



Agreement on the Conservation
of Albatrosses and Petrels

ACAP 2026 Review of Seabird Bycatch Mitigation Measures for Demersal Longline Fisheries

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INTRODUCTION

The incidental mortality of seabirds, mostly albatrosses and petrels, in demersal longline fisheries continues to be a growing global concern. The need for international cooperation in addressing this concern was a major reason for establishing the Agreement on the Conservation of Albatrosses and Petrels (ACAP). In demersal longline fisheries seabirds are killed when they become hooked or entangled and drowned while foraging for baits on longline hooks as the gear is deployed. Seabirds can also be hooked or entangled as the gear is hauled; however, many of these seabirds can be released alive with careful handling.

Demersal longline fisheries are those in which baited hooks are set on, or near the sea floor using a variety of systems and configurations. These include systems that deploy a single hookline (manually baited or mechanically baited (single line) systems), and systems that include a second hauling line floated above a hookline or a cluster of baited hooks (Spanish and Chilean (trotline) systems).

Many mitigation methods to reduce and eliminate seabird bycatch have been developed and tested over the last 20 plus years, especially for demersal longline fisheries. Although most mitigation measures are broadly applicable, the feasibility, design and effectiveness of some measures will be influenced by longlining method, gear configuration, and vessel size. Note, most scientific literature relates to fleets of larger vessels (typically $\geq 24\text{m}$). Some of this advice may need modification for smaller vessels (typically $< 24\text{m}$).

A range of technical and operational mitigation methods have been designed or adapted for use in demersal longline fisheries to reduce incidental mortality of seabirds. Operationally, peak areas and periods of seabird foraging activity should be avoided. Effective technical methods include actively deterring birds from, and minimising the visibility of, baited hooks. Vessels need to be made less attractive to birds, and the distance astern and time baited hooks are available to birds during line setting must be reduced. Mitigation methods need to be easy and safe to implement, cost effective, enforceable and should not reduce catch rates of target species or increase the bycatch rates of other protected species.

The feasibility, effectiveness and specifications of mitigation measures may vary by area, seabird assemblage, fishery, vessel size, and gear configuration. Some of the mitigation methods are well established and explicitly prescribed in demersal longline fisheries; however, additional measures are undergoing further testing and refinements.

The Seabird Bycatch Working Group (SBWG) of ACAP has comprehensively reviewed the scientific literature dealing with seabird bycatch mitigation in demersal longline fisheries. This document is a distillation of that review. With the exception of the Chilean system, the simultaneous use of weighted lines, bird scaring lines and night setting is considered best practice mitigation for reducing seabird bycatch in demersal longline fisheries. Although the Chilean system effectively prevents mortality as a sole measure given that hooks sink quickly from the surface, it is recommended to simultaneously deploy bird scaring lines.

THE ACAP REVIEW PROCESS

At each of its meetings, the ACAP SBWG considers any new research or information pertaining to seabird bycatch mitigation in demersal longline fisheries. The following criteria are used by ACAP to guide the assessment process, and to determine whether a particular technology or measure can be considered best practice to reduce the incidental mortality of albatrosses and petrels in fishing operations.

Best Practice Seabird Bycatch Mitigation Criteria and Definition

- i. Individual fishing technologies and techniques should be selected from those shown by experimental research to significantly¹ reduce the rate of seabird incidental mortality² to the lowest achievable levels. Experimental research yields definitive results when performance of candidate mitigation technologies is compared to a control (no deterrent), or to status quo in the fishery. When testing relative performance of mitigation approaches, analysis of fishery observer data can be plagued with a myriad of confounding factors. Where a significant relationship is demonstrated between seabird behaviour and seabird mortality in a particular system or seabird assemblage, significant reductions in seabird behaviours, such as the rate of seabirds attacking baited hooks, can serve as a proxy for reduced seabird mortality. Ideally, where simultaneous use of fishing technologies and practices is recommended as best practice, research should demonstrate significantly improved performance of the combined measures.
- ii. Fishing technologies and techniques, or a combination thereof, should have clear and proven specifications and minimum performance standards for their deployment and use. Examples would include: specific bird scaring line designs (lengths, streamer length and materials; etc.), number (one vs. two) and deployment specifications (such as aerial extent and timing of deployment); night fishing defined by the time between the end of nautical dusk and start of nautical dawn; and, line weighting configurations specifying mass and placement of weights or weighted sections.
- iii. Fishing technologies and techniques should be demonstrated to be practical, cost effective and widely available. Commercial fishing operators are likely to select for seabird bycatch reduction measures and devices that meet these criteria including practical aspects concerning safe fishing practices at sea.
- iv. Fishing technologies and techniques should, to the extent practicable, maintain catch rates of target species. This approach should increase the likelihood of acceptance and compliance by fishers.
- v. Fishing technologies and techniques should, to the extent practicable not increase the bycatch of other taxa. For example, measures that increase the likelihood of catching other protected species such as sea turtles, sharks and marine mammals, should not be considered best practice (or only so in exceptional circumstances).
- vi. Minimum performance standards and methods of ensuring compliance should be provided for fishing technologies and techniques, and clearly specified in fishery regulations. Relatively simple methods to check compliance should include, but not be limited to, port inspections of branch lines to determine compliance with branch line weighting, determination of the presence of davits (tori poles) to support bird scaring lines, and inspections of bird scaring lines for conformance with design requirements. Compliance monitoring and reporting should be a high priority for enforcement authorities.

