line hauling and when vessels are stationary on fishing grounds. VMS-derived assessment of vessel activity in relation to time of nautical dawn and dusk considered acceptable for implementation monitoring. Alternatively VMS-linked sensors fitted to mainline setting and hauling drum could be used to indicate compliance, as could sensors to trigger video surveillance cameras. This facility is currently unavailable and requires development.

3. a) Bird scaring bird scaring lines for vessels > 35m in total length

Scientific evidence for effectiveness in pelagic fisheries

PROVEN AND RECOMMENDED. For vessels > 35 m in length two bird scaring lines is considered best practice. Bird scaring lines with the appropriate aerial extent can be more easily rigged on large vessels. Two bird scaring lines are considered to provide better protection of baited hooks in crosswinds (Melvin *et al*. 2004; Melvin *et al.* 2011). 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; Melvin *et al.* 2011).

Caveats /Notes

Potentially increased likelihood of entanglement, particularly if attachment points on davits (tori poles) are insufficiently outboard of vessels. To achieve a minimum aerial extent bird-scaring lines line should be attached to the vessel such that it is suspended from a point a minimum of about 8 m above the water at the stern 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.

Need for combination

Should be used with appropriate line weighting and night setting.

Research needs

Developing methods that minimise entanglements of the in- water portion of bird-scaring lines with longline floats, while creating sufficient drag to maximise aerial extent, remains the highest priority for research on bird-scaring lines. Research evaluating the effectiveness of one vs. two bird-scaring lines; bird-scaring line design features (steamer lengths,

configurations, and materials); and methods for efficient retrieval and stowage of bird scaring lines remain research priorities.

Minimum standards

Vessels should deploy bird scaring lines with a minimum aerial extent of 100 m. Streamers should be: brightly coloured, a mix of long and short streamers, placed at intervals of no more than 5 m, and long streamers attached to the line with swivels that prevent streamers from wrapping around the line. Long streamers should reach the sea-surface in calm conditions.

If large vessels use only one bird scaring line it should be set to windward of sinking baits. If baited hooks are set outboard of the wake, the bird scaring line attachment point to the vessel should be positioned several meters outboard of the side of the vessel that baits are deployed.

Baited hooks shall be deployed within the area bounded by the two bird scaring lines. Bait-casting machines shall be adjusted so as to land baited hooks within the area bounded by bird scaring lines

Implementation monitoring

Requires fisheries observers, video surveillance, or at-sea surveillance (e.g. patrol boats or aerial over-flights).

3. b) Bird scaring lines for vessels <35m in total length

Scientific evidence for effectiveness in pelagic fisheries

PROVEN AND RECOMMENDED. 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. For vessels < 35 m in length a single BSL in combination with night setting and appropriate line weighting has been found effective for mixed and short bird scaring lines (ATF 2011; Domingo *et al.,* Gianuca *et al.* 2011).

Caveats /Notes

To achieve a minimum aerial extent bird-scaring lines line should be attached to the vessel such that it is suspended from a point a minimum of about 7 m above the water at the stern.

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.

Need for combination

Should be used with appropriate line weighting and night setting.

Minimum standards

Vessels should deploy bird scaring lines with a minimum aerial extent 75 m. Streamers should be brightly coloured. Short streamers (>1 m) should be placed at 1 m intervals along

the length of the aerial extent. Two designs have been shown to be effective: a mixed design that includes long streamers placed at 5 m intervals over the first 55 m of the bird scaring line and a design that does not include long streamers. Bird scaring lines should be the lightest practical strong fine line. Lines should be attached to the vessel with a barrel swivel to minimise rotation of the line from torque created as it is dragged behind the vessel.

Towed devices to create drag can tangle with float lines leading to interruptions in vessel operations and in some cases lost fishing gear. Short streamers can be tied into the line to bristle the line and create a bottlebrush like configuration to generate drag while minimising the chance of fouling streamer lines on float lines. Breakaways should be incorporated into the bird scaring line in-water extent to minimise safety and operational problems should a longline float foul or tangle with the in-water extent of a bird scaring line.

Implementation monitoring

Requires fisheries observers, video surveillance, or at-sea surveillance (e.g. patrol boats or aerial over-flights).

OTHER CONSIDERATIONS

4. Side setting with line weighting and bird curtain

Scientific evidence for effectiveness in pelagic fisheries

PROVEN AS AN EFFECTIVE MITIGATION MEASURE IN THE NORTHERN PACIFIC. Effectiveness in Southern Hemisphere fisheries has not been researched and consequently it is not recommended as a proven mitigation measures in these fisheries at this time (Brothers & Gilman 2006; Yokota & Kiyota 2006).

Caveats /Notes

Hooks must be sufficiently below the surface and protected by a bird curtain by the time they reach the stern of the vessel. In Hawaii, side-setting trials were conducted with a bird curtain and 45-60 g weighted swivels placed within 0.5 m of hooks. Japanese research concludes it must be used in combination with other measures (Yokota & Kiyota 2006). Not tested in southern hemisphere fisheries where seabird abundance is higher and secondary ingestion (hooks retrieved by diving birds and secondarily attacked by surface foragers) is more important. Hence, it cannot be recommended for use in these fisheries at this time.

Need for combination

Lines set from the side of vessels must be appropriately weighted in accordance with ACAP best practice advice and protected by an effective bird curtain.

