Seabird bycatch reduction in New Zealand’s inshore surface longline fishery

JOHANNA P. PIERRE
DAVID GOAD

Progress report for Department of Conservation
MIT2012–04: Surface longline seabird mitigation

www.dragonfly.co.nz

Dragonfly Science
PO Box 27535
Wellington 6141
New Zealand

Vita Maris Ltd
8 Parewaitai Ct
Papamoa 3118
New Zealand

To be cited as:
Johanna P. Pierre & David W. Goad (2013). Seabird bycatch reduction in New Zealand's inshore surface longline fishery. Progress report for Department of Conservation, MIT2012–04.

1. INTRODUCTION

Significant seabird bycatch issues were first identified in longline fisheries (e.g., Brothers 1991), and international management responses were initially focused on addressing this fishing method, ahead of others (FAO 1999). However, despite prolonged management and considerable scientific efforts, surface longlines still catch and kill significant numbers of seabirds annually, and worldwide (Anderson 2011). In New Zealand, surface longline fisheries are a source of bycatch risk for seabird species including Antipodean and Gibson's albatross (*Diomedea antipodensis antipodensis, D. a. gibsoni*), Campbell albatross (*Thalassarche impavida*), Salvin's albatross (*Thalassarche salvini*), southern Buller's albatross (*Thalassarche bulleri bulleri*), white-capped albatross (*Thalassarche steadi*), black petrel (*Procellaria parkinsoni*), Westland petrel (*Procellaria westlandica*), and white-chinned petrel (*Procellaria aequinoctialis*) (Abraham and Thompson 2011). It is highly likely that some of these species are caught in commercial fisheries in New Zealand waters at levels exceeding their sustainability limits (Richard and Abraham 2013), as well as being caught internationally (e.g., Baker et al. 2007).

Characteristics of surface longline gear that exacerbate the risk of seabird bycatch include relatively slow-sinking hooks, which remain within reach of seabirds for significant periods, the use of baits attractive to birds, long snoods, and the very long lengths of lines that are deployed with hooks attached (Bull 2007). Mitigation measures for this fishing method aim to reduce the availability of hooks to seabirds. Measures recognised as current global best practice for achieving this are line-weighting (which increases hook sink rates), deploying tori lines (which restricts bird access to hooks and lines during setting) and setting at night (when some species of seabirds, especially albatrosses, are less active) (ACAP 2011). The implementation of these measures is required in specified forms and combinations in New Zealand surface longline fisheries (New Zealand Government 2008).

Despite the existence of a number of measures to reduce bycatch in surface longline fisheries, continued captures in these fisheries demonstrate that the available measures do not preclude the existence of significant bycatch risk (Richard et al. 2013). This may be due to a variety of reasons e.g., inconsistent (or lack of) implementation, incompatibility with gear configurations, implementation of insufficient measures (e.g., night-setting without line-weighting). In particular, safety concerns with line weighting appear to dissuade fishers from utilising this bycatch reduction method (e.g., Maritime New Zealand 1996, 2003). Globally, research is ongoing into new measures aiming to reduce seabird bycatch in surface longline fisheries, including safe leads (Sullivan et al. 2012), hook pods[1] (Sullivan 2011), an underwater line-setter (Robertson and Domingo 2011), and double-weighted branchlines (WWF 2011). Improved safety is a key component in the development of some of these methods. Following promising results from trials of such innovative devices, the Overall Objective of this project is to test one or more mitigation methods which reduce the availability of surface longline hooks to seabirds at line setting. This objective encompasses two specific objectives:

Specific Objective 1. To test the safe use and mitigation effectiveness of one or more mitigation methods, not currently in common use in New Zealand surface longline fisheries that reduce the availability of surface longline hooks to seabirds at line setting.

[1] http://www.acap.aq/latest-news/united-kingdom-funds-hook-pod-trials-in-south-africa-to-reduce-pelagic-longline-mortality; http://www.fishtekmarine.com/hookpod.php

Specific Objective 2. To assess and quantify any impacts on catch rates between target and bycatch species between snoods with and without the target mitigation method.

Here, we report progress towards achieving these objectives in the first year of this project.

2. METHODS

Mitigation methods to be deployed were discussed and prioritised by an expert workshop in November 2012. In the first instance, two methods were identified for priority deployment. These were safe leads (Marine Safety Solutions Ltd 2008; Sullivan et al. 2012, Figure 1) and lumo leads (www.afma.gov.au/2012/11/trials-show-new-gear-in-tuna-longline-fisheries-better-for-crew-and-seabirds/, Figure 2). Safe leads are available from Fishtek (UK) (www.fishtekmarine.com). Lumo leads are available from Fishtek and Fishing International (Australia). Both types of weights tested were approximately 60 g.

Figure 1. Safe leads in two sizes (Image: www.fishtekmarine.com).

Figure 2. Lumo lead deployed at the hook (Image: www.fishtekmarine.com)

At-sea data collection

We developed methods for at-sea data collection in consultation with Ministry for Primary Industries scientists and Observer Services staff and Department of Conservation (Conservation Services Programme) scientists. Data collection was conducted as part of normal government fisheries observer coverage using protocols and forms specifically designed for this project. Observers aimed to collect data typically required during surface longline coverage, and additional project-related information. Given the amount of work required of observers, tasks were prioritised and split between fishing days, such that observers concentrated on data collection for this project on alternate days.

Setting:

During the set, observers conducted project-related work in three areas.

