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Seabird bycatch reduction in New Zealand surface longline fisheries

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SUMMARY

Surface longline fisheries continue to represent a bycatch risk to seabirds in New Zealand waters, including for ACAP-listed species. This paper summarises the methodological approach to trials of bycatch reduction measures to be tested in these fisheries in 2013. SafeLeads and lumo leads will be tested as a first priority. Trials of hook pods and possibly the Smart Tuna Hook are planned as a second phase of experimental work. Trained government fisheries observers will carry out testing of safe weights. The experimental methodology comprises a control and experimental longline. Response variables include line sink rates and seabird activity. Details of fish catch and seabird catch will also be recorded as a normal part of observer duties in surface longline fisheries. While initial work will focus on smaller inshore vessels, trialling mitigation measures on larger charter vessels is also planned.

RECOMMENDATIONS

1. That the Seabird Bycatch Working Group encourages the use, in different areas or fleets, of robust methods that are as similar as possible in order to maximise the comparability of experimental results.
2. That tests of mitigation measures involving manipulation of fishing gear include should include where possible the consideration of fish catch, as well as impacts on seabirds, as part of an overall assessment of efficacy.

Reducción de la captura secundaria de aves marinas en las pesquerías de palangre de superficie en Nueva Zelandia

Las pesquerías de palangre de superficie continúan representando un riesgo de captura secundaria para las aves marinas en las aguas de Nueva Zelandia, incluidas las especies incluidas en la lista del ACAP. Este documento resume el enfoque metodológico para las pruebas de las medidas de reducción de la captura secundaria que se evaluarán en estas

pesquerías en 2013. Se evaluaran SafeLeads y Lumo leads como una prioridad principal. Como segunda fase del trabajo experimental se planificaron pruebas de Hook Pod y posiblemente el Smart Tuna Hook. Las pruebas de los pesos seguros serán realizadas por observadores de pesquerías capacitados del gobierno. La metodología experimental comprende un palangre de control y uno experimental. Las variables de respuesta incluye las tasas de hundimiento de las líneas y actividad de las aves marinas. Asimismo, se registrarán detalles de la captura de peces y captura de aves marinas como parte normal de las tareas del observador en las pesquerías de palangre de superficie. Si bien el trabajo inicial se centrará en los buques costeros más pequeños, también está previsto realizar pruebas de las medidas de mitigación en buques contratados de mayor tamaño.

RECOMENDACIONES

1. Que el Grupo de Trabajo de Captura Secundaria de Aves Marinas aliente el uso, en distintas áreas o flotas, de métodos sólidos que sean tan similares como sea posible para maximizar la comparablidad de los resultados experimentales.
2. Que las pruebas de las medidas de mitigación que impliquen la manipulación equipos de pesca incluyan, cuando sea posible, el análisis de la captura de peces así como el efecto en las aves marinas, como parte de una evaluación general de la eficacia.

Réduction des captures accessoires d'oiseaux de mer dans les pêcheries à la palangre de la Nouvelle-Zélande

Les pêcheries à la palangre continuent de présenter des risques de capture accessoire d'oiseaux de mer dans les pêcheries des eaux de la Nouvelle-Zélande, y compris les espèces inscrites à l'ACAP. Ce document présente la méthodologique employée pour des essais de mesures de réduction des captures accesssoires dans ces pêcheries, prévus pour 2013. Nous envisageons d'effectuer des essais de lancers SafeLead et Lumo en priorité. La deuxième phase portera sur des casiers à hameçons et si possible sur des le dispositif d'hameçons de thon SmartTuna. Des observateurs venant des pêcheries du gouvernement seront formés en vue des essais et effectueront les tests de poids vif. La méthodologie se compose d'une palangre de contrÔle et d'une palangre expérimentale. Les facteurs de variabilité à prendre en compte dans les résultats incluent le taux de pose ainsi que les activités des oiseaux de mer. Les détails de la capture des poissons ainsi que des oiseax seront notés selon la procédure normale comme c'est actuellement le cas pour les palangriers dotés d'observateurs. Au stade initial ce travail touchera surtout les petits palangriers des régions cÔtières, cependant d'autres essais de mesures de réduction sont éventuellement envisagés sur des navires effectuant leurs opérations au large.

