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USE OF LIGHT STREAMER LINES AND LINE WEIGHTING ON LONGLINE VESSELS AND THE IMPLICATIONS FOR SEABIRD BYCATCH

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Use of light streamer lines and line weighting on longline vessels and the implications for seabird bycatch

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Abstract

This paper examines two commercial longline fishing vessel's seabird bycatch rates before and after gear was re-configured in an attempt to reduce incidental seabird capture. The data were collected using fishery observers. Both vessels were setting longlines at night and used multiple light streamer lines to deter seabirds from diving on the baited hooks during the set. Vessel 1 used three light streamer lines attached to poles of varying heights, and initially had no line weighting. Vessel 2 used two light streamer lines to deter seabirds and used line weighting to increase hook sink rates. Vessel 1 added line weighting and added long streamers to the streamer line. The result was a reduction of seabird captures from 12 captures in 12 sets to one capture in the subsequent 26 sets. The Vessel 2 used streamer lines with long streamers and a line weighting regime. This vessel caught 10 birds but 8 of which were thought to have been caught on the haul. The implications of these results are discussed and the advantages of using fishery observers on commercial longline fishing vessels as a platform for research are discussed.

Introduction

As a result of global concerns regarding the status of seabirds, in 2005 the Western and Central Pacific Fisheries Commission (WCPFC) adopted Resolution 2005-01 noting that some seabird species, notably albatrosses and petrels, are threatened with global extinction. In addition, experience from other Regional Fishery Management Organisations (RFMO's) such as the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) note that together with illegal, unreported and unregulated fishing, the greatest threat to Southern Ocean seabirds is mortality in longline fisheries in waters adjacent to its Convention Area.

Furthermore in Resolution 2005-01 and Conservation and Management Measures (CMM's) 2006-02 and 2007-04 the WCPFC noted that scientific research into mitigation of seabird bycatch in surface longline fisheries has showed that the effectiveness of various measures varies greatly depending on the vessel type, season, and seabird species assemblage present.

The Scientific Committee of the WCPFC has investigated this matter in some detail and recommended to the Commission that combinations of mitigation measures are essential for effective reduction of seabird bycatch. The WCPFC encourages Members, Cooperating Non-members and Participating Territories (CCM's) to undertake research to further develop and refine, and monitor measures to mitigate seabird bycatch (CMM 2007-04).

Annually a number of Japanese longline vessels fish in New Zealand waters, under charter to a New Zealand fishing company, targeting southern bluefin tuna (*Thunnus maccoyii*) but also landing bigeye tuna, yellowfin tuna, swordfish and a wide ranger of bycatch species. These vessels fish predominantly off the southwest coast of the South Island (Figure 1). As part of their fishing arrangement the vessels are required to adhere to a code of practice, as well as the New Zealand domestic fishing legislation. One part of the code of practice is that the vessels have a seabird bycatch limit of 15 birds per trip. If this limit is reached the vessel must stop fishing immediately. To mitigate against seabird captures the vessels are required use a combination of tori lines, setting at night (both of which are required by New Zealand regulation), and their code of practice which includes various other non-regulated measures such as the use of thawed bait, the use of bird frighteners during hauling and offal must be discarded on the port side during hauling. Fishing activity is monitored by onboard independent observers.

The observers collect data on the vessel, gear configuration, catch, effort, weather and undertake other technical tasks such as fish tagging. In most years the foreign charter vessels have had 100% observer coverage, however, in 2008 for various logistic reasons only 50% of fishing effort was observed.

While at-sea seabird mitigation trials are difficult to undertake and working platforms for these trials are often confounded by many variables, undertaking seabird mitigation trials on working vessels is ideal when testing if systematic changes in gear or gear deployment significantly reduce the rate at which seabirds are inadvertently hooked by longlines as it also allows the usability of the mitigation technique to be assessed. The development of useable and effective seabird mitigation is considered to be best done through a cooperative approach, thus incorporating fishers, the end users of the mitigation techniques (Melvin and Parrish 2003).

The data collected from two vessels fishing under this charter arrangement were assessed to determine the feasibility of undertaking a seabird mitigation trial under experimental conditions from working longline vessels using the onboard observer programme to collect the data and run the experiments. The preliminary results are presented in this paper.