1. Monitoring the set-up of weights on the gear before setting (daily)
2. Deploying TDRs on snoods in 4 baskets (alternate days)
3. Recording bird behaviour (if sufficiently light to see at setting, alternate days)

It was intended that the normal length of longline deployed by fishers would be divided into two parts for this project. Given the number of hooks typically used on inshore surface longlines, two parts each of approximately 500 hooks was deemed to be an appropriate setup for this project. One part would bear snoods and experimental weights ("experimental line"). On the other part, the skipper would use his normal weight arrangement (or unweighted gear, if that was his normal practice) ("normal line"). Separating the weighted and unweighted snoods onto completely separate sections of longline ensured their independence. The two parts were to be set consecutively, i.e., without large breaks of time between. Set-up is shown in the diagram below (Figure 3). Whether the first line set on a day was an experimental line or a normal line was determined according to a random list of treatment orders issued to observers at the start of their deployments. After the first line was set in accordance with the required treatment order, the other line type was set. For example, on fishing day 1, the first line type was experimental. The next set would be normal. In contrast, on fishing day 3, the first set was normal, so the second set would be experimental. While these first two lines soaked, any other lines set were at the discretion of the skipper, until the next day. Fishing days ran from midnight to midnight.

Longline Part 1 ("experimental"): On the experimental line, 500 snoods were to be fitted with safe leads or lumo leads, attached at distances of 0.5 m from the hook. Twelve Time Depth Recorders (TDRs) were also to be fitted on this line on alternate days. For TDR deployment, four baskets at different points along the line were targeted. TDRs were not to be deployed on the first two or the last two baskets of the line. Three TDRs were to be deployed in each of the four TDR-baskets, approximately at ¼, ½ and ¾ of the way along the basket. TDRs were deployed on unbaited hooks to reduce the risk of them being lost due to a bite-off. To keep the setup and weighting of snoods with TDRs as similar to those without, old (i.e., no longer glowing) lightsticks were to be deployed on TDR snoods in two of the four baskets with TDRs (Figure 3).

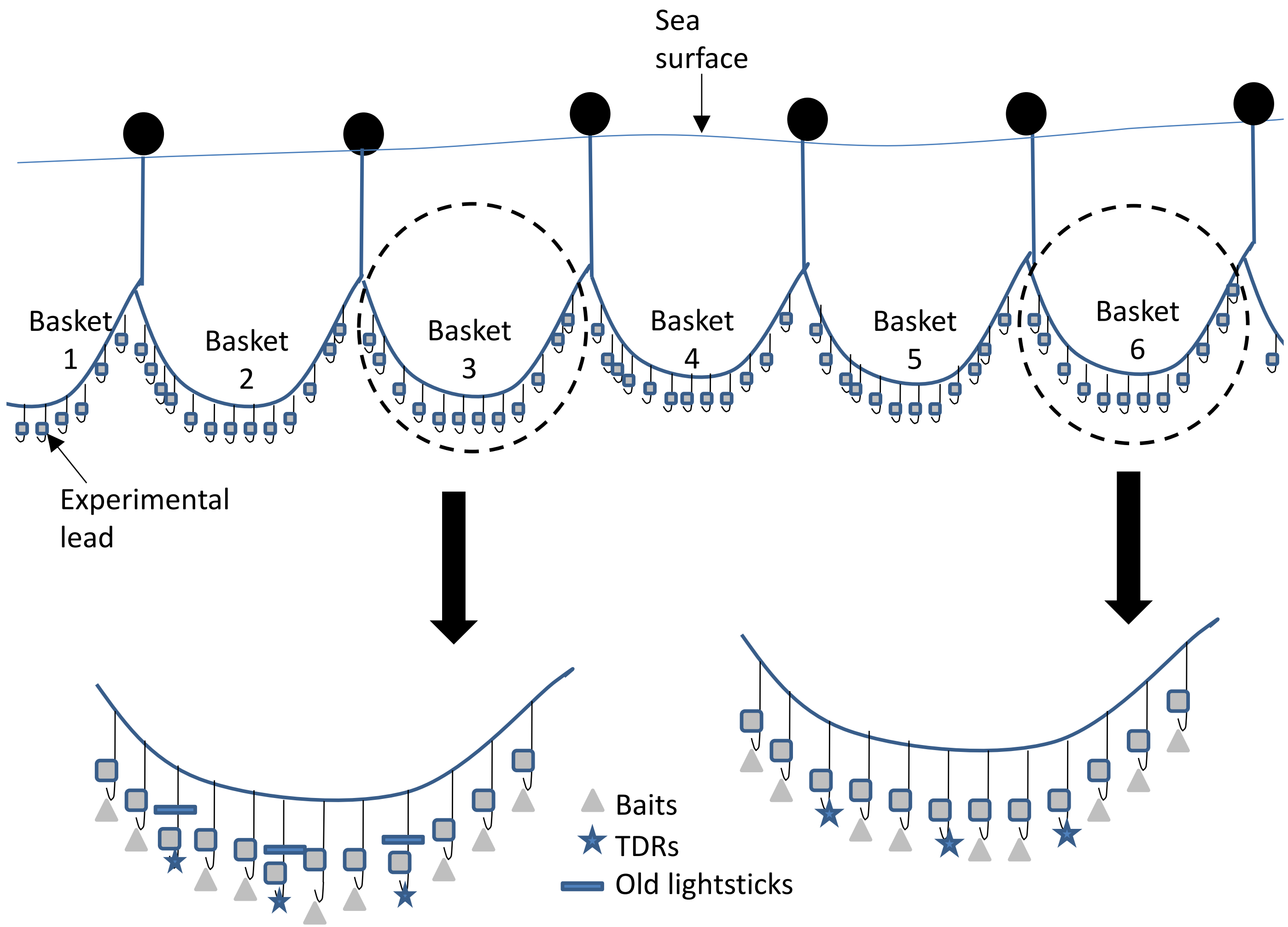

Figure 3. Gear set-up at line setting: Longline Part 1 (sizes and distances not to scale). See text above for details.