Research needs

Currently untested in Southern Hemisphere fisheries against assemblages of diving seabirds (e.g. *Procellaria* sp. Petrels and *Puffinus* sp. Shearwaters) and albatrosses - urgent need for research.

Minimum standards

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. The distance forward of the stern refers to the position from which baits are manually deployed. Baited hooks must be thrown by hand forward of the bait deployment location if they are to be afforded "protection" by being close to the side of the vessel.

Implementation monitoring

Requires fisheries observers or video surveillance.

5. Blue dyed bait

Scientific evidence for effectiveness in pelagic fisheries

UNPROVEN AND NOT RECOMMENDED. Boggs 2001; Brothers 1991; Gilman *et al*. 2003a; Minami & Kiyota 2001; Minami & Kiyota 2004; Lydon & Starr 2005.Cocking *et al*. 2008.

Caveats /Notes

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.

Need for combination

Must be combined with bird scaring lines or night setting.

Research needs

Need for tests in Southern Ocean.

Minimum standards

Mix to standardised 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).

Implementation monitoring

The current practice of dyeing bait on board vessels at sea requires observer presence or video surveillance to monitor implementation. Assessment of implementation in the absence of on-board observers or video surveillance requires baits be dyed on land and monitored through port inspection of all bait on vessels prior to departure on fishing trips.

6. Line shooter

Scientific evidence for effectiveness in pelagic fisheries

UNPROVEN AND NOT RECOMMENDED. Robertson *et al*. 2010.

Caveats /Notes

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 (Robertson *et al*. 2010). Use of a line shooter to set gear deep cannot be considered a mitigation measure.

Need for combination

Not Applicable.

Research needs

Not Applicable.

Minimum standards

Use of this measure is not recommended as a mitigation measure.

Implementation monitoring

Not Applicable.

7. Bait caster

Scientific evidence for effectiveness in pelagic fisheries

UNPROVEN AND NOT RECOMMENDED. Duckworth 1995; Klaer & Polacheck 1998.

Caveats /Notes

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. Current machines (without variable power control) likely to deploy baited hooks well beyond the streaming position of bird scaring lines, increasing risks to seabirds. Few commercially-available machines have variable power control. Needs more development.

Need for combination

Not recommended as a mitigation measure at this time.

Research needs

Develop (and implement) casting machine with a variable power control.

Minimum standards

Not recommended as a mitigation measure

Implementation monitoring

Not Applicable

8. Underwater setting chute

Scientific evidence for effectiveness in pelagic fisheries

UNPROVEN AND NOT RECOMMENDED. Brothers 1991; Boggs 2001; Gilman *et al*. 2003a; Gilman *et al*. 2003b; Sakai *et al*. 2004; Lawrence *et al*. 2006.

Caveats /Notes

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).

Need for combination

Not recommended for general application at this time.

Research needs

Design problems to overcome.

Minimum standards

Not yet established

Implementation monitoring

Not Applicable.

9. Management of offal discharge

Scientific evidence for effectiveness in pelagic fisheries

UNPROVEN. McNamara *et al*. 1999; Cherel *et al*. 1996.

Caveats /Notes

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.

Need for combination

Must be combined with other measures.

Research needs

Further information needed on opportunities and constraints in pelagic fisheries (long and short term).

Minimum standards

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.

Implementation monitoring

Requires offal discharge practices and events to be monitored by fisheries observers or video surveillance.

10. Live bait

Scientific evidence for effectiveness in pelagic fisheries

LIVE BAIT NOT RECOMMENDED. Trebilco *et al*. 2010; Robertson *et al*. 2010.

Caveats /Notes

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.

Need for combination

Use of live bait is not a mitigation measure.

Research needs

Not Applicable.

Minimum standards

Live bait is not a mitigation measure.

Implementation monitoring

Not Applicable.

11. Bait thaw status

Scientific evidence for effectiveness in pelagic fisheries

NOT RECOMMENDED. Brothers 1991; Duckworth 1995; Klaer & Polacheck; Brothers *et al*.1999; Robertson & van den Hoff 2010.

Caveats /Notes

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 practical for fishers to use fully frozen baits). Partially thawed baits sink at similar rates to fully thawed baits.

Need for combination

Not a mitigation measure

Research needs

Not Applicable.

Minimum standards

Not recommended as a mitigation measure.

Implementation monitoring

Not Applicable.

12. Area closures

Scientific evidence for effectiveness in pelagic fisheries

PROVEN AND RECOMMENDED. Avoiding fishing at peak areas and during periods of intense foraging activity has been used effectively to reduce bycatch in longline fisheries.

Caveats /Notes

An important and effective management response, especially for high risk areas, and when other measures prove ineffective**.** Highly effective for target locations/seasons but may displace fishing effort into adjacent or other areas which may not be as well regulated, thus leading to increased incidental mortality elsewhere.

Need for combination

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.

Research needs

Further information about the seasonal variability in patterns of species abundance around fisheries.

Minimum standards

No work done but highly recommended.

Implementation monitoring

Vessels equipped with VMS and activities monitored by appropriate management authority is considered appropriate monitoring. Areas/seasons should be patrolled to ensure effectiveness if IUU activities are suspected.

13. Haul Mitigation

Scientific evidence for effectiveness in pelagic fisheries

UNPROVEN. Strategies to reduce seabird hooking during the haul have yet to be developed for pelagic longline fisheries.

Caveats /Notes

No information

Need for combination

No information

Research needs

Developing methods that minimize seabird hooking during line hauling.

Minimum standards

No information

Implementation monitoring

No information

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