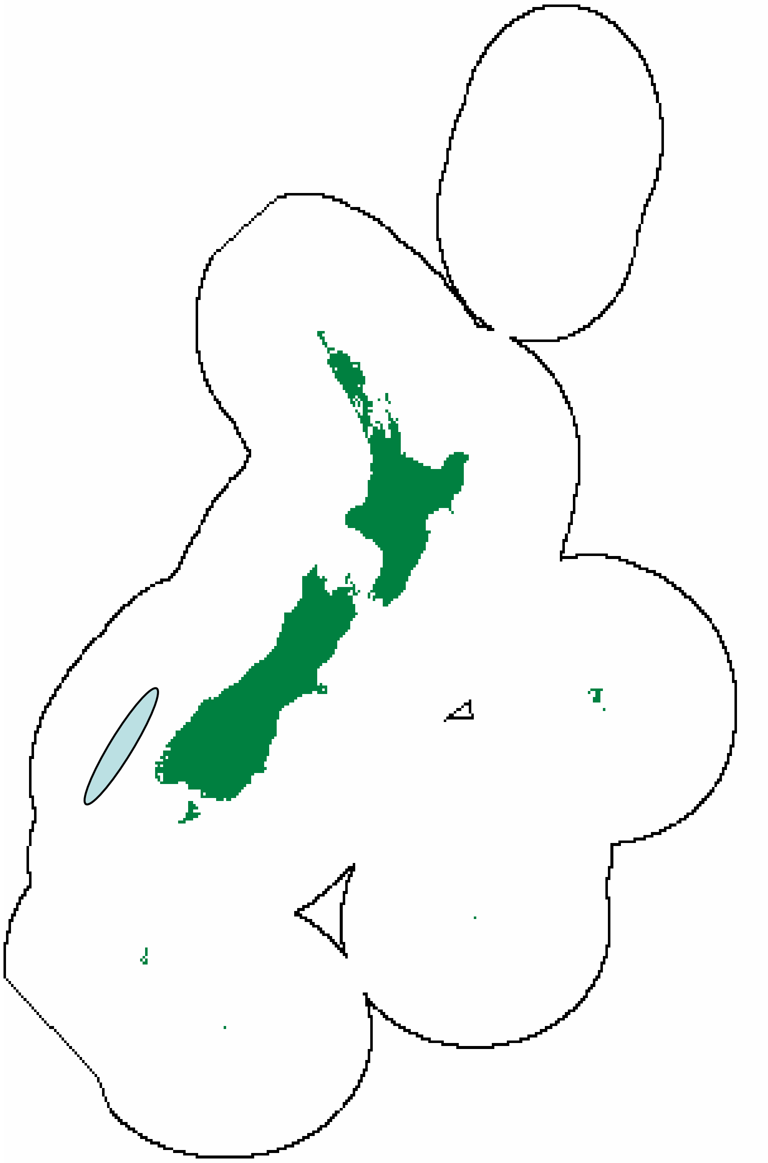


Figure 1: Map of New Zealand showing New Zealand's EEZ and the fishing grounds where the study took place shaded blue.

Methods

The two vessels observed during the 2008 differed in both longline and light streamer line configuration[1]. During the course of their trips, both vessels responded to seabird bycatch events and changed their fishing practices. Both the initial configurations and altered practices are described here. The two vessels fished in the same area and at the same time of year (mid April to early June).

Vessel 1's initial hookline configuration consisted of a 6mm braided monofilament backbone and 35-40m long snoods attached approximately every 40 metres with shark clips. After every 10 snoods a 30cm plastic float was attached to the backbone with a 13m drop line, at the backbone end of the buoyline a weight of 60gms was attached. Snoods were made in various configurations with monofilament, braided monofilament and rope (Figure 2).

Vessel 1 used three light streamer lines attached to various poles: 10m above the waterline in the centre of the vessel, 8m above the waterline on the port side and 5m above the waterline outboard of the port side using a boom (Figure 3a). The lengths of the streamer line back bones were 185m for the centre line, 175m for the port and 60m for the outboard port line. These streamer lines had short streamers attached to the backbone which were made from bunches of 50cm lengths of bait box strapping (Figure 3b).

After a succession of seabird bycatch events, Vessel 1 changed both the line weighting and streamer line configuration after set 12. The gear was re-configured as follows: each 60gm weight at the bottom of each buoyline was replaced with 100gm weights, and 3gm weights were attached immediately above the hook on each snood (Figure 2). Four streamers (7m rope with bait box strapping) were added to the centre and port light streamer lines (Figure 3b). Additional length was added to both the centre and port light streamer lines, extending them to 200m long.

Vessel 2 used a similar initial longline configuration, with a 30cm float attached to 6mm nylon braid backbone with 13m drop lines with 400m of backbone and 10 snoods between the attached floats. Vessel 2's snoods were also approximately 40m long but included various weighting, snoods either included 85gm weighted hooks, weighted swivels (113g) or sections of integrated weight line to increase sink rate of hooks and baits (Figure 2).