¹ Any use of the word 'significant' in this document is meant in the statistical context

² This may be determined by either a direct reduction in seabird mortality or by reduction in seabird attack rates, as a proxy

On the basis of these criteria, the scientific evidence for the effectiveness of mitigation measures or fishing technologies/techniques in reducing seabird bycatch is assessed, and explicit information is provided on whether the measure is recommended as being effective, and thus considered best practice, or not. The ACAP review also indicates whether the measure needs to be combined with additional measures, and provides notes and caveats for each measure, together with information on performance standards and further research needs. Following each meeting of ACAP's SBWG and Advisory Committee, this review document and ACAP's best practice advice, is updated (if required). A summary of ACAP's current best practice advice is provided in the preceding section of this document.

SEABIRD BYCATCH MITIGATION FACT SHEETS

A series of seabird bycatch mitigation fact sheets have been developed by ACAP and BirdLife International to provide practical information, including illustrations, on seabird bycatch mitigation measures (<https://www.acap.aq/bycatch-mitigation/bycatch-mitigation-fact-sheets>). The sheets, which include information on the effectiveness of the specific measure, their limitations and strengths and best practice recommendations for their effective adoption, are linked to the ACAP review process, and are updated following ACAP reviews. Links to the available fact sheets are provided in the relevant sections below. The mitigation fact sheets are currently available in [English](#), [French](#), [Spanish](#), [Portuguese](#), [Japanese](#), [Korean](#), [Simplified Chinese](#), [Traditional Chinese](#), and [Indonesian](#).

BEST PRACTICE MEASURES

1. Area and seasonal closures

Scientific evidence for effectiveness in demersal longline fisheries

Proven and recommended mitigation measure. Must be combined with other measures, especially appropriately weighted lines, effective bird scaring lines, night setting and offal management both in the specific areas at which time the fishing season is reopened, and also in adjacent areas to ensure displacement of fishing effort does not lead to a spatial shift in the incidental mortality. A number of studies have reported marked seasonality in seabird bycatch rates, with the majority of deaths taking place during the breeding season (Moreno *et al.* 1996; Ryan *et al.* 1997; Ashford & Croxall 1998; Ryan & Purves 1998; Ryan & Watkins 1999; Ryan & Watkins 2000; Weimerskirch *et al.* 2000; Kock 2001; Nel *et al.* 2002; Ryan & Watkins 2002; Croxall & Nicol 2004; Reid *et al.* 2004; Delord *et al.* 2005). In some studies, mortality occurred almost exclusively within the breeding season. Several studies have also shown that proximity to breeding colonies is an important determinant of seabird bycatch rates (Moreno *et al.* 1996; Nel *et al.* 2002). The much higher rate of seabird bycatch during the breeding period led to the temporal closure of the fishery in CCAMLR sub-area 48.3 from 1998, which contributed to a ten-fold reduction in seabird bycatch (Croxall & Nicol 2004). Movement of fishing effort away from the Prince Edward Islands coincided with a reduction in seabird bycatch in the sanctioned Prince Edward Island fishery (Nel *et al.* 2002).

Notes and Caveats

It's difficult to separate the performance of a temporal/spatial closure from increased uptake/implementation of other mitigation measures. Likewise, some variation over time and space in the location of favoured foraging areas for seabirds is expected. However, closures are clearly an important and effective management response, especially for high risk areas, and when other measures prove ineffective (Waugh 2008). 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 (Copello *et al.* 2016).

Minimum standards

Minimum standards are based on the overlap of albatrosses and petrels with fishing effort so can vary from area to area. For example, the area around South Georgia (Islas Georgias del Sur)³ (CCAMLR Subarea 48.3) is closed for fishing between September and mid-April each year (which coincides with the breeding seasons of most seabirds at South Georgia (Islas Georgias del Sur)³), as provided for by CCAMLR Conservation Measures in force (CCAMLR 2019).

Implementation monitoring

Onboard at-sea surveillance or AIS is required to assess implementation.

Research needs

Continued gathering of temporal and spatial information of seabirds and fishing effort, should be ongoing, especially for high risk areas (e.g. adjacent to important breeding colonies) and to better understand the effects of climate change on seabirds. In some studies, incidental mortality has been greatest during the chick-rearing period (Nel *et al.* 2002; Delord *et al.* 2005), whereas others have reported highest mortality during the incubation period (Reid *et al.* 2004). This difference likely relates to where the birds are foraging in relation to fishing effort at the time, and highlights the importance of understanding this interaction. Research is also required to determine the regional impact of closures on catches of target species.

2.a) Externally weighted double lines without nets: Spanish system

Scientific evidence for effectiveness in demersal longline fisheries

Proven and recommended mitigation method. Should be combined with other measures, especially effective bird scaring lines, offal management and/or night setting (Agnew *et al.* 2000; Robertson 2000; Robertson *et al.* 2008a; 2008b; Moreno *et al.* 2006; Moreno *et al.* 2008; Düssler *et al.* 2026).

³ A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Islas Malvinas), South Georgia and the South Sandwich Islands (Islas Georgias del Sur e Islas Sandwich del Sur) and the surrounding maritime areas.

Notes and Caveats

Spanish system double longlines are buoyant and weights must be attached to sink gear to fishing depth. Longlines with externally added weights sink unevenly, with faster rates at the weights than at the midpoint between weights. Although gear configuration and setting speed influence the sink profiles of the hook lines (Seco Pon *et al.* 2007), the principle determinants of sink rates are the mass of the weights and the distance between them (Robertson *et al.* 2008a). It is critical that line tension astern is eliminated to ensure the smooth flow of lines and hooks from gear baskets. This can be done by ensuring the correct packing of lines and snoods in baskets, preventing hooks snagging on snood baskets, and by ensuring that weights are released from the vessel before line tension occurs (Robertson *et al.* 2008a,b). Weights must be attached and removed for each set-haul cycle, which is onerous and potentially hazardous for crew members. Weights comprised of rocks enclosed in netting bags and concrete blocks deteriorate and require ongoing maintenance/replacement and monitoring to ensure weights are the required mass (Otley *et al.*, 2007); weights made of solid steel are much preferred, in terms of mass consistency, handling, maintenance and monitoring compliance (Robertson *et al.* 2008b, Paterson *et al.* 2017). Achieving faster sink rates may be needed to effectively mitigate seabird bycatch in areas with deep diving petrels (Düssler *et al.* 2026).