Longline Part 2 ("normal"): This line was to also comprise 500 snoods, set up as the fisher would normally operate. Twelve Starr-Oddi DST Centi Time Depth Recorders (TDRs) were to be deployed on this line on alternate days. As above, four baskets were selected for TDR deployment at different points along the line, excluding the first two and the last two baskets on the line. Three TDRs were to be deployed in each of the four TDR-baskets, approximately at ¼, ½ and ¾ of the way along the basket. As for the experimental line, TDRs were to be deployed on hooks without baits. Old lightsticks were to be deployed on snoods with TDRs as described for the experimental line.

Protocols used for deploying TDRs were developed from those used for previous work in longline fisheries (Goad et al. 2010; Goad 2011). TDRs were programmed at sea, using Sea Star software. Initially TDRs were set to record every 30 seconds for 30 minutes prior to the set, in order to record them acclimatising to seawater temperature in a bucket of seawater. After this was deemed impractical, this sampling period was dropped. TDRs were then set to record at one second intervals for a period sufficient to cover the set, followed by a lower sampling frequency of every 1 or 10 minutes to collect some data during the soak. Finally, TDRs sampled once every 24 hours in case the line was lost.

Information collected before and after TDR deployment included water depth, tidal flow and direction, weather including atmospheric pressure, wind speed and direction, swell height and direction, and vessel course. For each TDR, the TDR number, position on the line, time it left the vessel, and time it entered the water were recorded. Gear setup was also recorded in detail for each longline deployed with TDRs, including the vertical distance between the backbone at the stern and the water surface, the dimensions and order of hooks and floats, snood spacing, length, diameter, material and breaking strain, and the lengths of float ropes used. TDRs were clipped onto the longline at setting. After hauling, TDR data were downloaded using Sea Star.

Finally, if sufficient light was available on setting after TDR deployments were complete, observers were tasked with making observations of seabird abundance and diving activity, two indirect metrics describing the risk of seabird captures. These metrics were quantified in an area 30 m (across the vessel stern) by 75 m (behind the vessel) (Figure 4).

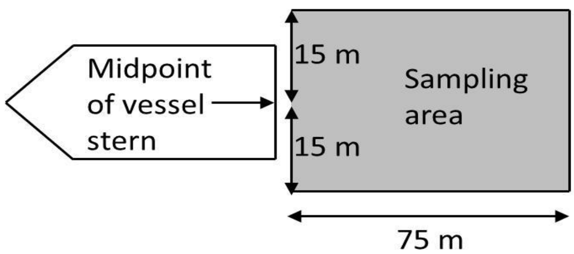

Figure 4. The sampling area in which to count seabirds, and seabird dives, astern the vessel.

Prior to commencing observations, vessel and environmental covariates were documented (e.g., vessel speed, number of other vessels visible, swell height, wind strength). Each abundance count took no longer than 5 minutes. Each period of dive sampling was fixed at 5 minutes in duration. A set of observations included one abundance count followed by four dive counts and another abundance count. Observers were tasked with making as many of these sets of observations as they could fit in around their other duties. They were able to take breaks between sets of observations as needed.

The abundances of seabirds were to be counted using a series of sweeps through the sampling area (Figure 4). Seabirds were not identified to species. Instead, three groupings were utilised:

- Large birds: All albatrosses, northern and southern giant petrels
- Small birds: All petrels, shearwaters and prions (except giant petrels and cape petrels)
- Cape petrels: *Daption capense*

The number of 'dives' was also recorded by species groups in the area shown in Figure 4. A 'dive' is defined as a bird putting its head under the water (which we interpret as the intention of foraging, and therefore potentially eating a bait (e.g., Pierre and Norden 2006)). 'Dives' also included when a petrel/shearwater brought up a bait to the surface, and an albatross subsequently attacked that bait.

<u>Hauling:</u>

During hauling, observers were tasked with five main duties. These were to be undertaken every day or on alternate days as indicated below.

1. Documenting the fish catch (daily)
2. Recording any seabirds caught (daily)
3. Recording the occurrence and result of any bite-offs or situations where the hook pulled out of the caught fish,
4. Recording when safe leads or lumo leads slipped on the snoods (alternate days as a minimum, but daily if possible as these are a rare event).
5. Recording the positions of lightsticks on snoods and snoods with TDRs along the lines deployed (alternate days).

When observers were unable to complete their work and keep pace with hauling speed, they were able to reduce data collection in a structured way (e.g., sampling every second snood, or alternating baskets on the haul).

Documentation of fish catch is a component of the normal duties carried out by government fisheries observers. However, in this project, it was of particular interest to attribute catch to each snood in case the mitigation measures applied affected catch. Details of fish catch included species, time landed, status of the fish on landing, fish size, any samples taken, etc. (See the Gear and Catch Details Form, Figure 5). Observers also recorded bite-offs and slippage of safe leads and lumo weights on snoods.

At the conclusion of the haul, observers were tasked with checking the position of experimental weights on the snoods. It was intended that this be consistent (0.5 m from the hook) for both weight types and all experimental sets.

Throughout the trip, observers were also requested to report their own impressions of the safety of the safe leads and lumo leads, and any feedback from the crew on safety or other aspects of line-weighting.

Gear and Catch Details Form

Page ____ of ____

Trip No. [ ]   Set No. [ ]

Observer ______________   Vessel ______________

Snood No.	Weight Type - (SL) Safe lead (LL) Lumo lead (WS) Weighted swivel (DT) Other (U) Unknown	(T) TDR (L) Lightstick (S) Unobserved	Loss Type - (B) Bite off (R) Hooked ripped from fish	Loss outcome*	Weight distance (cm) from hook at haul (SL/LL only)	Sample number	Spp. code	Time landed	Status codes*	Damage*	Fork length	Length 2	Green weight	Proc. weight code	Processed weight	Sex	Sample codes*	Notes

Weight codes

Note: When the same weight type is used on all snoods, write the code once for snood 1 only.