Vessel 2 used two light streamer lines, one attached to the mast 6m above the water line and another attached outboard on the port side using a bamboo pole. Both lines had bunches of blue and yellow packing tape attached to the streamer backbone as streamers. They also had 5 long streamers attached every 5m, these consisted of rope with a bunch of blue and yellow packing tape at the terminal end (Figures 4 & 5). Used bait was discharged over the stern of the vessel during the haul.

[1] Note: the New Zealand specifications are consistent with those outlined in Attachment O, Annex 1 of CMM 2007/04 (specifications for Column A mitigation measures): 1a) – Tori lines. Therefore the streamer lines used by the two vessels did not comply with the requirement for streamers along the aerial section of the line to be long enough to generally reach the sea surface.

In response to successive bycatch events during the haul, from set 22 onwards Vessel 2 retained waste bait on deck and discharged the waste bait on the opposite side of the vessel while hauling to deter birds from congregating on the hauling side.

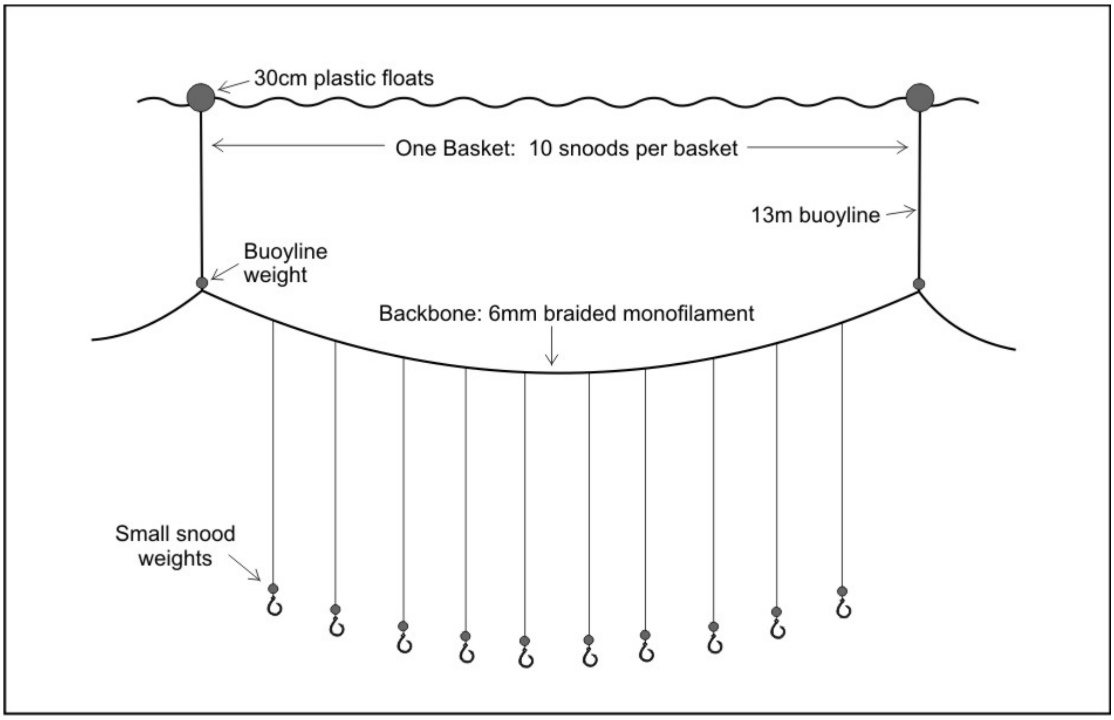


Figure 2: Longline configuration for both vessels observed off the west coast of New Zealand's South Island. For Vessel 1 after the gear was re-configured the small snood weights were added and the buoyline weight was increased.

Each vessel had one observer to record catch and effort data as well as target species biological data and bycatch data for fish and non-fish bycatch. At 10 am each day the observer made species specific bird counts from the deck of the vessel, counting birds in a 100m radius around the vessel. For both vessels lines were set at night and hauled the following day.

