

The logo features a blue rectangular background with a repeating pattern of fish swimming to the right. The text "South Pacific Regional Fisheries Management Organisation" is written in white, bold, sans-serif font across the center of the rectangle.

South Pacific Regional Fisheries Management Organisation

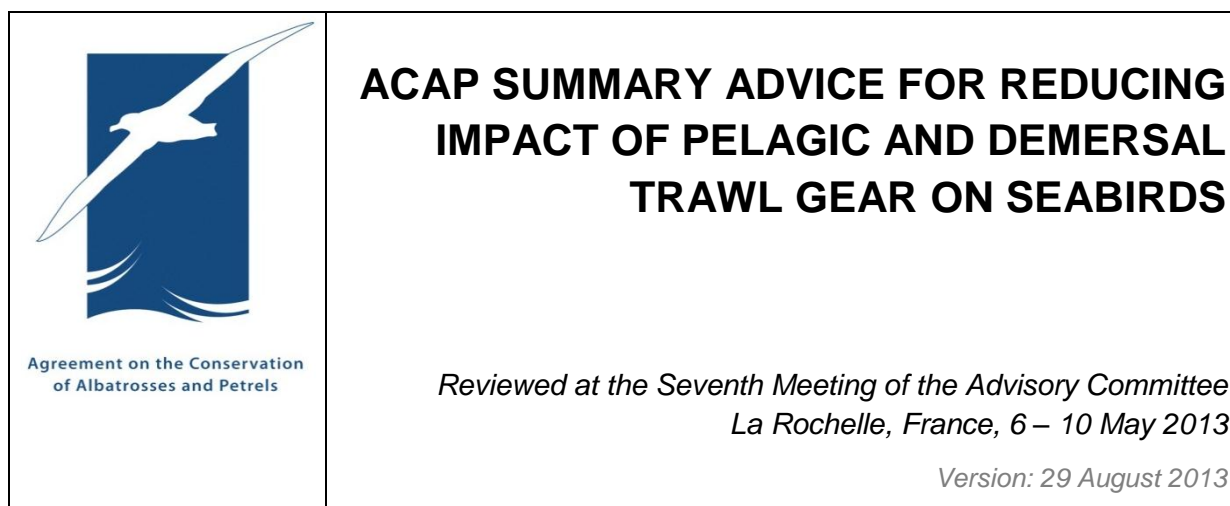
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Trawl Mitigation Review and Advice

Agreement on the Conservation of Albatrosses and Petrels



The causes of mortality in trawl fisheries are varied and dependent on the nature of the fishery (pelagic or demersal), the species targeted and fishing area. Mortalities may be categorised into two broad types: (1) cable-related mortality, including collisions with net-monitoring cables, warp cables and paravanes; and (2) net-related mortality, which includes deaths caused by net entanglements. Seabird interactions have been demonstrated to be significantly reduced by the use of mitigation measures that include protecting the warp cable, managing offal discharge and discards, and reducing the time the net is exposed on the surface of the water. The following measures have been demonstrated to be effective at reducing seabird bycatch in trawl fisheries and are recommended:

Cable strike

1. Deploy bird scaring lines while fishing to deter birds away from warp cables and net monitoring cable.
2. Install a snatch block at the stern of a vessel to draw the net monitoring cable close to the water to reduce its aerial extent.

Net entanglement

1. Clean nets after every shot to remove entangled fish (“stickers”) and benthic material to discourage bird attendance during gear shooting;
2. Minimise the time the net is on the water surface during hauling through proper maintenance of winches and good deck practices; and
3. For pelagic trawl gear, apply net binding to large meshes in the wings (120–800 mm), together with a minimum of 400-kg weight incorporated into the net belly prior to setting.

In all cases the presence of offal and discards is the most important factor attracting seabirds to the stern of trawl vessels, where they are at risk of cable and net interactions. Managing offal discharge and discards while fishing gear is deployed has been shown to reduce seabird attendance. The following management measures are recommended:


1. Avoid any discharge during shooting and hauling;
2. Where possible and appropriate, convert offal into fish meal and retain all waste material with any discharge restricted to liquid discharge / sump water to reduce the number of birds attracted to a minimum; and
3. Where meal production from offal and full retention are not feasible, batching waste (preferably for two hours or longer) has been shown to reduce seabird attendance at the stern of the vessel. Mincing of waste has also been shown to reduce the attendance of large albatross species.