SL	Safe lead		
LL	Lumo lead		
WS	Weighted swivel		
DW	Double-weighted branchline		
	C	Weight at clip	
	H	Weight at hook	
	E	Weight elsewhere	
O	Other		
N	None		

Losses

Bite-offs	B
Hooks ripped from fish	H

Outcome of loss

0	Weight doesn't move on snood
1	SL/LL slides but stays on line
2	SL/LL slides off line
3	Weight flies back at vessel < 1 m above waterline
4	Weight flies back at vessel > 1 m above waterline
H	Snood in hand when loss occurred
B	Snood on backbone when loss occurred

Position of snood at time of loss

H	In hand
B	On backbone

Status on landing codes

Code	Status	Code	Status
1	Alive	R	Retained
2	Dead	D	Discarded
3	Killed by crew	L	Lost
4	Unobserved	F	Finned
		U	Unobserved

Processed weight codes

Code	Type of Processing
GR	Green
FW	Filleted weight
HG	Headed and gutted
SP	STN processed
SI	As for SP, tail intact
FT	Fins trimmed only
OT	Other

Sex

1	Male
2	Female
3	Unknown
4	Not sexed

Damage codes

Code	Damage type
1	Net slight
2	Net Moderate
3	Net Severe
4	Net old
5	Shark
6	Seal
7	Orca
8	Propeller
9	Cookie-cutter shark
10	Old hooks
11	Unidentified
12	Other

Sample codes

Code	Sample
1	Head
2	Viscera
3	Head and viscera
4	Fillet/half steak
5	Stomach (stomach log)
6	Both otoliths
7	One otolith
8	Tail
9	Gonads
10	Liver
11	Dorsal fin
12	Anal fin
13	Vertebrae
14	Entire specimen
15	White muscle
16	Eye
17	Photo
18	Gillraker
19	Blood
20	Scale
21	Stomach contents - kept
22	Embryos

Figure 5. The Gear and Catch Details Form used by observers deployed during line-weighting trials

Implementation of at-sea data collection

Government fisheries observers and skippers were briefed by MPI Observer Services staff and the project team prior to going to sea. Involvement of skippers in the project was voluntary. Typically, prior to observer deployments, skippers were provided with a small number of weights by the project team to inform their decision on whether to fit out a significant number of snoods with the new devices. When weights were given to skippers, a discussion about safety covered the potential risks associated with using weighted gear and the need for ongoing caution. Prior to being deployed, potential safety issues were also discussed with observers. Written material on safety and previous work with safe leads and lumo leads was also provided to skippers and observers before weights were used on vessels.

Once at sea, observers worked with skippers to implement the project design and data collection regime, with varying degrees of success (see Results). On their return to land after deployment, observers were debriefed by MPI Observer Services staff and the project team. Both groups also provided feedback and ongoing advice on trial implementation during observer deployments.

Data analysis

Data collected by TDRs were downloaded at sea. A correction to the raw TDR data was applied, following similar methods to those in Goad et al. (2010). This correction comprised two parts. First, an offset was applied such that TDR readings were 0 m at the sea surface. Second, readings of surface temperature were corrected because TDRs take some time to acclimatise to a change in temperature, and use temperature readings when converting pressure readings to a depth.

Observers found it difficult to deploy TDRs and accurately record the time the hook entered the water as well as the time the snood was clipped onto the backbone. Priority was given to the clip-on time but accurate times were not always available, and in some cases the watch used was not synchronised to the TDR clocks. Consequently four plots of TDR depth versus time were constructed for each deployment, using the following start times, when available: recorded time the TDR entered the water, the estimated time the TDR entered the water based on TDR temperature records, the recorded clip on time, and the time the TDR started to sink consistently away from the surface.

Given the small amount of data collected to date on weight deployments and fish catch, these data have not been analysed. However, all data collected is being double-entered into a secure online database and cross-checked. Then, entered data will be examined using grooming rules implemented through a programming framework. These rules will be constructed specifically for the dataset. This will ensure data are available in a form that is readily usable for any future work in this area.

3. RESULTS TO DATE

Eighteen surface longline skippers have been contacted by MPI Observer Services and the project team to date. As part of that contact, skippers' interest in taking part in line-weighting trials was explored. Skippers' views on observer coverage, line-weighting and taking part in the project were mixed. These included skippers:

- conveying that they would not take part in the project due to safety concerns about line-weighting,
- not wanting to set during the day and therefore having no requirement for weighting under the current legal specifications,
- considering that the current weighting regime they deployed (i.e., weighted swivels) was sufficient for seabird bycatch reduction,
- not wanting to host an observer as, given the size of the vessel, this meant a crew member would be dropped for the period of the observer's deployment,
- participating in the surface longline fishery for part of the year only and therefore not being available for coverage, and,
- not returning calls when contact was attempted.

Of those 18 vessels, observed trips involving experimental weights have been conducted on two vessels in the first year of this project. Total sea days for the two trial trips are shown in Table 2. Note that bad weather and time spent in port consumed some observer days on both trips.

Table 1. Observer days counted against the planned observer days for the year ending June 30. This includes observer days at sea and onshore. Hooks set shows the range in the number of hooks set per longline during the trip. Main retained catch shows the commercial species most commonly caught and retained during the trip: ALB = albacore tuna (*Thunnus alalunga*), STN = southern bluefin tuna (*Thunnus maccoyii*), BWS = blue shark (*Prionace glauca*), MOO = moonfish (*Lampris guttatus*), POS = porbeagle shark (*Lamna nasus*), SWO = broadbill swordfish (*Xiphias gladius*), RBM = Ray's bream (*Brama brama*).