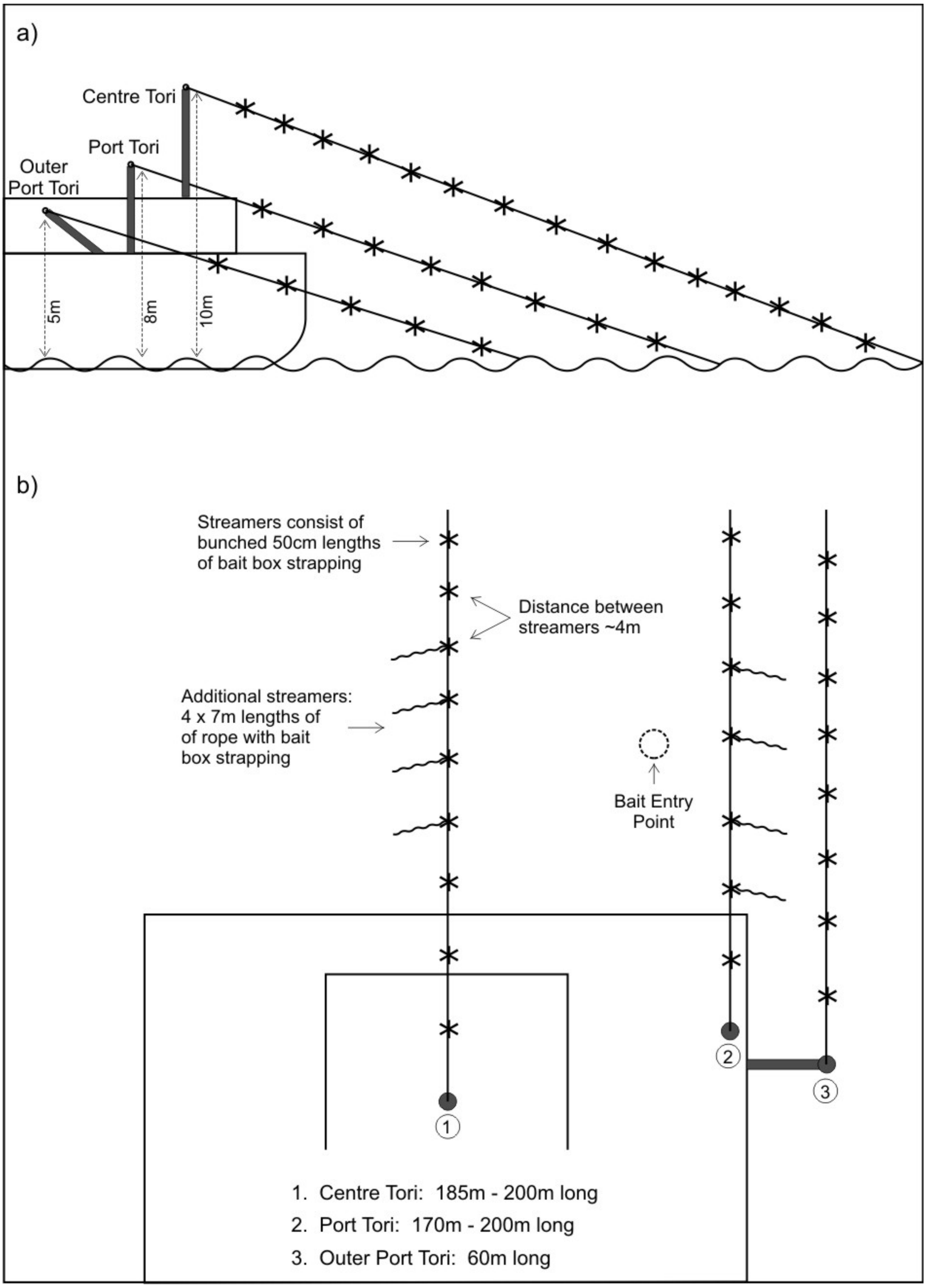


Figure 3: Light streamer line configuration for Vessel 1 observed off the west coast of New Zealand's South Island.