Further measures include avoiding peak areas and periods of seabird foraging activity. It is important to note that there is no single solution to reduce or avoid incidental mortality of seabirds in trawl fisheries, and that the most effective approach is to use the measures listed above in combination. Net entanglements during the haul remain the most difficult interactions to mitigate.

CONTEXT

The FAO Best Practice Guidelines for IPOA/NPOA-Seabirds were recently amended to include trawl fisheries in addition to longline fisheries (FAO 2009), demonstrating increased serious concern and awareness of seabird mortality on global trawl fisheries.

ACAP has comprehensively reviewed the scientific literature dealing with seabird bycatch mitigation in trawl fisheries and this document is a distillation of the review (Report of Seabird Bycatch Working Group, AC7 Doc 14 Rev 1 ANNEX 6).

 <p data-bbox="194 533 475 573">Agreement on the Conservation of Albatrosses and Petrels</p>	<h2 data-bbox="600 241 1401 394">ACAP REVIEW OF SEABIRD BYCATCH MITIGATION MEASURES FOR TRAWL FISHERIES</h2> <p data-bbox="608 546 1401 618"><i>Reviewed at the Seventh Meeting of the Advisory Committee La Rochelle, France, 6 – 10 May 2013</i></p>
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To monitor implementation of all trawl mitigation measures the presence of fisheries observers and/or electronic monitoring is recommended.

1. Nets

1.1. Net binding

Scientific evidence for effectiveness in trawl fisheries

Shown to be a highly effective mitigation measure in CCAMLR icefish trawl fishery, reducing seabird bycatch to minimal levels (Sullivan 2010 submitted).

Caveats /Notes

Sisal string has been used to bind the sections of the net which pose the greatest threat seabirds prior to shooting (Sullivan et al. 2004). Bindings are simply tied onto the net to prevent the net from lofting and the mesh opening as the tension created by the vessel speed of between 1-3 knots is lost due to waves and swell action. Once shot-away the net remains bound on the surface until it sinks. Once the trawl doors are paid away and the net has sunk beyond the diving depth of seabirds the force of the water moving the doors apart is sufficient to break the bindings and the net spreads into its standard operational position.

Need for combination

Recommend combination with net cleaning and net weights to minimise the time the net is on the surface (Sullivan *et al.* 2010 submitted)

Research needs

Not needed.

Minimum standards / Recommendation

Recommended for reducing bycatch when shooting gear in pelagic gear.

3-ply sisal string (typical breaking strength of c.110 kg), or a similar inorganic material should be applied to the net on the deck, at intervals of approximately 5 m to prevent net from spreading and lofting at the surface. Net binding should be applied to mesh ranging from 120–800 mm as these are known to cause the majority of seabird entanglements (Sullivan et al 2010). When applying string, tie an end to the net to prevent string from slipping down the net and ensure it can be removed when net is hauled.

1.2. Net weights

Scientific evidence for effectiveness in trawl fisheries

Evidence suggests net weighting on or near the cod end increases the angle of ascent of the net during hauling operations, thus reducing the time the net is on the water's surface. All attempts should be made to retrieve the net as quickly as possible. Good deck practices to minimise the time that the net is on the water's surface have been the key factors in reducing seabird entanglements during hauling in South Atlantic trawl fisheries (Hooper *et al.* 2003; Sullivan 2010 submitted).

Caveats /Notes

None identified.

Need for combination

Recommend combination with net binding and net cleaning to minimise the time the net is on the water's surface during both setting and hauling (Sullivan 2010 submitted).

Research needs

Development of minimum standards for amount and placement of weight (cod end, wings, footrope, mouth, belly), to build on work to date in CCAMLR trawl fisheries (Sullivan *et al.* 2010 submitted).

Minimum standards / Recommendation

None established.

Recommended for reducing bycatch during both shooting and hauling of gear (Sullivan *et al.* 2010).

Suitable for both pelagic and demersal gear.

1.3. Net cleaning

Scientific evidence for effectiveness in trawl fisheries

Removal from nets of all fish 'stickers' and other material is a critical step to reducing net entanglement during shooting (Hooper *et al.* 2003; Sullivan *et al.* 2010 submitted).

Caveats /Notes

None identified.

Need for combination

Recommend combination with net binding and net weights to minimise the time net is on water's surface during both setting and hauling (Sullivan 2010 submitted).