Trip	Vessel	Weight deployed	Days 2012/13	Days 2013/14	Sets completed	Hooks set / line	Main retained catch
3768	A	Safe leads	21	59	8	1 000 - 1 400	ALB, BWS, RBM, STN, SWO
3786	B	Lumo leads	-	31	12	600 - 950	ALB, MOO, POS, STN, SWO

During the development of the experimental protocol, feedback received from skippers and observers was that skippers were broadly comfortable with the concept of splitting their longline backbone into two pieces, one for the weighted and the other for the unweighted snoods. However, on the two trips undertaken, neither skipper was willing to split the backbone. One skipper considered that splitting the line into two parts would affect fish catch rates. He was also concerned that the two sections would tangle unless located ≥ 2 nm apart, which would add extra time into an already long hauling day. When cutting the line was not supported, the skipper was asked to consider locating a gap of one to two baskets of monofilament with no snoods between the sections of backbone carrying weighted and unweighted snoods. He was unwilling to do this. Instead of physically separating the longline or having a gap between parts, lines were run out as normal but with the two types of snoods attached. That is, all sets completed (enumerated in Table 2) included sections with weighted and unweighted snoods.

Observers reported that vessel setup (e.g., deck configuration and crewing arrangements) strongly influenced the workability of line-weighting and the weighting trials. Moving heavy bins of weighted snoods around the deck area meant that a vessel setup with the shooting and hauling bays in different locations was not ideal. Similarly, any obstacles such as staircases or hatches between the setting and hauling bays made carrying bins of snoods more difficult. Cramped setting or hauling bays where observers and crew needed to work in close quarters were not desirable. Keeping track of the activities of multiple crew members was also challenging for observers when they needed to monitor the gear snood by snood.

Observers worked with crews to incorporate setting unbaited hooks with TDRs attached into the setting operation. One observer found this easiest using a separate drum of snoods and setting the hooks directly from this. On the other vessel it was deemed easier to take a set of snoods out at the haul, attach TDRs, coil the snoods up and then deploy them from the coils. In both cases acclimatising TDRs to sea water temperature prior to setting whilst maintaining normal setting practice was not practical.

Observers reported that the workload created by overlaying the line-weighting project on top of normal observer duties was too high. The programming, setting and downloading of 24 TDRs took considerable time, and although this was possible observers favoured setting less TDRs (up to 12 per line) but deploying them daily, when weather conditions were conducive. Trouble programming and downloading TDRs at sea due to electrical interference disrupted TDR data collection but was overcome, following advice from Starr-Oddi. Observers were unable to keep up with the work especially during hauling, and felt that unreasonably long hours were required to complete the tasks requested of them. In consultation with MPI scientists, Observer Services staff revised the tasking for observers and reduced the amount of non-project work requested. However, observers still felt that keeping track of gear on the haul was especially difficult and when tangles occurred or a landed catch item needed particular attention, they were not able to keep up. Structured approaches to managing gear monitoring on the haul (e.g., documenting every second basket) did not get significant traction with observers. Observers reported that collecting the observations in an electronic (rather than a paper) form would have made the data collection more manageable. Only collecting the data required for the line-weighting project work was also considered to be feasible. One observer suggested that having two data collectors would be valuable, as tasks could be divided between the two (e.g., TDR retrieval and data recording, or fish processing on hauling and data recording).

As a result of the challenges with implementing the intended project design and data collection at sea, data that were collected are of constrained quality. For example:

- parts of lines carrying weighted and unweighted snoods were joined and so not independent,
- there are often gaps in what observers have been able to record,
- matching the configuration of lines set and hauled is difficult,
- TDR deployment is relatively variable rather than consistent,
- the number of weighted and unweighted snoods deployed varied during trips (e.g., as weights were lost and not replaced) and between sets (e.g., given variation in the number of snoods set), and,
- the distances of weights from hooks may not be consistent amongst snoods.

All these factors constrain the robustness of the analysis and conclusions drawn.

However, despite the constraints of data collection, sink profiles were obtained from both observed trips.