Minimum standards

Global minimum standards have not been established. Requirements vary by fishery. For example, CCAMLR minimum requirements for vessels using the Spanish double longline method of longline fishing are:

- 5 kg weights at 40 m intervals when using solid steel weights;
- 8.5 kg mass at 40 m intervals when using rocks at weights; or
- 6 kg mass at 20 m intervals when using concrete weights.

Implementation monitoring

Fishing gear is deployed manually. Weights are attached by hand during line setting and removed during line hauling. Distance between weights and the mass of the weight used may vary in accordance with fishing strategy and for operational reasons. Onboard monitoring is required to assess implementation.

Research needs

Sink rates and sink profiles of line weighting regimes may vary according to vessel type, setting speed and deployment position relative to propeller turbulence. It is important that the sink rate relationships of different line weighting regimes are understood for a particular fishery (or fishery method) and that testing confirms the effectiveness of the line weighting regime and the sink profile in reducing seabird mortality.

Mitigation Fact Sheet

<https://www.acap.aq/en/resources/bycatch-mitigation/mitigation-fact-sheets/762-fs-02-demersal-longline-line-weighting-external-weights/file>

2.b) Externally weighted lines: Chilean double line method (trotline with nets)

Scientific evidence for effectiveness in demersal longline fisheries

Proven and recommended mitigation method. Although the Chilean method effectively prevents mortality as a sole measure given that hooks sink quickly from the surface, it is recommended to also deploy a bird scaring streamer line. This method (first tested on large longline vessels in 2005) is a variant of the traditional Spanish double line method of longlining and was developed in Chile to minimise depredation of Patagonian toothfish by toothed whales (Figure 1). This system makes use of net sleeves or ‘cachaloteras’ which envelop captured fish during hauling. Hooks are clustered on secondary lines to which weights are attached, resulting in very fast hook sink rates (mean: 0.8 m/s c.f. 0.15 m/s for the Spanish system) in the first 15-20 m (the length of the secondary lines) of the water column. The Chilean method has the capacity to reduce (or eliminate) seabird mortality to negligible levels (Moreno *et al.* 2006; Moreno *et al.* 2008; Robertson *et al.* 2008b). Because of its effectiveness in reducing impacts of toothed whales, this method is currently used in many longline fleets operating in South American waters (Moreno *et al.* 2008), as well as in the south west Atlantic.

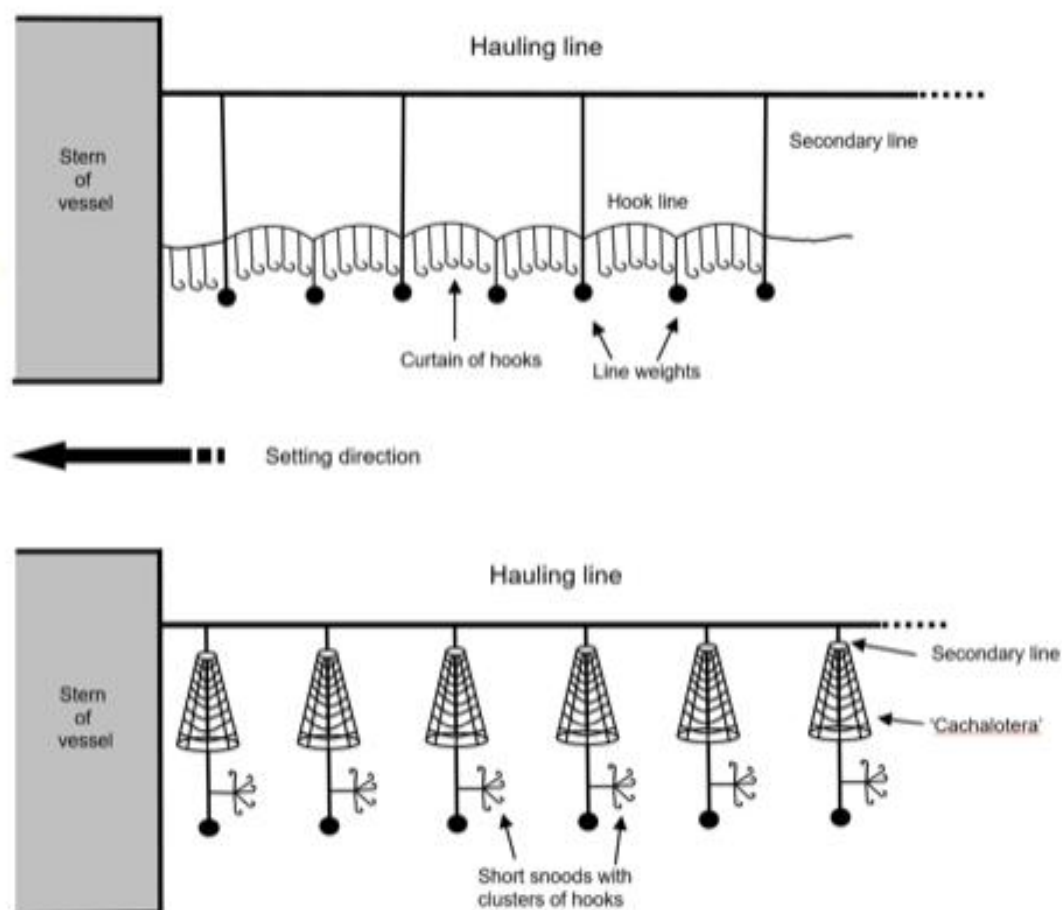


Figure 1. Typical configurations of the traditional Spanish double line system (top panel) and Chilean (trotline) system (bottom panel) showing differences in gear design and location of weights in relation to hooks. The open-ended secondary/connecting lines (not joined by a continuous hook line) and proximity of weights to hooks of the Chilean system enables hooks to sink rapidly with no lofting in propeller turbulence from the surface close to a vessel stern. Drawings not to scale.