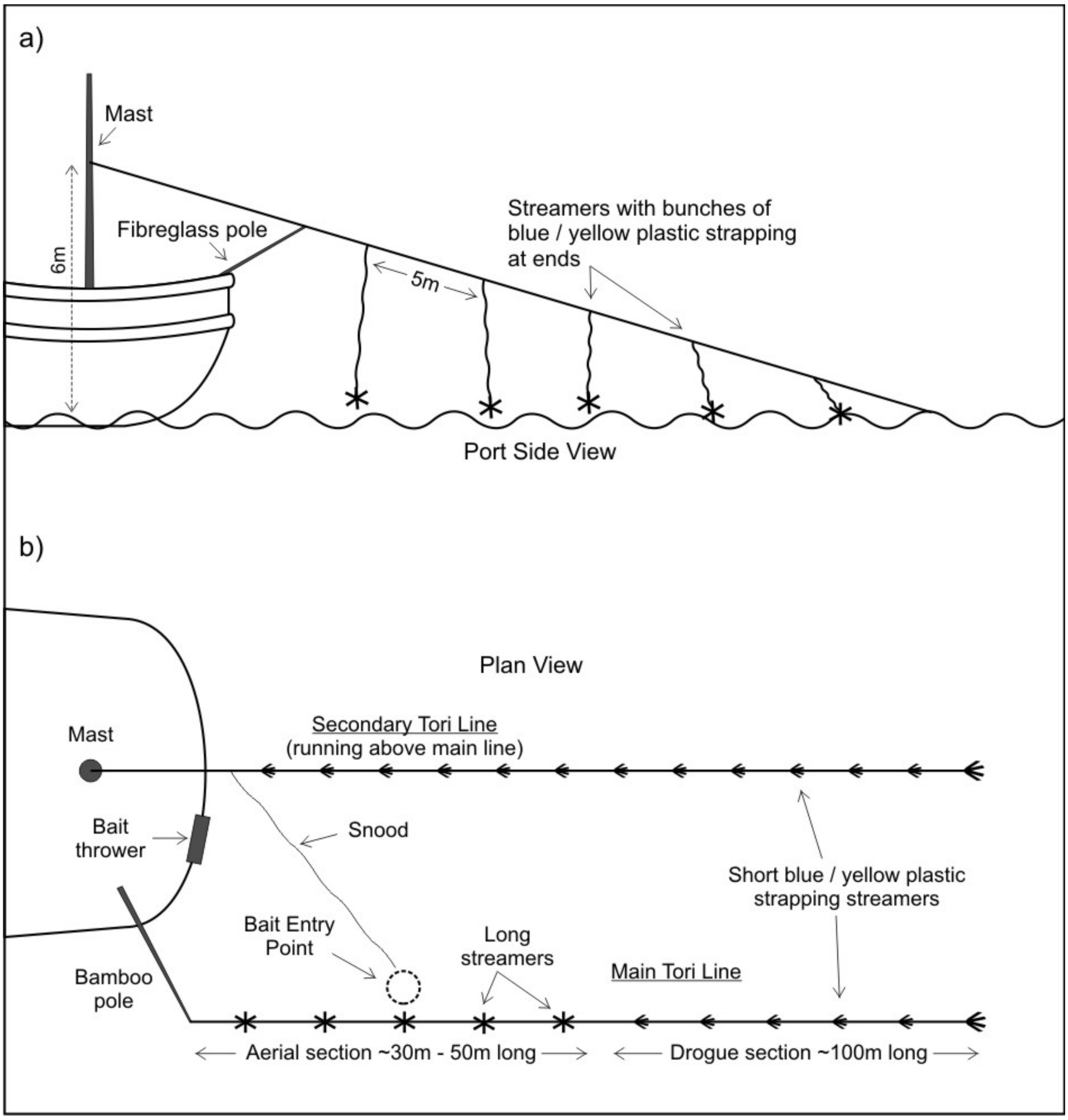


Figure 4: Light streamer line configuration for Vessel 2 observed off the west coast of New Zealand's South Island.

Figure 5: Light streamer line configuration for Vessel 2 observed off the west coast of New Zealand's South Island. Note at the time this photo was taken this light streamer line was deployed for testing purposes, the deployments under fishing conditions occurred at night.

Results

A total of 83 longline sets were observed from two vessels. Seabird abundance was estimated at 10, 682 around the vessels. Fourteen different bird species were recorded around the two vessels, with Southern Buller's albatross being the most common bird counted followed by white-chinned petrel and New Zealand white capped albatross (Table 1).

A total of 23 birds were caught by the two vessels 13 by Vessel 1 and 10 by Vessel 2. All of the birds caught by Vessel 1 were dead on retrieval (Table 2), while 2 out of the 10 birds caught by Vessel 2 were dead (Table 3).

Vessel 1 changed its mitigation gear after set 12, prior to that, a total of 12 birds were captured, all of which were dead and thought to be caught on the set. After re-configuring the fishing and mitigation gear only 1 bird was caught in the remaining 26 sets, despite bird number remaining relatively constant with no significant change over the remainder of the trip (Figure 6).

For Vessel 2 the gear configuration remained consistent throughout the trip. Birds were caught throughout the trip, despite variable bird abundance in the vicinity of the vessel. However most of birds caught (83%) were landed alive and were thought to have been caught on the haul.

Table 1: Birds observed around on two longline vessels observed off the west coast of New Zealand's South Island and the percentage frequency of bird abundance.