RECOMMANDATION

1. Que le Groupe de Travail encourage l'utilisation de méthodes robustes dans d'autres zones ou régions de pêche, qui se rapprocheraient de celles qui sont proposées et qui assureraient le maximum de comparaison avec nos résultats
2. Que tout essai d'une mesure de réduction de la capture accessoire, si cet essai

comprend une manipulation de l'engin de pêche, devrait inclure si possible la capture des poissons de même que l'impact sur les oiseaux de mer, ceci dans le but d'obtenir une vue globale de l'efficacité de la mesure.

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).

Characteristics of surface longline gear that exacerbate the risk of seabird bycatch include its relatively light weight and long snoods, which keeps hooks within reach of seabirds for significant periods, the attractiveness of baits to seabirds, and the very long lengths of lines that are deployed with hooks attached (Bull 2007). Mitigation measures in this fishery 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 New Zealand fisheries demonstrate that the available measures do not preclude the existence of significant bycatch risk (Richard et al. 2011). This may be due to a variety of reasons including, for example, inconsistent (or lack of) implementation, incompatibility with gear configurations or implementation of insufficient measures (e.g., night-setting without line-weighting). Globally, research is ongoing into new measures aiming to reduce seabird bycatch in surface longline fisheries, including SafeLeads (Sullivan et al. 2012), hook pods (Sullivan 2011), an underwater line-setter, and double-weighted branchlines (WWF 2011). Following promising results from trials of such innovative devices elsewhere, the objective of the work described here is to test one or more mitigation methods which reduce the availability of hooks to seabirds at line-setting in New Zealand surface longline fisheries. This objective comprises two components (CSP 2012):

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

Following a workshop involving government, scientists, stakeholders, and fishers, two methods were selected for testing during the first series of trials. These were SafeLeads and Lumo leads. When testing is completed on those methods, the intention is to trial methods that are still in the development phase, specifically hook pods. Depending on the changing legal context around marine pollution[1], the Smart Tuna Hook may also be deployed.

2. METHODOLOGICAL APPROACH

The New Zealand Government's fisheries observer programme will be used as the experimental platform for this work. Observers are trained to record many different types of fisheries and bycatch data and information. Specific protocols have been developed for use by observers undertaking work testing mitigation measures. Observers will be briefed on these in detail. Skippers will also be briefed on the requirements of the trials, prior to the deployment of observers, to help ensure work can be undertaken smoothly on all vessels involved. At-sea methods to be used by observers, and to be used for data analysis, are summarised below. While this document identifies safe leads and lumo leads specifically, similar approaches will be used to test all mitigation measures included in this project, thereby maximising the comparability of results obtained.

2.1. At-sea trials

Fisheries observers will be given a set of priority tasks to focus on daily (Table 1).

Table 1. Observer tasking during mitigation trials on surface longline vessels.

Every day	**Every second day (tasks in priority order)**
Check weight set-up before deployment	Deploy TDRs
Record fish catch	Record lightstick placement
Record seabird catch	Record bite-offs or hook pull-outs and weight slippage*
	Record bird behaviour

*Note: These are rare events and to be recorded daily if possible.

2.1.1 Setting

During the set, there are three main sets of tasks for observers to complete.

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 it is sufficiently light to see, alternate days)

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[1] http://www.maritimenz.govt.nz/Publications-and-forms/Safe-Seas-Clean-Seas/Issue-42-11.asp

Gear set-up:

The longline will be set in two parts for these trials. One part will be set up normally, and one will involve the deployment of the experimental weighting measure. The two parts will be set consecutively, i.e., without large breaks of time between. Set-up is shown in Figure 1. Whether the first line set on a day is an experimental line or a normal line is determined randomly.

Longline Part 1 ("experimental"): 500 snoods will be fitted with safe leads or lumo leads, at a distance of 0.5 m from the hook. Twelve Time Depth Recorders (TDRs) will be fitted on this line *on alternate days*. For TDR deployment, four baskets at different points along the line will be targeted. The first two and the last two baskets on the line, and adjacent baskets, will be avoided for TDR deployment. Three TDRs will be deployed in each of the four TDR-baskets, at ¼, ½ and ¾ of the way along the basket. To create a similar situation to normal fishing operations, but without exacerbating the risk of TDR loss through bite-offs, old (i.e., no longer glowing) lightsticks will be deployed on all TDR snoods in 2 of the 4 baskets with TDRs (i.e., the first and third baskets with TDRs have 3 snoods carrying both TDRs and old lightsticks, and the second and fourth baskets with TDRs have 3 snoods with TDRs but no lightsticks).