Notes and Caveats

Although this system has been in use since 2005, it should still be monitored and possibly refined. Concern has been raised about the excessive discarding of fish bycatch (e.g. grenadiers) with embedded hooks from the hook cluster and the ingestion of these hooks by albatrosses especially with this gear type (Phillips *et al.* 2010). The solution to this problem is to stop hooks from being discarded. This is best achieved by banning the discarding of hooks as part of the licence conditions, as is already done in many fisheries, and also increasing awareness amongst fishers, observers, and operators to facilitate compliance with such a ban.

Minimum standards

Global standards not established.

Implementation monitoring

Weights need to be attached to hook-bearing secondary lines to sink. However, alternating between the Chilean fishing method and the traditional Spanish method within fishing trips does take place and is problematic. While this capacity exists, the Spanish system requirements should apply to both methods within a trip (see “2a”, above). Onboard monitoring is required to assess implementation.

Research needs

Although likely effective as a solitary measure against albatrosses and most likely effective against *Procellaria* spp. petrels due to the very rapid sink rates to depths beyond the known diving range of this group of seabirds, the simultaneous use of bird scaring lines is recommended. Research is required to determine effectiveness against *Puffinus* spp. shearwaters.

This is still considered a relatively new fishing method and may need further refinement. It is important to monitor changes to gear design, especially those likely to affect the sink rates of baited hooks.

Mitigation Fact Sheet

<https://www.acap.aq/en/resources/bycatch-mitigation/mitigation-fact-sheets/1799-fs-04-demersal-longline-line-weighting-chilean-system/file>

2.c) Externally weighted lines: Auto-bait

Scientific evidence for effectiveness in demersal longline fisheries

Proven and recommended mitigation method. Weights must be used in combination with an effective bird scaring line. In the Southern Hemisphere, evidence in support of line weighting specifications (below) were developed based on matching or exceeding sink rates of external weight configurations to that of integrated weight lines, not to their effectiveness at deterring seabirds. Attachment of 5 kg weights at no more than 40 m intervals increased mean sink rate from 0.1 m/s (unweighted gear) to 0.3 m/s on the section of longlines mid-way between line weights (Robertson 2000). This rate exceeds that of integrated weight longlines, which have been thoroughly tested against seabirds (see below). Attachment of external weights is necessary in Antarctic toothfish *Dissostichus mawsoni* fisheries to comply with the

minimum sink rate (0.3 m/s) required by CCAMLR for vessels operating in high latitude areas in summer, where it was not possible to set lines at night.

Notes and Caveats

As for the Spanish system it is important to release external weights from vessels in a manner that avoids line tension. Line tension astern may lift sections of the deployed longline already deployed out of the water farther from the vessel, and enhances the risk of seabirds being hooked. Achieving faster sink rates may be needed to effectively mitigate seabird bycatch in areas with deep diving petrels (Düssler *et al.* 2026).

Minimum standards

Minimum standards are informed by those currently applied to two Southern Hemisphere fisheries. CCAMLR requires, as a minimum, a 5 kg mass at intervals no more than 40 m. It is also required that weights be released before line tension occurs. In the New Zealand fisheries, a minimum of 4 kg (metal weight) or 5 kg (non-metal weight) are required every 60 m if the hookline is 3.5 mm or greater in diameter, and a minimum of 7 kg of weight every 60m when the line is less than 3.5 mm diameter.

Implementation monitoring

Weights are attached to longlines manually. Onboard monitoring is required to assess implementation.

Research needs

Likely to be effective in deterring albatrosses and *Procellaria* spp. petrels from sinking baited hooks. Evidence is lacking for effectiveness against *Puffinus* spp. shearwaters.

Mitigation Fact Sheet

<https://www.acap.aq/en/resources/bycatch-mitigation/mitigation-fact-sheets/762-fs-02-demersal-longline-line-weighting-external-weights/file>

3. Integrated weight longlines

Scientific evidence for effectiveness in demersal longline fisheries

Proven and recommended mitigation method. Should be used in combination with bird scaring lines, offal management and/or night setting. Apart from the practical advantages of integrated weight (IW) longlines – superior handling qualities and practically inviolable – the IW longlines sink more quickly and uniformly out of reach of most seabirds compared with externally weighted lines. IW longlines have been shown to substantially reduce mortality rates of surface foragers and diving seabirds, while not affecting catch rates of target species (Robertson *et al.* 2003; Robertson *et al.* 2006; Dietrich *et al.* 2008).

Notes and Caveats

Restricted to single line vessels. The sink rate of IW longlines can vary depending on vessel type, setting speed and deployment of line relative to propeller wash (Dietrich *et al.* 2008). Setting speed influences the extent of the seabird access window – the area in which most

seabirds are still able to access the baited hooks in the absence of bird scaring lines (Dietrich *et al.* 2008). Use of IW lines is likely to increase the portion of the line on the seafloor, and may lead to increases in the bycatch of vulnerable fish, shark and ray species. This may be mitigated by placing a weight and a float on a 10 m line at the point of the dropper line attachment, thus ensuring the line sinks rapidly to 10 m, out of reach of vulnerable seabirds, but remains off the seabed (Petersen *et al.* 2009). Achieving faster sink rates may be needed to effectively mitigate seabird bycatch in areas with deep diving petrels (Düssler *et al.* 2026). We note that the use of lead in fishing gear is prohibited in some fishery jurisdictions.