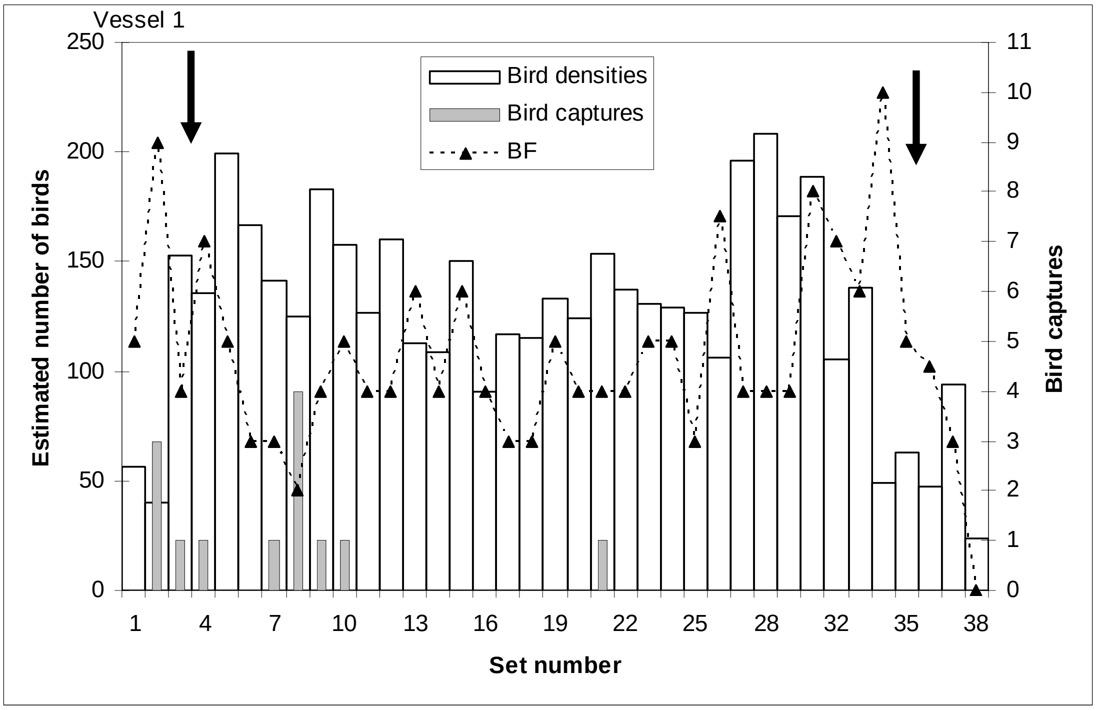
Common name	Scientific name	Percentage of total
Southern Buller's albatross	*Thalassarche bulleri*	64
White-chinned petrel	*Procellaria aequinoctialis*	11
New Zealand white capped albatross	*Thalassarche steadi*	10
Sooty shearwater	*Puffinus griseus*	6
Cape pigeon	*Daption capense*	5
Prion	*Pachyptila spp*	2
Giant Petrel	Procellariidae	1
Wandering albatross	*Diomedea* sp.	1
Black-browed albatross	*Thalassarche melanophyrs*	<1
Southern royal albatross	*Diomedea epomophora*	<1
Salvin's albatross	*Thalassarche salvini*	<1
Storm petrel	Hydrobatidae	<1
Light-mantled sooty albatross	*Phoebetria palpebrata*	<1
Skua	Stercorariidae	<1

Table 2: Seabird bycatch by set for Vessel 1 observed off the west coast of New Zealand's South Island.

Set number	Number of birds	Common name	Recovery state
2	2	White-capped albatross	Dead
2	1	White-chinned petrel	Dead
3	1	Southern Buller's albatross	Dead
4	1	Southern Buller's albatross	Dead
7	1	Southern Buller's albatross	Dead
8	3	Southern Buller's albatross	Dead
8	1	White-chinned petrel	Dead
9	1	Southern Buller's albatross	Dead
10	1	Southern Buller's albatross	Dead
21	1	White-chinned petrel	Dead

Table 3: Seabird bycatch by set for Vessel 2 observed off the west coast of New Zealand's South Island. Most of the captures were thought to be caught during the haul.

Set number	Number of birds	Common name	Recovery state
5	1	White-chinned petrel	Dead
14	1	Southern Buller's albatross	Alive
15	1	Southern Buller's albatross	Alive
16	1	Southern Buller's albatross	Alive
19	1	Southern Buller's albatross	Alive
22	1	Southern Buller's albatross	Alive
24	1	White-capped albatross	Dead
28	1	Southern Buller's albatross	Alive
34	1	Southern Buller's albatross	Alive
40	1	Southern Buller's albatross	Alive