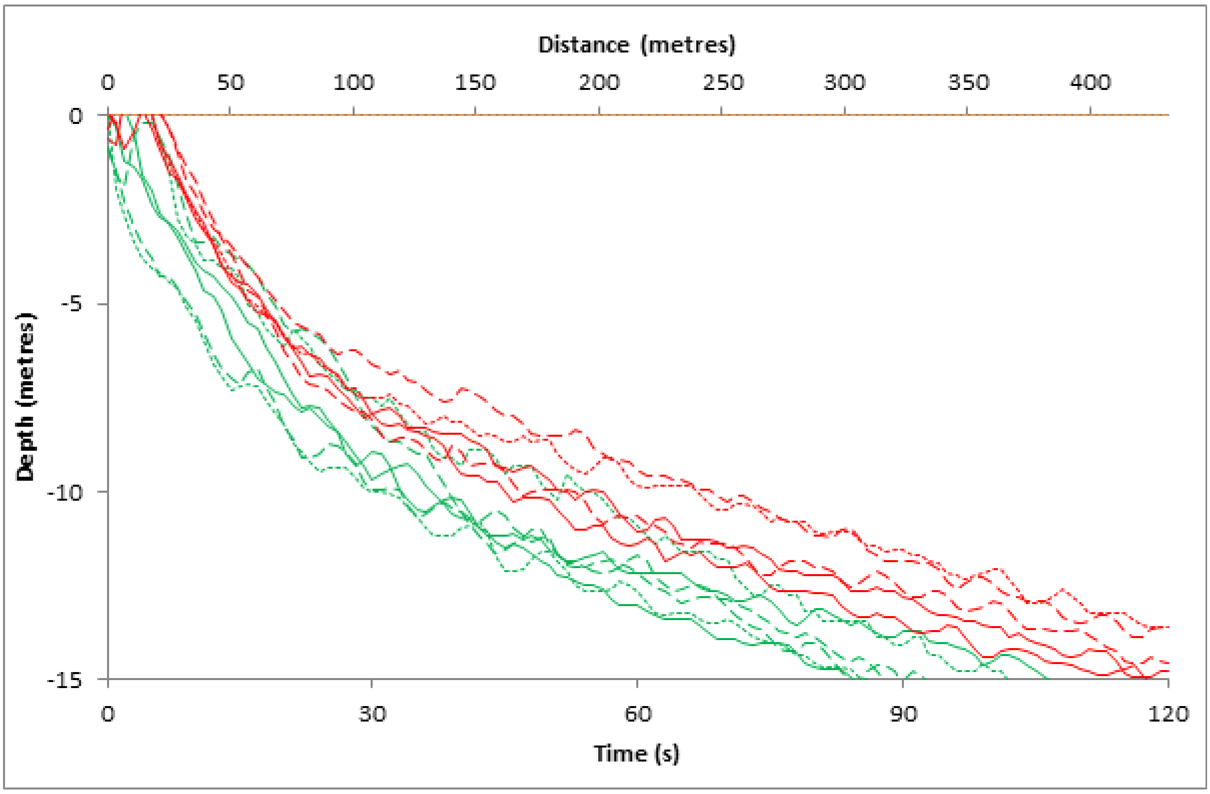

Figure 6: Time after snoods were clipped onto the backbone and the distance behind the vessel versus the depth of time depth recorders (TDRs). Red lines show TDRs on normal gear and green represents TDRs on experimental gear (carrying safe leads). Dotted lines are ¼ way into a basket, dashed lines are midway and solid lines are ¾ of the way into the basket. Distance is calculated from the vessel's GPS derived speed. Data from vessel A.

Plotting time after the TDRs were clipped onto the longline, versus depth, shows three stages to the sink profile. Initially some hooks stayed near the surface, presumably held up in the propeller wash, then sink rate is relatively fast to a depth corresponding approximately with the length of the snood, followed by a slower sink rate which is presumably limited by the sink rate of the backbone (Figure 6).

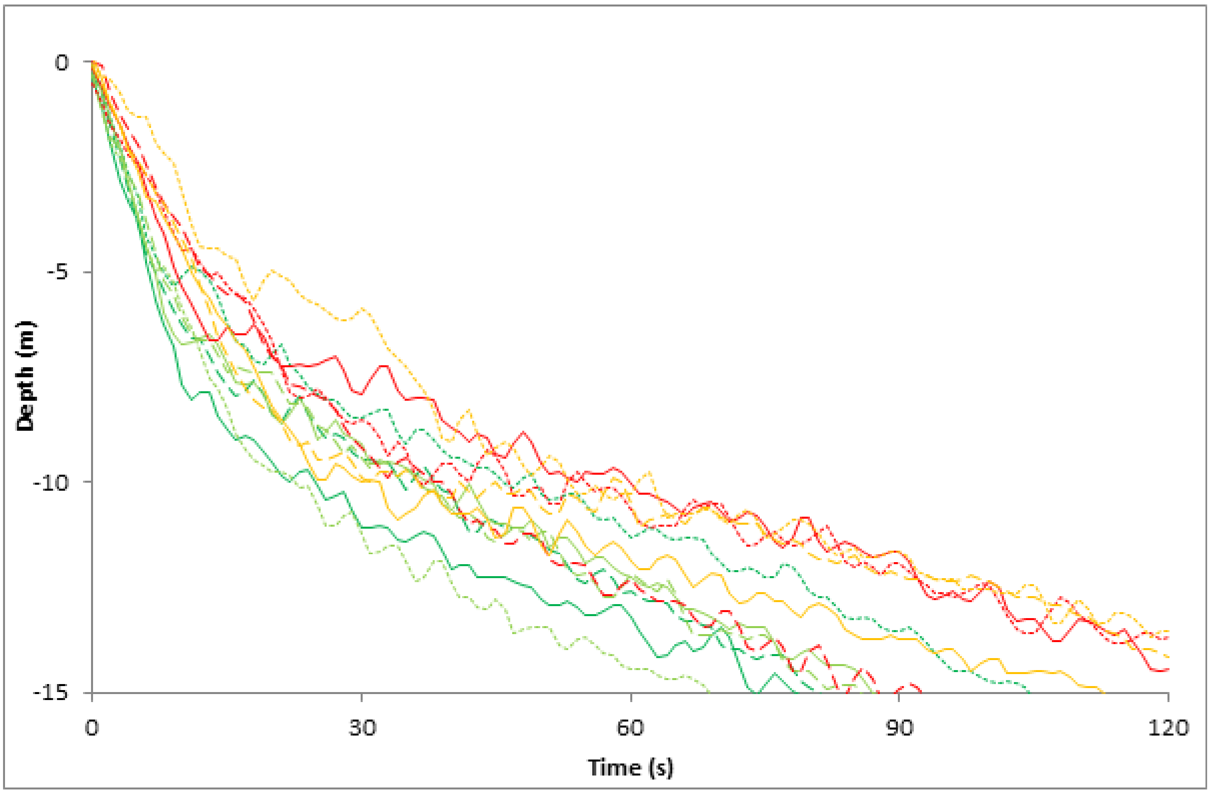

Figure 7: Time after time depth recorders (TDRs) start sinking consistently versus depth. Light and dark green lines are from baskets fitted with lumo leads with, and without, a moneymaker float mid-basket, respectively. Similarly, red and orange lines are from normal gear with and without a moneymaker float. Dotted lines are ¼ way into a basket, dashed lines are midway and solid lines are ¾ way into the basket. Data from vessel B.

Plotting time after the hook starts sinking continuously versus depth provides a clearer indication of the increase in sink rate attributable to the addition of weights at the hook, especially at depths shallower than 5 m (Figure 7).