Minimum standards

Global minimum standards are evolving. CCAMLR and New Zealand currently require IW lines with a minimum lead core of 50 g/m in their single line demersal longline fisheries.

Implementation monitoring

Weight (lead core) is integrated into the fabric of the line, so compliance with weighting requirements is intrinsic to this measure. It is impractical to alter longlines when at sea, including for vessels with long transit times to fishing grounds (e.g. Antarctic and subantarctic fisheries). Port inspection of all longlines onboard prior to embarkation on fishing trips is considered adequate for to assess compliance.

Research needs

The relationship between line-weighting regime, setting speed, sink rates/profiles and the distance astern seabirds can access baited hooks should be investigated for other fisheries. Testing should prioritize determining the necessary aerial extent for bird scaring lines with these factors.

Mitigation Fact Sheet

<https://www.acap.aq/en/resources/bycatch-mitigation/mitigation-fact-sheets/1504-fs-03-demersal-longline-integrated-weight-longlines/file>

4. Night setting

Scientific evidence for effectiveness in demersal longline fisheries

Proven and recommended mitigation method. Should be used in combination with bird scaring lines and/or weighted lines, especially to reduce incidental mortality of birds that forage at night (Ashford *et al.* 1995; Cherel *et al.* 1996; Moreno *et al.* 1996; Barnes *et al.* 1997; Ashford & Croxall 1998; Klaer & Polacheck 1998; Weimerskirch *et al.* 2000; Belda & Sánchez 2001; Nel *et al.* 2002; Ryan & Watkins 2002; Sánchez & Belda 2003; Reid *et al.* 2004; Gómez Laich *et al.* 2006; Gladics *et al.* 2017; Melvin *et al.* 2019; Düssler *et al.* 2026).

Notes and Caveats

Setting longlines at night (defined as the time between the end of nautical twilight and before nautical dawn as set out in the Nautical Almanac tables for relevant latitude, local time and date) is highly effective at reducing incidental mortality of seabirds because the majority of vulnerable seabirds are inactive at night. However, bright moonlight and deck lights can reduce the effectiveness of this mitigation measure. Night setting can also be less effective for

some crepuscular/nocturnal foragers such as the White-chinned Petrel (Paterson *et al.* 2017) but more effective than setting during the day. Night setting increases the bycatch rate of Northern Fulmar *Fulmarus glacialis* (Gladics *et al.* 2017; Melvin *et al.* 2019). In order to maximise effectiveness of this mitigation measure, deck lights should be off or kept to an absolute minimum, and used in combination with additional mitigation measures, especially when setting in bright moonlight conditions. Night setting is not a practical option for fisheries operating at high latitudes during summer. Civil twilight was found equally effective as nautical twilight at reducing seabird mortalities in US west coast and Alaskan fisheries (Gladics *et al.* 2017; Melvin *et al.* 2019)

Minimum standards

Night is defined as the period between the times of nautical twilight (nautical dark to nautical dawn as set out in the Nautical Almanac tables for relevant latitude, local time and date.).

Implementation monitoring

Onboard monitoring or at-sea surveillance (including AIS monitoring) is required to assess implementation.

Research needs

Effect of night setting on catch rates of target species for different fisheries.

Mitigation Fact Sheet

<https://www.acap.aq/en/resources/bycatch-mitigation/mitigation-fact-sheets/1824-fs-05-demersal-pelagic-longline-night-setting/file>

5. Single bird scaring line

Scientific evidence for effectiveness in demersal longline fisheries

Proven and recommended mitigation method. It is the aerial extent of the line with streamers attached that is important for the prevention of bird interactions with baited hooks. Effectiveness of the streamer line is maximized when streamers are positioned above the sinking hook line, and the aerial extent matches the distance astern that seabirds can access baited hooks. Weighted longlines reduce this distance and make streamer lines more efficient at excluding foraging birds from hooks. Effectiveness is increased when using multiple bird scaring lines and when used in combination with other measures – e.g. night setting, appropriate line weighting and offal management. The use of a single bird scaring line has been shown to be an effective mitigation measure in a range of demersal longline fisheries, especially when used properly (Moreno *et al.* 1996; Løkkeborg 1998, 2001; Melvin *et al.* 2001; Smith 2001; Løkkeborg & Robertson 2002; Løkkeborg 2003, Melvin *et al.* 2004; Dietrich *et al.* 2008; Paterson *et al.* 2017; Melvin *et al.* 2019) and is suitable for small vessels under 24 m in length, with some modification (Melvin & Weinstein. 2004; Goad & Debski 2017).

Notes and Caveats

Effective only when streamers are positioned over sinking hooks and the aerial extent matches the distance astern that seabirds can no longer access baited hooks. These are the most important factors influencing their performance. Single bird scaring lines can be less effective

in strong crosswinds (Løkkeborg 1998; Brothers *et al.* 1999; Agnew *et al.* 2000; Melvin *et al.* 2001; Melvin *et al.* 2004). In the event of strong crosswinds, bird scaring lines should be deployed from the windward side. This problem can also be overcome by using paired bird scaring lines (see below). The effectiveness of bird scaring lines is also dependent on the design, proper placement, as well as seabird species attending line setting (proficient divers are more difficult to deter than surface feeding birds). There have been a few incidents of birds becoming entangled in bird scaring lines (Otley *et al.* 2007). However, it must be stressed that the numbers are minuscule, especially when compared with the number of mortalities recorded in the absence of bird scaring lines. Bird scaring lines remain a highly effective mitigation measure, and efforts should be directed to further improve their effectiveness.