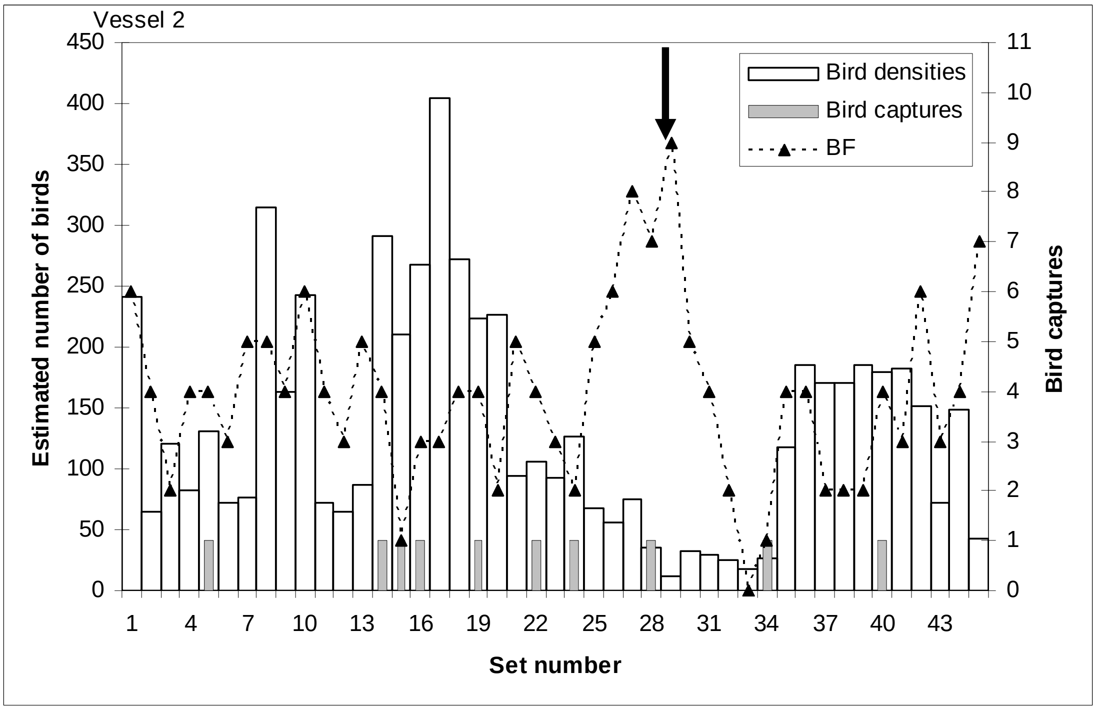


Figure 6: Bird captures, densities and wind force Beaufort scale (BF) on two longline vessels observed off the west coast of New Zealand's South Island. Arrows indicate full moon nights.

Figure 7: A New Zealand white-capped albatross caught during the set by longline Vessels 1 off the west coast of New Zealand's South Island.

The vessels were able to deploy streamer lines in all observed fishing conditions, even when fishing in a Beaufort scale 9 wind (Figure 6).

Discussion

Seabird mitigation work has been ongoing for a number of year's world wide. Streamer lines have been used on Norwegian fishing grounds since 1992 when the first experiments were conducted (Løkkeborg and Bjordal, 1992). Despite the high level of attention that has been directed at seabird mitigation in the WCPFC, within the context of the WCPFC seabird mitigation has received little experimental attention. Alternative designs have been considered by Yokota *et al*. (2007) and Bull (2006) provided a through review of mitigation methods and their effectiveness.

This study examined the effectiveness of using independent fishery observers and commercial fishing vessels to undertake seabird mitigation observations. The success of this work was largely attributed to the co-operation of the vessel crew with the observer and the good data collection procedures in place for the observer.

Various studies consider that a streamer lines with streamers work both as a visual and physical deterrent because the narrowly spaced streamers move with the speed of the vessel and wind, and will hit birds as they approach the baited line. Although birds may habituate to visual deterrents, habituation to a streamer line with long streamers is unlikely because of the unpredictable movements of the streamers (Løkkeborg and Robertson 2002). Several authors consider that the streamer lines with long streamers can create a physical barrier that the birds will not breach, for example Brothers

(1995) described a streamer line that is correctly constructed and correctly used as a conspicuous moving fence, which creates an impassable barrier excluding seabirds from the area of the water where the baited hooks enter.

In a study that focussed on the efficacy of mitigation devices in a trawl squid fishery in a similar area to that covered by this study found that of the devices trialled, streamer lines were most effective at reducing seabird strikes on trawl warps (Middleton and Abraham 2007). Warp strikes reduced to between 5% and 20% compared to their frequency without mitigation. Middleton and Abraham (2007) also noted that streamer lines, which had a strike rate similar to that recorded on the trawl warps without mitigation, provide a physical barrier between the birds and the baited hook. Due to the fragility of bird's wings, tendons, and their reliance on intact feather coverage of their primary and secondary feathers, seabirds are known to be reluctant to risk injury or feather damage and hence avoid close proximity to objects in their environment.