Research needs

None identified.

Minimum standards / Recommendation

Remove all stickers from net prior to shooting gear.

Recommended for reducing bycatch during both shooting and hauling of gear.

Suitable for both pelagic and demersal gear.

1.4. Reduced mesh size

Scientific evidence for effectiveness in trawl fisheries

Roe (2005) reported on the use of reduced mesh size from 200 to 140 mm in the pelagic icefish fishery in CCAMLR waters, but did not quantify effectiveness of the measure.

Caveats /Notes

Measure may be impractical. Reduced mesh size was believed to have caused severe damage to the net because of increased water pressure during trawling (Roe 2005), although the use of chain weights in the net may also have been influential.

Need for combination

None identified.

Research needs

Thorough testing in a range of fisheries required if measure is practical.

Minimum standards / Recommendation

None. Insufficient evidence to recommend this measure, although theoretically should be effective in reducing seabird entanglement in nets.

1.5. Net jackets

Scientific evidence for effectiveness in trawl fisheries

Free-floating panels of net attached to the most dangerous mesh sizes have been trialled in CCAMLR's icefish trawl fishery, with efficacy uncertain (Sullivan *et al.* 2010 submitted).

Caveats /Notes

Found to cause serious drag and subsequent damage to the net. Drag also slows vessel speed and increases fuel consumption (Sullivan *et al.* 2010 submitted).

Need for combination

None identified.

Research needs

Efficacy of measure not quantified.

Minimum standards / Recommendation

Not recommended.

Currently detrimental to fishing efficiency and mitigation efficacy uncertain.

1.6. Acoustics

Scientific evidence for effectiveness in trawl fisheries

The use of acoustic ‘scaring’ devices on nine vessels in CCAMLR trawl fisheries indicated that loud noises (bells and flares/fireworks) had limited effect and birds quickly became habituated to the sound, no longer causing an aversion response (Sullivan *et al.* 2010).

Caveats /Notes

May be a useful back-up measure for circumstances when another measure is needed immediately (Sullivan *et al.* 2010 submitted).

Need for combination

None identified.

Research needs

None identified.

Minimum standards / Recommendation

None. Insufficient evidence to recommend this measure.

1.7. Net restrictor

Scientific evidence for effectiveness in trawl fisheries

The net restrictor was identified as a potential mitigation device in response to observed net captures in the New Zealand scampi trawl fishery, where multiple nets are deployed adjacently (Pierre *et al.* 2013). The net restrictor acts to restrict the opening of the net on haul when captures were observed.

Caveats /Notes

May be a useful in demersal trawl fisheries where multiple nets are deployed adjacently, and nets (particularly the middle net) are liable to billow open at or near the surface on haul.

Need for combination

None identified.

Research needs

At-sea testing required to determine effectiveness.

Minimum standards / Recommendation

None. Insufficient evidence to recommend this measure at present.

2. Cables**2.1. Offal discharge¹ and fish discard management**

The most important factor influencing contacts between seabirds and warp cables is the presence of discharge (Wienecke & Robertson 2002; Sullivan *et al.* 2006a). Methods used to reduce the attractiveness of vessels to seabirds through management of offal discharge and fish discards include mealing (the conversion of waste into fish meal waste reducing discharge to sump water), mincing waste to a nominal maximum particle size of 25 mm diameter prior to discharge, batching (storage or controlling release of discards / discharge during fishing operations). Where practicable the full retention of all waste material is recommended.

2.1.1. Mealing**Scientific evidence for effectiveness in trawl fisheries**

Mealing resulted in significant reduction in the number of seabirds species feeding behind vessels, relevant to the discharge of unprocessed fish waste (Abraham *et al.* 2009; Wienecke & Robertson 2002; Favero *et al.* 2010) or minced waste (Melvin *et al.* 2010).

Caveats /Notes

Good evidence in global fisheries that fish meal processing and reducing discharge to stick / sump water is highly effective in reducing seabird bycatch.

Need for combination

None identified.

Research needs

None.

¹ Offal discharge refers to the disposal at sea of any fish waste resulting from processing, including heads, guts and frames. Fish discards refers to any unwanted whole fish (and or benthic material)

Minimum standards / Recommendation

Suitable for both pelagic and demersal trawl gear.