Use of a weak link is recommended to allow a bird scaring line to break-away from the vessel in the event of an entanglement with the main line (a secondary attachment between the bird scaring line and the vessel can be used to attach the break-away bird-scaring line to the mainline for subsequent retrieval during the haul).

Minimum standards

Current minimum standards vary. CCAMLR was the first conservation body that required all longline vessels in its area of application to use bird scaring lines (CCAMLR 2018). The bird scaring (streamer) line has gone on to become the most commonly applied mitigation measure in longline fisheries worldwide (Melvin *et al.* 2004). CCAMLR currently prescribes a range of specifications relating to the design and use of bird scaring lines. These include the minimum length of the line (150 m), the height of the attachment point on the vessel (7 m above the water), and details about streamer lengths and intervals between streamers. Other fisheries have adapted these measures. Some, such as those in New Zealand and Alaska have set explicit standards for the aerial coverage of the bird scaring lines, which varies according to the size and speed of the vessel and the sink rates of baited longlines.

For small vessels (<24 m), we recognise that the length of aerial extent will vary by setting speed, with 75 m being achievable for vessels setting at ≥ 4 knots, or 50 m if setting at speeds < 4 knots, that streamers may be modified over the first 15 m to avoid tangling, and that drag may be achieved using either towed devices or longer in-water sections (Goad & Debski 2017).

Implementation monitoring

Bird scaring lines are usually deployed and retrieved before and after each set (they are not a fixed part of fishing gear/operations). On-board observers, electronic monitoring (cameras), at-sea surveillance or an electronic BSL compliance monitoring device (Ngcongco & Miranda 2024; <https://imveloblue.co.za/electronic-monitoring-imvelo-bsl/>) are options for required assessment of implementation.

Research needs

The use and specifications/performance standards are fairly well established in demersal longline fisheries. However, there is scope to improve further the effectiveness and practical use of bird scaring lines in individual fisheries and on individual vessels or vessel types.

Mitigation Fact Sheet

<https://www.acap.aq/en/resources/bycatch-mitigation/mitigation-fact-sheets/1912-fs-01-demersal-longline-streamer-lines/file>

6. Paired or multiple bird scaring lines

Scientific evidence for effectiveness in demersal longline fisheries

Proven and recommended mitigation method. Effectiveness is maximized when BSLs are paired and deployed so that they bracket sinking baited hook lines, and the aerial extents of the lines cover the area astern to where birds can no longer access baited hooks. Effectiveness is further increased when used in combination with other measures – e.g. night setting, appropriate weighting of line and offal management. Several studies have shown that the use of two or more BSLs is more effective at deterring birds from baited hooks than a single BSL (Melvin *et al.* 2001; Sullivan & Reid 2002; Melvin 2003; Melvin *et al.* 2004; Reid *et al.* 2004). The combination of paired BSLs and IW longlines is considered the most effective mitigation measure in demersal longline fisheries using single line systems (Dietrich *et al.* 2008).

Notes and Caveats

The likelihood of entanglement using two BSLs with gear is potentially increased compared to using a single BSL. Towing an effective device that keeps lines from crossing surface gear may improve compliance with this measure. Manual retrieval of paired or multiple BSLs requires more effort than a single BSL. This can be overcome by using winches to retrieve lines.

Minimum standards

Current minimum standards vary across fisheries. In Alaskan demersal longline fisheries paired BSLs are required on larger vessels (≥ 16.8 m) and encouraged/recommended by CCAMLR, except in the French exclusive economic zone (CCAMLR Subarea 58.6 and Division 58.5.1), where paired BSLs have been compulsory since 2005. Paired BSLs have also been required in the Australian longline fisheries off Heard Island since 2003 (Dietrich *et al.* 2008).

Implementation monitoring

BSLs are typically deployed and retrieved before and after each set (they are not a fixed part of fishing gear/operations). Onboard monitoring or at-sea surveillance is required to assess implementation.

Research needs

Further trialling in fisheries which currently only use single BSLs.

Mitigation Fact Sheet

<https://www.acap.aq/en/resources/bycatch-mitigation/mitigation-fact-sheets/1912-fs-01-demersal-longline-streamer-lines/file>

7. Haul bird exclusion devices (BED)

Scientific evidence for effectiveness in demersal longline fisheries

Proven and recommended as a haul mitigation measure. BEDs must be used in combination with line setting mitigation measures – bird scaring lines, line weighting, night setting and offal management. The use of a BED can effectively reduce the incidence of birds becoming foul hooked when the line is being hauled (Brothers *et al.* 1999; Sullivan 2004; Otley *et al.* 2007; Reid *et al.* 2010). For small vessels (<20 m in length), where the application of mitigation devices requiring robust support structures and on-water sections can be challenging, the use of simple haul mitigation devices has been demonstrated to be both practical and effective at deterring birds from hauling points (Goad *et al.* 2023).

Notes and Caveats

Some species, such as the Black-browed Albatross *Thalassarche melanophris*, and Cape Petrel *Daption capense*, can become habituated to the curtain, so it is important to use it strategically – e.g. when there are high densities of birds around the hauling bay (Sullivan 2004).

Minimum standards

Standards are evolving. BEDs are required in high risk CCAMLR areas. The exact design is not specified, rather it is required that they fulfil two operational characteristics: 1) deter birds from flying into the area where the line is being hauled, and 2) prevent birds that are sitting on the surface from swimming into the hauling bay area. BEDs are required in some UK longline fisheries (A. Wolfaardt pers. comm.).