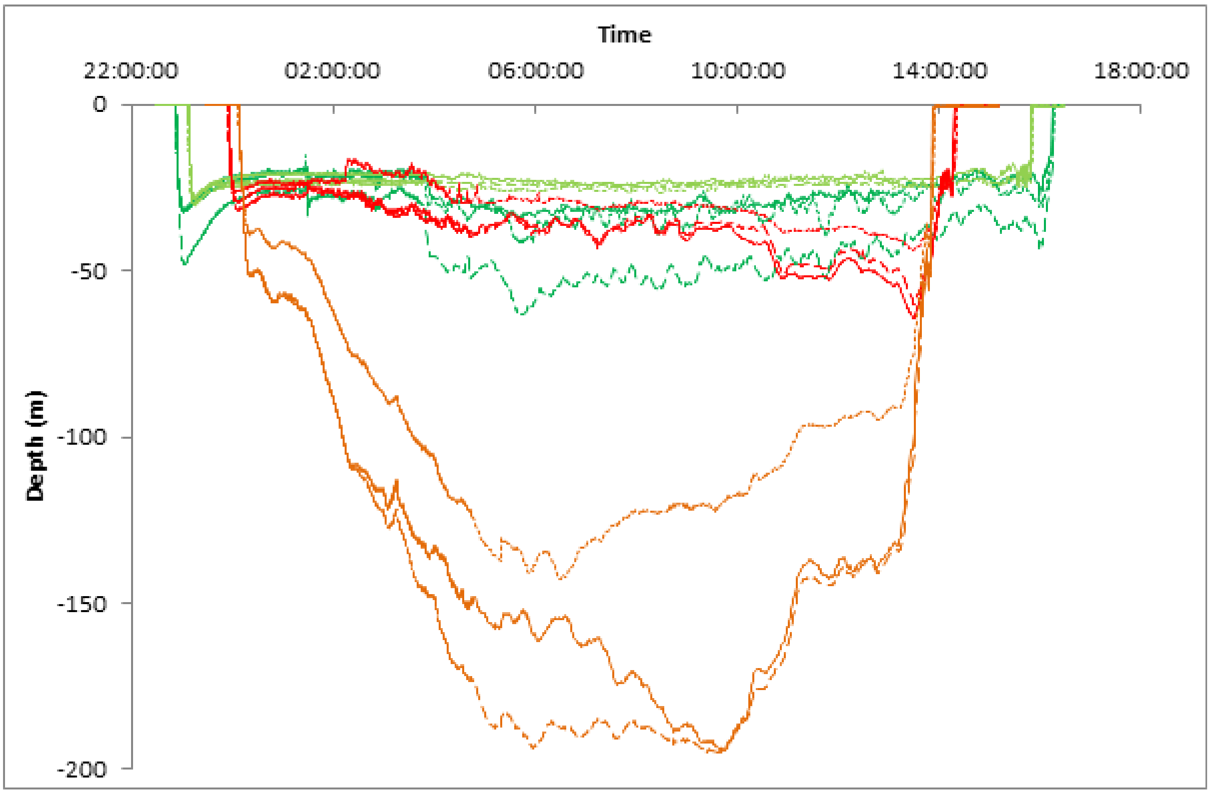

Figure 8: Graph showing time versus depth for time depth recorders for the duration of the set, haul and soak. The set finished at 00:30 and the haul started at 12:50. Light and dark green lines are from gear fitted with lumo leads with and without a moneymaker float respectively. Similarly red and orange lines are from normal gear with and without a moneymaker float. Dotted lines are ¼ way into a basket, dashed lines midway and solid line ¾ way into the basket. Data from vessel B.

TDR records from the soak (e.g., Figure 8) provide an indication of the depths fished using normal and experimental gear. This information allowed skippers to adapt basket size, for example, to target similar depths with normal and experimental lines.

One observer reflected that he and the crew felt safe using the weights, and stopped wearing safety helmets after the fifth set conducted during the trip. Only one incident of a concerning nature from a safety perspective was reported, and this occurred when the observer was not on the vessel. A blue shark estimated to be over 20 kg in weight had been hooked, and this animal actively swam away from the vessel. Eventually the shark's teeth cut through the monofilament line securing the hook but the crimp at the end of the snood remained in place. As a result, the safe lead could not slide off despite the extreme stretching the monofilament underwent. The snood and safe lead flew back and hit the vessel approximately 1 m forward of the skipper's location at the hauling station. The safe lead deformed on impact, but the rubber o-rings remained in place.

More generally reflecting on operational feasibility of the weights, observers reported that the safe leads could be fiddly to install on snoods and ensuring weights were at a consistent distance from the hooks prior to setting was a difficult task given how gear was stored. The weight of the safe leads (e.g., when stored in bins, as mentioned above), meant that one skipper who saw merit in weighting preferred a lighter weight (e.g., the commercially-available 40 g lumo leads).

4. CONCLUSIONS AND RECOMMENDATIONS

Key factors influencing the execution of this work to date are as follows:

- The use of government fisheries observer coverage as a platform on which to base data collection at sea.

  Observers have reported that the amount of work involved in their normal duties, plus project-related tasks, to be unmanageable.

- Skippers were reluctant to be involved in line-weighting trials for a variety of reasons, including safety, their level of personal interest, and vessel availability.

  The lack of interest from skippers reduced the pool of vessels available for this work significantly.

- Skippers did not want to change their gear setup to fully accommodate the trials.

  This constrained the implementation of the trial significantly, in particular limiting the quality of the experimental design that could be used.

- The setup of some vessels.

  Such experimental work appears more appropriate on more spacious vessels, to ensure that data collection can be accomplished effectively, and with minimal disruption of fishing activities. Flexibility in crew operations also facilitates project work.

- Data collection in hard copy rather than an electronic form

  Observers considered that collecting data electronically could have made their tasking more manageable than using hard copy forms.

To maximise the likelihood of a successful outcome to future work, a change in approach is recommended. While the use of normal government observer coverage for project implementation and data collection has worked well on larger offshore vessels (e.g., trawlers, Pierre et al. 2012) it is not recommended in the smaller-vessel inshore surface longline fleet. Instead, the deployment of (paid) technicians dedicated to project implementation and data collection on board vessels is proposed. It is recommended that technicians are deployed on vessels with skippers willing to be involved in experimental trials. Skippers must be amenable to changing the setup of their gear to suit the requirements of the project. To recognise that this represents a departure from normal practice for skippers, it is recommended that a partial or full charter option is explored. For example, crew would retain commercial species caught on the trip, and would also be paid a portion or all running costs for the day of vessel operations.