Trials in the New Zealand ling (*Genypterus blacodes*) demersal autoline fishery on the Chatham Rise found that the aerial section of the streamer line appeared to keep all seabird species except cape pigeons (*Daption capense*) away from the longline (Smith 2001). Smith (2001) described the streamer line as having most effect on the larger seabird species, especially *Diomedea* albatrosses, which have relatively long wings and are less manoeuvrable than the smaller petrels such as cape pigeons and shearwaters.

Concerns have been raised as to whether or not streamer lines can be set in rough seas. The work presented here showed that weather played no role in the ability of the vessel to deploy streamer lines even when fishing in a Beaufort scale 9 wind. The gear was successfully deployed when the vessel set into the prevailing wind. The bearing of the vessel relative to the wind direction has an effect on the coverage of the baited hooks by the streamer line streamers in strong winds.

Brothers *et al*. (2001) tested the effect of line weighting (20 g, 40 g and 80 g swivels) on sink rate and bycatch on 10 pelagic longline vessels within the Australian fishing zone. Vessels with faster line sink rates recorded lower seabird bycatch rates than those with slower line sink rates. Boggs (2001) tested the effectiveness of attaching 60 g swivel weights 3.7 m above the bait in the Hawaiian-based pelagic longline swordfish fishery. Contact rates (expressed as contact rate/bird/100 branchlines) were significantly lower for weighted lines compared to unweighted lines: the weights were 93% effective for black-footed albatrosses and 91% for Laysan albatrosses respectively.

While this present study is observational only, the changes in bird capture rates for Vessel 1 after it changed its gear and mitigation configurations certainly warrant further investigation. Of particular interest is the decrease in bird captures following:

1. The addition of longer streamers to the streamer line. This might suggest the streamer lines with short streamers do not provide a physical barrier preventing the birds from approaching the baited hook. This observation is strengthened by the different bird capture patterns for Vessel 1 and Vessel 2, whereby the latter used a streamer line that did incorporate some longer

streamers. While Vessel 2 did capture some birds, most were caught alive and probably on the haul.

2. The addition of more weights to the line. This observation would tend to reinforce the studies cited above that note that line weighting may increase the sink rate of baited hooks and thus reduce their availability to seabirds.

This work shows that commercial vessels and observers can and should be used for future work to assess seabird mitigation, and that more work is needed to assess the effectiveness of different streamer line configurations as effective tools to mitigate against incidental seabird catch. Furthermore, combinations of mitigation techniques should be further tested.

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References

Boggs, C.H. 2001. Deterring albatrosses from contacting baits during swordfish longline sets. Pp. 79–94 in Melvin, E.; Parrish, J.K. (Eds): Seabird bycatch: trends, roadblocks and solutions. University of Alaska Sea Grant, Fairbanks, Alaska.

Brothers, N., Gales, R., Reid, T. 2001. The effect of line weighting on the sink rate of pelagic tuna longline hooks, and its potential for minimising seabird mortalities. Unpublished conference report *CCSBT-ERS/0111/53.* 23 p.

Brothers, N. 1995. Principles of birdline construction and use to reduce bait loss and bird deaths during longline setting. *CCAMLR Working Paper WG-IMALF-94.* Hobart, Australia. 19 p.

Bull, L. 2006. A review of methodologies aimed at avoiding and/or mitigating incidental catch of seabirds in longline fisheries. WCPFC-SC2-2006/EB WP-5

Middleton, D.A.J., Abraham, E.A., 2007. The efficacy of warp strike mitigation devices: trials in the 2006 squid fishery. Final research report for Ministry of Fisheries contract IPA2006-02.

Melvin, E. F., and J. K. Parrish. 2003. Focusing and testing fisher know-how to solve conservation problems: A common sense approach. Pages 224-226 *in* N. Haggan, C. Brignall, and L. Wood, editors. Putting Fishers' Knowledge to Work: Conference Proceedings. University of British Columbia, Vancouver, Fisheries Centre Research Report, Vol. 11.

Lokkeborg, S., Robertson, G., 2002. Seabird and longline interactions: effects of a bird-scaring streamer line and line shooter on the incidental capture of northern fulmars *Fulmaris glacialis. Biological Conservation 106, p359-364.*

Smith, N.W.M., 2001. Longline sink rates of an autoline vessel, and notes on seabird interactions. *Science for Conservation 183.* Department of Conservation, Wellington, New Zealand. 32 p.

Yokota, K., Minami, H. and Kiyota, M. 2007. Effective factors of tori-poles in reducing incidental catch of seabirds in the Japanese longline fishery. WCPFC-SC3-EB SWG/WP-13