Implementation monitoring

BEDs are usually deployed and retrieved before and after each set (they are not a fixed part of fishing gear/operations). Onboard monitoring or at-sea surveillance is required to assess implementation.

Mitigation Fact Sheet

<https://www.acap.aq/en/resources/bycatch-mitigation/mitigation-fact-sheets/1907-fs-12-demersal-pelagic-longline-haul-mitigation/file>

OTHER CONSIDERATIONS

8. Hook size and shape

Scientific evidence for effectiveness in demersal longline fisheries

Unproven and not recommended as a primary mitigation measure. Must be used in combination with other mitigation measures – bird scaring lines, line weighting, night setting and offal management. Hook size was found to be an important determinant in seabird bycatch rates of Argentinean and Chilean longline vessels fishing in Subarea 48.3 in the 1995 season, with smaller hooks killing significantly more seabirds than larger hooks (Moreno *et al.* 1996).

Notes and Caveats

Other than the finding of Moreno *et al.* (1996), little or no work has been conducted to investigate the impact of hook design and shape on seabird bycatch levels.

Minimum standards

No global standard.

Implementation monitoring

Port inspection of all hooks on board considered adequate for monitoring implementation.

Research needs

Determine impact on seabird bycatch and on catch of target species.

9. Olfactory deterrents

Scientific evidence for effectiveness in demersal longline fisheries

Unproven, and not recommended as a mitigation measure at this time. Dripping shark liver oil on the sea surface behind vessels has been shown to effectively reduce the number of seabirds (restricted to burrow-nesting birds) attending vessels and diving for bait in New Zealand (Pierre & Norden 2006; Norden & Pierre 2007).

Notes and Caveats

The shark liver oil investigated did not deter albatrosses, giant petrels, or Cape petrels from vessels (Norden & Pierre 2007). The potential impact of releasing large amounts of concentrated fish oil into the marine environment is unknown, as is the potential for contaminating seabirds attending vessels. Seabirds may also become habituated to the deterrent (Pierre & Norden 2006).

Minimum standards

No standards established.

Implementation monitoring

Onboard monitoring or at-sea surveillance of line setting operations is required to assess implementation.

Research needs

Testing should be extended to candidate/suitable species of conservation concern, such as White-chinned Petrels *P. aequinoctialis* and Sooty Shearwaters *Ardenna grisea*. Research is also required to identify the key ingredients in the shark oil that are responsible for deterring seabirds, and the mechanism by which the birds are deterred. The potential “pollution” effects also need to be investigated.

10. Acoustic Deterrents

Scientific evidence for effectiveness in demersal longline fisheries

Unproven and not recommended. Published reports unavailable; however, anecdotal reports of using percussive sound as with an orchard cannon showed that birds initially disperse but quickly habituate; i.e., disperse and quickly return or ignore completely with continuous use (E. Melvin, pers comm.)

Minimum standards

Not Applicable.

Implementation monitoring

Not Applicable.

Research needs

Undefined

11. Strategic management of offal discharge

Scientific evidence for effectiveness in demersal longline fisheries

Not recommended as a primary mitigation measure. Some studies have shown that dumping homogenised offal (which is generally more easily available and thus attractive to seabirds than bait) during setting attracts birds away from the baited line to the side of the vessel where the offal is being discharged, and thus reduces bycatch of seabirds on the baited hooks (Cherel *et al.* 1996; Weimerskirch *et al.* 2000).

Notes and Caveats

Although strategic offal discharge has been shown to be effective at reducing seabird bycatch around Kerguelen Island, there are many risks associated with the practice. Offal discharge needs to be continued throughout the setting operation so as to ensure the birds do not move on to the baited hooks. This will only be possible in fisheries where line setting is short, and there is sufficient offal to sustain the discharge during the entire line-setting period. This measure also has the potential to foul hook birds if offal is discharged with hooks. It is crucial, then, that all offal is checked for hooks before being discharged. Given these risks, and the fact that the presence of offal is a critical factor affecting seabird numbers attending vessels, most fisheries management regimes require that no offal can be discharged during line setting, and that if discarding is necessary at other times it should take place on the side of the vessel opposite to where the lines are being hauled.

Minimum standards

In CCAMLR demersal longline 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. A system to remove fish hooks from offal and fish heads prior to discharge is required. Similar requirements are prescribed by other demersal longline fisheries (e.g. some UK, South African and New Zealand fisheries).

Implementation monitoring

Requires offal discharge practices and events to be monitored onboard.

Research needs

Further information needed on opportunities to manage offal more effectively – considering both practical aspects and seabird bycatch mitigation – in the short and long term.

12. Line-setter/shooter

Scientific evidence for effectiveness in demersal longline fisheries

Unproven and not recommended as a mitigation measure at this time. A line shooter delivers a baited longline to the surface of the water astern of the vessel slack. Less used in demersal long-line fisheries compared with pelagic longline fisheries; variation in the precise method of operation is cause of variation in efficacy. In Norway, no statistical differences were detected in catch rates of Northern Fulmars *Fulmarus glacialis* between sets with and without a line shooter (Løkkeborg & Robertson 2002; Løkkeborg 2003). In Alaska, use of a line shooter increased seabird bycatch due to the longline being suspended in the vessel's wake resulting in delayed sinking (Melvin *et al.* 2001).

Notes and Caveats

Robertson *et al.* (2008c) found no significant difference between the sink rates of integrated weight longlines of single line vessels that were set with and without a line setter in the Ross Sea, and were doubtful that the use of line setters would lead to substantial reductions in interactions between seabirds and longlines. Unequivocal evidence of effectiveness in reducing seabird bycatch is lacking. Further refinement is needed.

Minimum standards

Not considered a mitigation measure at this time.