Longline Part 2 ("normal"): This line will also comprise 500 snoods, which will be set up as the fisher normally operates. Twelve TDRs will also be deployed on this line on alternate days. As above, for TDR deployment, four baskets will be targeted at different points along the line, avoiding the first two and last two baskets, and avoiding adjacent baskets. As above, old lightsticks will be deployed on snoods with TDRs.

When setting is conducted in light conditions allowing seabird observations, seabird abundances will be quantified in accordance with a defined protocol (Annex 1).

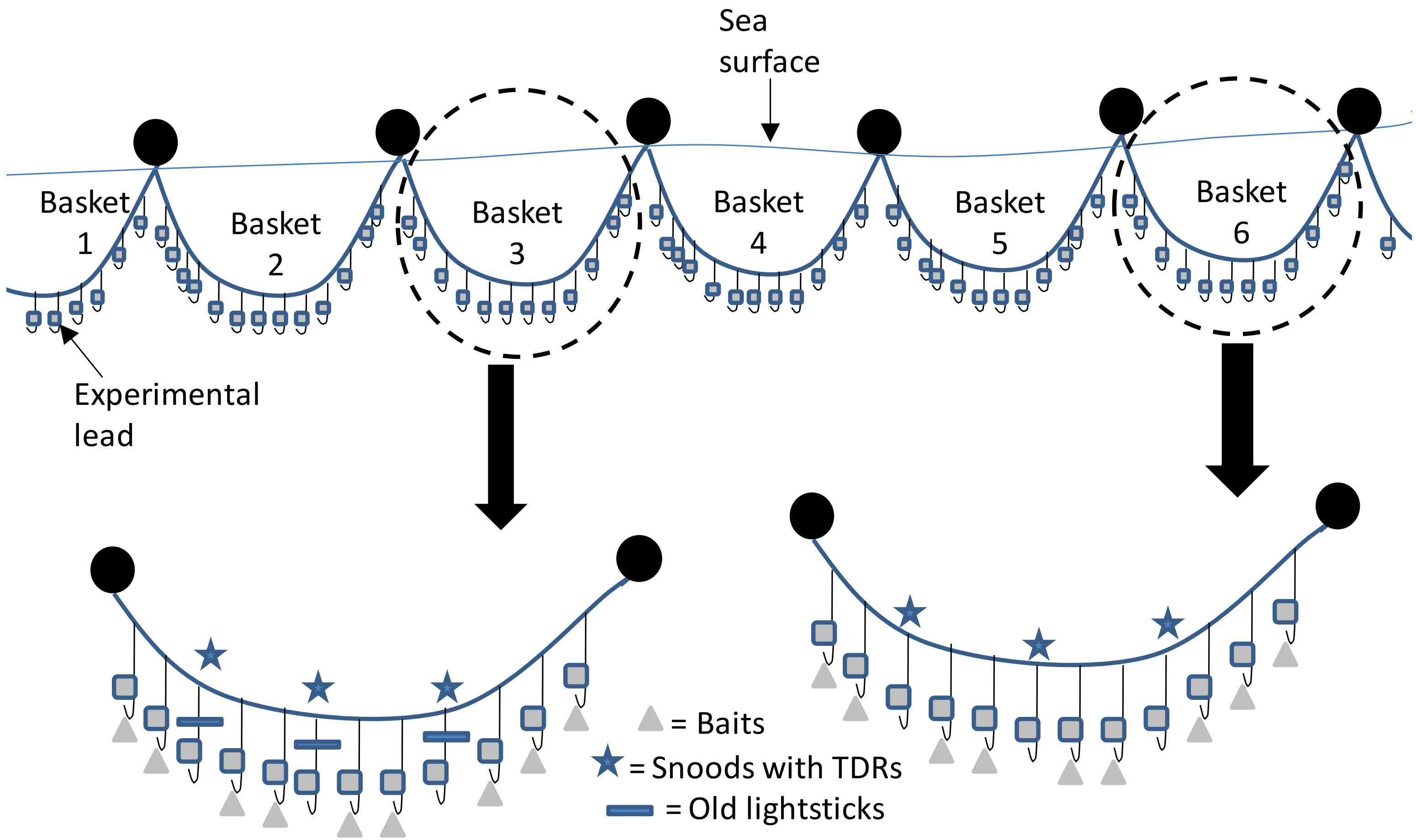

Figure 1. Gear set-up at line setting: Longline Part 1 (sizes and distances not to scale). See text above for details.