While fewer days of data collection may be undertaken through such an approach, data collected would be of higher quality and therefore greater value than under a compromised experimental regime.

5. ACKNOWLEDGEMENTS

Thanks to participants in the Technical Advisory Group who helped initiate this project (K. Baird, B. Baker, S. Brouwer, I. Debski, H. Jusseit, L. Mitchell, K. Ramm, B. Sharp, J. Williamson), observers deployed (R.Coy, S. Hornby), and the vessel owners, skippers and crews who altered their fishing operations and worked cooperatively with observers at sea to allow the project to be undertaken.

This project was funded by the Department of Conservation's Conservation Services Programme as projects MIT 2012-04, principally through a levy on the quota holders of relevant commercial fish stocks. The Ministry for Primary Industries coordinated observer deployments and supplied additional funding.

References

Abraham, E. R., and Thompson, F. N. 2011. Estimated capture of seabirds in New Zealand trawl and longline fisheries, 2002–03 to 2008–09. New Zealand Aquatic Environment and Biodiversity Report No. 79. Ministry of Fisheries, Wellington.

ACAP. 2011. ACAP summary advice for reducing impact of pelagic longlines on seabirds. Agreement on the Conservation of Albatrosses and Petrels. Sixth Meeting of the Advisory Committee, Guayaquil, Ecuador, 29 August – 2 September 2011. AC6 Doc 14 Rev4.

Anderson, O.R.J., Small, C., Croxall, J.P., Dunn, E.K., Sullivan, B.J., Yates, O., Black, A. 2011. Global seabird bycatch in longline fisheries. Endangered Species Research 14: 91-106.

Baker, G.B., Double, M.C., Gales, R., Tuck, G., Abbott, C.L., Ryan, P.G., Petersen, S.L., Robertson, C.J.R., and Alderman, R. 2007. A global assessment of the impact of fisheries-related mortality on shy and white-capped albatrosses: Conservation implications. Biological Conservation 137: 319-333.

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

Bull, L.S. 2007. Reducing seabird bycatch in longline, trawl and gillnet fisheries. Fish and Fisheries 8: 31-56.

FAO. 1999. International Plan of Action for Reducing Incidental Bycatch of Seabirds in Longline Fisheries. FAO, Rome.

Goad, D. (2011). MIT2010/01 development of mitigation strategies: inshore fisheries. Research Report held by the Department of Conservation, Wellington. Available at: http://www.doc.govt.nz/publications/conservation/marine-and-coastal/conservation-services-programme/csp-reports/development-of-mitigation-strategies-inshore-fisheries/

Goad, D.; Temple, S.; Williamson, J. (2010). MIT2009/01 development of mitigation strategies: inshore fisheries. Draft Research Report held by the Department of Conservation, Wellington. Available at: http://www.doc.govt.nz/publications/conservation/marine-and-coastal/conservation-services-programme/csp-reports/development-of-mitigation-strategies-for-inshore-fisheries/

Marine Safety Solutions Ltd. 2008. Safe lead impact study: Impact comparisons between SLL snoods fitted with safe leads, weighted swivels and no line weighting. Unpublished report, Department of Conservation. Available at: www.doc.govt.nz/conservation/marine-and-coastal/conservation-services-programme/csp-reports/archive/2007-2008/safe-lead-impact-study/

Maritime New Zealand. 2003. Maritime Operations Boat Notice – 03/2003 May. Protective clothing on fishing boats. Maritime New Zealand, Wellington.

Maritime New Zealand. 1996. Maritime New Zealand Guidelines: Boat Notice BN 07/1996 May. Hazards with surface longline fishing. Maritime New Zealand, Wellington.

New Zealand Government. 2008. Fisheries (Seabird Sustainability Measures—Surface Longlines) Notice 2008 (No. F429). New Zealand Gazette 21 February 2008, No. 31. New Zealand Government, Wellington.

Pierre, J.P. and Norden, W.S. 2006. Reducing seabird bycatch in longline fisheries using a natural olfactory deterrent. Biological Conservation 106: 406-415.

Pierre, J.P., Abraham, E.R., Richard, Y., Cleal, J. and Middleton, D.A.J. 2012. Controlling trawler waste discharge to reduce seabird mortality. Fisheries Research 131-133: 30-38.

Richard, Y. and Abraham, E.R. 2013. Application of Potential Biological Removal methods to seabird populations. New Zealand Aquatic Environment and Biodiversity Report No. 108. 30 p.

Robertson, G. and Domingo, A. 2011. SBWG-4 Doc 06 Rev2: Progress report on the BS30 Underwater Bait Setter for pelagic longline fisheries. Agreement on the Conservation of Albatrosses and Petrels: Sixth Meeting of the Advisory Committee, Guayaquil, Ecuador, 29 August – 2 September 2011.

Sullivan, B. 2011: Hook Pod Update. SBWG-4 Doc 10 Rev 1. Fourth Meeting of the Seabird Bycatch Working Group, Agreement on the Conservation of Albatrosses and Petrels: Sixth Meeting of the Advisory Committee, Guayaquil, Ecuador, 22 – 24 August 2011.

Sullivan, B.J., Kibel, P., Robertson, G., Kibel, B., Goren, M., Candy, S.G. and Wienecke, B. 2012. Safe Leads for safe heads: safer line weights for pelagic longline fisheries. Fisheries Research 134–136: 125– 132.

WWF. 2011. Yamazaki Double-Weight Branchline Factsheet. Available at: http://www.wwf.or.jp/activities/upfiles/WINNER_TUNA-Prizes-Double-Branchline-Fact.pdf