Research needs

Need to investigate whether refinement/modification of the device will be able to overcome the problem of propeller wash and ensure consistently rapid sink rates and significantly reduced seabird mortality.

Mitigation Fact Sheet (for pelagic longline fisheries)

<https://www.acap.aq/en/resources/bycatch-mitigation/mitigation-fact-sheets/771-fs-11-pelagic-longline-bait-caster-and-line-shooter/file>

13. Underwater setting funnel/chute

Scientific evidence for effectiveness in demersal longline fisheries

Unproven and not recommended as a mitigation measure at this time. An underwater setting funnel has been tested in demersal longline fisheries in Alaska, Norway and South Africa, with all studies showing a reduction in the mortality rate, although the extent of the reduction varied between studies (Løkkeborg 1998, 2001; Melvin *et al.* 2001; Ryan & Watkins 2002).

Notes and Caveats

Present design is mainly for a single line system. Results from studies to date have been inconsistent, likely due to the depth at which the device delivers the baited hooks and the diving ability of the seabirds in the fishing area studied. The pitch angles of the vessel, which are influenced by the loading of weight and sea conditions, affect the performance of the funnel (Løkkeborg 2001).

Minimum standards

Not yet established.

Implementation monitoring

Onboard monitoring or at-sea surveillance is required to assess implementation.

Research needs

Need to investigate improvements to the current design to increase the depth at which the line is set, especially during rough seas. Should also be tested with integrated weight lines to determine whether this improves bycatch reduction. Also need to investigate optimal use of device together with other mitigation measures (e.g. BSLs and weighted lines).

Mitigation Fact Sheet

<https://www.acap.aq/en/resources/bycatch-mitigation/mitigation-fact-sheets/766-fs-06-demersal-longline-underwater-setting-chute/file>

14. Underwater Line Setter

Scientific evidence for effectiveness in demersal fisheries

Unproven and not recommended as a mitigation measure at this time. A line setter was identified as a potential mitigation device in New Zealand inshore demersal longline fisheries, (Goad 2011). This line setter is an underwater setting device that involves running the hookline through a set of rollers towed behind the vessel at depth. Underwater line setting devices for demersal longline fisheries differ from those assessed for pelagic longline fisheries which involve a computer operated and hydraulically powered machine that deploys baited hooks individually underwater to a target depth.

Notes and Caveats

An initial prototype had been developed through a series of at-sea trials which were conducted during 2011. While these trials were encouraging, the issue of weights and floats fouling on the rollers require resolution (Goad 2011). A new prototype has been developed and refined in a flume tank (Baker and Frost 2013) for application in a range of demersal longline operations.

Minimum standards

Not considered a mitigation measure at this time.

Research needs

Resolution of mainline loss issues under flume tank conditions prior to further evaluation in at-sea trials.

15. Lasers

High Energy Lasers Strongly Discouraged

Scientific evidence for effectiveness in demersal longline fisheries

Available evidence shows that high energy lasers (Class 4 lasers, the highest class in terms of laser hazards) are ineffective at deterring seabirds from danger areas around fishing vessels (Melvin *et al.* 2016) and likely damage seabird visual systems with negative effects on foraging behaviour of laser exposed seabirds (Fernandez-Juricic, 2023).

Notes and Caveats

Concerns are ongoing regarding the safety (to both humans and birds) and efficacy of laser technology of unknown energy levels as a seabird bycatch mitigation tool, as they continue to be used currently in various fisheries. Available evidence shows that high energy lasers are no longer marketed for fishery applications. Currently, evidence is lacking on the possibility that lasers of lower energy levels delivered in different ways (scanning, blinking, wave-length, etc.) could be used safely and be effective in some applications.

Minimum standards

Not Applicable as strongly discouraged.

Need for combination

Not Applicable as strongly discouraged.

Implementation monitoring

Not Applicable as strongly discouraged.

Research needs

As high energy lasers continue to be used in some fisheries, we encourage reporting of the extent and output power levels of laser use by ACAP Parties, including any information on effectiveness, as well as bird welfare effects.

16. Mitigation measures to improve sink rates of baited hooks on floated longlines

Scientific evidence for effectiveness in demersal longline fisheries

Unproven and not recommended as a mitigation measure at this time. Demersal longline vessels that use floated gear (which incorporates subsurface floats on the mainline to raise the hooks off the seabed) are particularly susceptible to seabird bycatch, with one study reporting that albatrosses attacked floated longlines at rates ten times more than longlines

without floats (Gladics *et al.* 2017). The sink rate of the slowest sinking hooks, where seabird bycatch is most pronounced, is the key factor to consider when prescribing mitigation measures for demersal longline fisheries using floated gear. The slowest sink rates are associated with deployment of buoys in demersal fishing gear (Debski 2016). Increasing the length of buoy lines improves the sink rate (Debski 2016, Robertson *et al.* 2021). Options to increase the sink rates of Merluza system gear include the use of longer float lines, equipping float lines with sinkers and the elimination of line tension astern. Limited trials in NZ found that through the use of dropper floats, together with manipulation of line weighting regimes and BSL configurations, improved sinking to depth within the aerial extent of BSLs can be achieved in small vessel floated demersal longline fisheries (Goad *et al.* 2024).

Notes and Caveats

Sink rate management tools (e.g. Plencner and Debski 2026) can be used by small vessel demersal longline fishers to both meet regulatory requirements for sink rate records and to assess and manage sink rates to reduce the risk to seabirds.

Minimum standards

No global standard.

Implementation monitoring

Onboard monitoring or at-sea surveillance is required to assess implementation.

Research needs

Further work is required to identify mitigation measures that increase the sink rate of baited hooks on floated longlines.

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