2.1.2 Hauling

At hauling, observers will record fish catch, seabird bycatch, the occurrence of any bite-offs or hook pull-outs, and the positions of lightsticks and TDRs along the gear. Data recorded in relation to fish catch include time of catch, species, length, damage evident at hauling, and processed form and weight. TDRs will be retrieved and their data downloaded and processed.

Seabirds caught are to be recorded by time, shot, species, the mode of capture (hook through wing, hook through beak, etc.).

2.1.3 Overall safety and feasibility of safe leads and lumo leads

In New Zealand domestic (generally small vessel) surface longline fisheries, fishers are sometimes unenthusiastic about line-weighting due to safety concerns. Therefore, as well as confirming the performance of weighted lines, observers will record any feedback from the crew on the novel gear, and any observations they make themselves regarding the safety and practicality of the safe leads or lumo leads.

2.2. Analytical methods

2.2.1. Seabird bycatch risk

All data collected will be subjected to exploratory analyses to describe and summarise the datasets, and confirm approaches to full quantitative analyses (see below). For qualitative data, only exploratory analyses may be appropriate, or, qualitative data may be categorised numerically to facilitate inclusion into statistical models as covariates.

Modelling analyses will be carried out using statistical computing methods available in the package R (R Development Core Team 2012). Preliminary inspection of the data will be conducted to ascertain the form of models appropriate for analyses. However, it is expected that the data will be best analysed using negative binomial generalised linear models (GLMs) (Gelman et al. 2004, 2006). GLMs have been used successfully to analyse data collected from experiments on a variety of mitigation measures and approaches (e.g., warp strike mitigation devices (Middleton and Abraham 2007) and trawler waste management measures (Pierre et al. 2012)). Models will predict the response variables as a function of covariates, including the mitigation devices deployed. In addition to the mitigation devices in use, other covariates that may influence the efficacy of the mitigation devices, including the abundance of birds around the vessels, sea state, fishing location, presence of fish waste discharge, discharge rate, etc. Information on covariates will be derived largely from data collection forms used during the trials. The importance of the various covariates will be examined using an automated step routine. That is, at each step, covariates will be tested for explanatory power, using the Akaike Information Criterion, and only the most explanatory covariates will be retained in models.

Modelling analyses will identify covariates in order of importance with respect to their influence on the selected response variable(s). This will allow the most effective device to be identified, facilitating the development of recommendations applicable to surface longline vessels more broadly.

2.2.2. Fish catch

The response variables of fish catch, and catch per unit effort, will be compared between lines (or parts of lines) with mitigation measures, compared to those without. Different mitigation measures may also be compared, in terms of effects on fish catch.

As for data relating to seabirds, exploratory data analysis will precede a full analysis of data on fish catch collected. Modelling analyses will be carried out using statistical computing methods available in the package R (R Development Core Team 2012). It is expected that the data will be best analysed using GLMs (Gelman et al. 2004, 2006), which will predict fish catch as a function of covariates, including the mitigation devices deployed. Other covariates that may influence fish catch will also be incorporated in the modelling, e.g., time of day, sea state, fishing location, etc. Information on covariates will be derived largely from data collection forms used during the trials, but may include other relevant data recorded during the trip. The importance of the various covariates will be examined using an automated step routine, and only the most explanatory covariates will be retained in models.

By identifying covariates in order of importance with respect to their influence on the selected response variable(s) relating to fish catch, any effects of different mitigation devices will be identifiable.

Overall, following consideration of both fish catch and seabird bycatch risk, and crew safety, the mitigation device(s) best applied to surface longline operations will be identified. Ideally this device will increase, or not affect, fish catch, while decreasing the risk of seabird capture in surface longline operations. Preferred devices may also differ between components of the surface longline fleet (e.g., large charter vessels compared to smaller vessels).