2.1.2. Mincing**Scientific evidence for effectiveness in trawl fisheries**

Mincing reduced the number of large albatrosses (*Diomedea* spp) attending vessels but had no effect on other groups of seabirds (Abraham *et al.* 2009; Abraham 2010).

Caveats /Notes

Bottom trawled material, such as rocks, may impact the feasibility of mincing.

Need for combination

Should be used in combination with other mitigation methods.

Research needs

At present only demonstrated to be effective against large *Diomedea* spp albatrosses. Efficacy with *Thalassarche* spp albatrosses needs to be proven before measure can be recommended (Abraham *et al.* 2009).

Minimum standards / Recommendation

Insufficient evidence to recommend this as a primary measure at present, although reduced bird abundance should reduce cable impacts and mortality for larger albatross species.

2.1.3. Batching**Scientific evidence for effectiveness in trawl fisheries**

Batching (storage or controlling release of discards / discharge during) has been trialed in New Zealand and was shown to significantly reduce the number of seabirds associated with vessels (Pierre *et al.* 2010; SBWG-4 Doc 14 Rev1).

Caveats /Notes

Effectiveness of batching relies on efficient (fast) dumping of batched material.

Need for combination

Should be used in combination with other mitigation methods.

Research needs

Robust trialling to investigate the extent to which reduced seabird abundance affects seabird interaction rates.

Minimum standards / Recommendation

Recommended when full retention or mealing not possible. Batch waste for at least 2 hours,

preferably 4 hours or longer.

2.1.4. Full retention

Scientific evidence for effectiveness in trawl fisheries

Repeated studies have shown in the absence of offal discharge / fish discards seabird interactions and mortality levels are negligible (Sullivan *et al.* 2006; Watkins *et al.* 2008; Melvin *et al.* 2010; SBWG-3 Doc 14 Rev 1; Abraham & Thompson 2009). Storage of all fish discard and offal, either for processing or for controlled release when cables are not in the water, resulted in a significant reduction in the attendance of all groups of seabirds (Abraham *et al.* 2009).

Caveats /Notes

None.

Need for combination

None identified.

Research needs

None identified.

Minimum standards / Recommendation

Suitable for both Pelagic and Demersal trawl gear.

2.2. Bird Scaring Lines (BSL) for warp cables

Scientific evidence for effectiveness in trawl fisheries

Attachment of a Bird Scaring Line to both the port and starboard sides of a vessel, above and outside of the warp blocks, greatly reduces the access of birds to the danger zone where warps enter the water (Watkins *et al.* 2006; Reid & Edwards 2005; Melvin *et al.* 2010). An off-setting towed device has been demonstrated to improve BSL performance (BirdLife 2010).

Caveats /Notes

Effectiveness reduced in strong cross winds and rough seas, when BSLs are deflected away from warps (Sullivan & Reid 2003; Crofts 2006a, 2006b). This can be alleviated in part by towing a buoy or cone attached to the end of lines to create tension and keep lines straight (Sullivan *et al.* 2006a; Cleal *et al.* 2013). Hard wearing and non-tangling materials and design can improve performance (Cleal *et al.* 2013), including the use of semi rigid streamers, particularly those constructed from Kraton,

Need for combination

None identified.

Research needs

Further research is required on the effectiveness on the design and performance of an off-setting towed device under operational conditions.

Minimum standards / Recommendation

BSL are recommended even when appropriate offal discharge and fish discard management practices in place (Melvin *et al.* 2010).

Suitable for both pelagic and demersal trawl gear.

It is recommended that for every metre of block height 5 m of backbone be deployed and 1.2 kg of terminal object drag weight be used.

2.3. Warp scarers**Scientific evidence for effectiveness in trawl fisheries**

Warp scarers (weighted devices attached to each warp with clips or hooks, allowing the device to slide up and down the warp freely and stay aligned with each warp) create a protective area around the warp (see Bull 2009, Fig.2; Sullivan *et al.* 2006a).

Warp scarers have been shown to reduce contact rates but not to significant levels, and were not as effective as BSLs (Sullivan *et al.* 2006b, Abraham *et al.*, cited in Bull 2009).

Caveats /Notes

Attachment to the warp eliminates problems associated with crosswinds as the mitigation devices do not behave independently of warps. Warp scarers cannot be deployed while the warp cable is being set, or remain in place during hauling, leaving periods when warps are not protected.

Concerns have been raised regarding associated practicality and safety issues (Sullivan *et al.* 2006a; Abraham *et al.*, cited in Bull 2009).

Need for combination

None identified.

Research needs

None identified.

Minimum standards / Recommendation

None. Insufficient evidence to recommend this measure.

2.4. Bird bafflers**Scientific evidence for effectiveness in trawl fisheries**

Bird bafflers comprise two booms attached to both stern quarters of a vessel. Two of these booms extend out from the sides of the vessel and the other two extend backwards from the

stern. Dropper lines are attached to the booms, to create a curtain to deter seabirds from the warp–sea interface zone (see Bull 2009, Fig.3; Sullivan *et al.* 2006a).

Generally bird bafflers are not regarded as providing as much protection to the warp cables as BSLs or warp scarers (Sullivan *et al.* 2006a).

Caveats /Notes

Various designs exist including the Brady Baffler, the Burka and a modified Burka design or “curtain baffler” (Cleal *et al.* 2013).

While bafflers were designed to minimise warp interactions, the Brady Baffler has been used (inappropriately) within CCAMLR Icefish fisheries to mitigate net entanglements where they have been found to be consistently ineffective (Sullivan *et al.* 2010).

The great variability in the design and deployment of bird bafflers may influence their overall effectiveness.

Need for combination

None identified.

Research needs

The full range of baffler designs have not been experimentally tested. Trials should be conducted in a range of fisheries and areas to demonstrate efficacy.

Minimum standards / Recommendation

None. Insufficient evidence to recommend this measure.

2.5. Cones on warp cables

Scientific evidence for effectiveness in trawl fisheries

A plastic cone attached to each warp cable reduced the number of birds entering the warp/water interface in Argentine Hake Trawl Fishery by 89% and no seabirds were killed while cones were attached to the warp (Gonzalez-Zevallos *et al.* 2007).

Caveats /Notes

Applicable for small vessels.

Need for combination

None identified.

Research needs

Needs to be trialled in a range of fisheries and areas to demonstrate efficacy.

Minimum standards / Recommendation

None. Insufficient evidence to recommend this measure.

2.6. Warp boom

Scientific evidence for effectiveness in trawl fisheries

A boom with streamers extending to the water forward of the stern can divert birds feeding on offal away from the warps (Melvin *et al.* 2010).

Caveats /Notes

Results did not identify a statistically significant reduction in seabird interactions with the warp.

Need for combination

None identified.

Research needs

Longer-term studies required to identify effectiveness including work to identify suitable configuration and materials.

Minimum standards / Recommendation

None.

2.7. Snatch block

Scientific evidence for effectiveness in trawl fisheries

A snatch block, placed on stern of a vessel to draw the third-wire close to the water to reduce its aerial extent, reduced seabird strikes, although performance varied by vessel (Melvin *et al.* 2010).

Caveats /Notes

Melvin *et al.* (2010) were confident that third-wires can be pulled closer to the water or submerged at the stern to make this measure highly effective, but noted that, as third-wires are fragile and expensive, any snatch block-like system should aim to minimise cable wear.

Need for combination

Should be used in combination with other mitigation methods.

Research needs

Needs to be trialled in a range of fisheries and areas to further demonstrate efficacy.

Development of technical specification required.

Minimum standards / Recommendation

None.

Recommended on the basis that shortening aerial extent of monitoring cables will, intuitively, reduce seabird strikes.

3. General measures

3.1. Area closures

Scientific evidence for effectiveness in trawl fisheries

Avoiding fishing at peak areas and during periods of intense foraging activity has been used effectively to reduce bycatch in longline fisheries. The principles are directly transferrable to trawl and other net fisheries.

In some studies, longline-associated mortality has been almost exclusively within the breeding season of seabirds. 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) and temporal closures around breeding areas contributed to a substantial reduction in seabird bycatch (Croxall & Nicol 2004).

Caveats /Notes

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.

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 trawl fisheries.

Minimum standards / Recommendation

No work done but highly recommended.

4. Measures under development

4.1. Tamini Tabla off-setting towed device

In order to improve the performance of Bird Scaring Lines, an off-setting towed device (Tamini Table) is under development in Argentina. This device is attached to the terminal end of the BSL and has a buoyant upper board with three 45° vertical keels, which are weighted for stability. Under forward motion of the vessel, the keels cause the device to move outward of the trawl cables and therefore maintain the BSL from entangling with trawl cables.

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