3. NEXT STEPS

From mid-late April 2013, it is expected that government fisheries observers will be available to implement at-sea trials of mitigation measures. Initially, inshore vessels will be the focus of experimental work. Subsequently, work may involve larger charter vessels.

Research on methods to reduce seabird bycatch in pelagic longline fisheries is expected to continue in New Zealand, while there are bycatch risks to seabird species of conservation concern.

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ANNEX 1

SEABIRD OBSERVATION PROTOCOL USED BY GOVERNMENT FISHERIES OBSERVERS DURING MITIGATION TRIALS IN THE NEW ZEALAND INSHORE SURFACE LONGLINE FISHERY.

Seabird Observation Protocol: Setting during weight trials

If it is sufficiently light during the set, please collect information about seabird abundances astern the vessel, and the number of seabird 'dives' on baits. These are both indirect measures of the risk of seabird captures.

Please record abundance and dive information on the Seabird Data Collection Form: Setting during weight trials.

Please record seabird counts at times other than setting, and all other protected species sightings, as you normally would for longline operations, using the CSP Protected Species Abundance Form (PSAF) and associated instructions.

Area observed:

Please record seabird abundance, and diving activity, in an area 30 m (across the vessel stern) by 75 m (behind the vessel), as shown in the diagram (Figure 1). As a guide to how far 75 m is astern the vessel, pace out the distance or lay a rope alongside the vessel when at the wharf. Or, use the tori line as a guide, if the vessel deploys one.

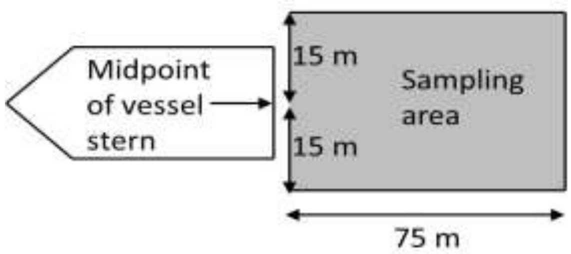

Figure 1. The sampling area in which to count seabirds, and seabird dives, astern the vessel.

Observation procedure:

If it is sufficiently light, start observations after you have completed deployment of the TDRs on each set. These observations are only to be made during the set. Each abundance count should take no longer than 5 minutes. Each period of dive sampling will be 5 minutes in duration. Use of a stopwatch or timer will help ensure this. Complete one abundance count followed by four dive counts. Then complete another abundance count, and take a break for around 10 minutes. Repeat this for as long as you have time during the set.

Each sequence of abundance count-4 dive counts-abundance count is called an 'Observation Period' and these are numbered across the form. Data are recorded moving down the column within an Observation Period. If for some reason you cannot complete 4 dive counts, do as many as you can. Try to complete the final abundance count, before breaking for around 10 minutes. If possible, please aim to complete 4 observation periods per set. (However, obviously this will depend on the duration of the set, the amount of light, and your other duties).

Before starting counts:

Please complete the identifier fields (trip number, set number, date), vessel speed, swell height, and wind strength, and circle the type of weight used on the line you are observing. Enter the Tori Line Equipment Code (from the Tori Line Details Form). Enter the time and the number of visible vessels at the start of each observation period.

Seabird counts:

Each seabird count should be the result of one sweep through the sampling area (area shown in Figure 1). One sweep will result in one number for a cell in the data form. Seabirds will not be identified to species. Instead, use the following groupings:

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

Dives:

The number of 'dives' will also be recorded for periods of 5 minutes. 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). The same bird may dive numerous times during this period. 'Dives' counted also include when a petrel/shearwater brings up a bait to the surface, and an albatross subsequently attacks that bait. (Please note on the back of the form which Observation Periods you observe this happening). Dives will also be grouped into large birds, small birds, and cape petrels. You may find it easier to record dives for each category of birds on a separate piece of paper for later transcription onto the data sheet.

Record dives for 4 periods of 5 minutes. Then complete the final abundance count for that Observation Period.

As above, between Observation Periods, take a break of around 10 minutes.

Comments:

Include any comments on the back of the Seabird Data Collection Form.