Fifth Meeting of the Seabird Bycatch Working Group

La Rochelle, France, 1-3 May 2013

Early results from trials of Bird Scaring Lines (BSLs) attached to 14 m booms on a demersal trawler

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SUMMARY

The introduction of bird scaring lines (BSLs) has greatly reduced incidental mortality of seabirds in the demersal trawl fishery of the Falkland Islands. However, incidental seabird mortality remains a challenge, with annual minimum estimates from the last five years averaging more than 500 birds, predominantly Black-browed Albatross that are killed in the finfish trawl fishery. Here we report the preliminary results of initial trials conducted to assess the efficacy of aerially mounted BSLs that were designed to overcome some of the main shortcomings of the standard BSLs currently used in the fishery.

RECOMMENDATIONS

1. The purpose of this paper is to inform the SBWG of work currently underway to improve seabird bycatch mitigation in the trawl fisheries of the Falkland Islands, and to solicit feedback from the Working Group.
2. It is recommended that options to improve the efficacy of bird scaring devices in reducing seabird interactions with trawl gear should continue to be investigated, and the outcomes these investigations should inform best practice advice and implementation.
3. The management of discards to reduce seabird bycatch in trawl fisheries remains a priority, and further work is required to investigate and develop practical options for implementation.

Resultados preliminares de las pruebas de las líneas espantapájaros (LE) sujetadas a botavaras de 14 m de un arrastrero demersal

La introducción de las líneas espantapájaros (LE) ha reducido significativamente la mortalidad incidental de aves marinas en la pesca de arrastre demersal de las Islas

Malvinas. Sin embargo, la mortalidad incidental de aves marinas continúa siendo un desafío, con estimaciones anuales mínimas de los últimos cinco años que promedian más de 500 aves, principalmente albatros de ceja negra que mueren en la pesca de arrastre de peces. En este documento presentamos los resultados preliminares de las pruebas realizadas para evaluar la eficacia de las LE aéreas diseñadas para superar algunas de las deficiencias principales de las LE estándar que se usan actualmente en la pesca.

RECOMENDACIONES

1. El propósito de este documento es informar al GdTCS sobre el trabajo que se está llevando a cabo para mejorar las medidas de mitigación de la captura secundaria de aves marinas en las pesquerías de arrastre de las Islas Malvinas, y solicitar los comentarios del Grupo de Trabajo.
2. Se recomienda que continúen investigándose las opciones para mejorar la eficacia de los dispositivos espantapájaros para reducir las interacciones de las aves marinas con los equipos de arrastre, y los resultados de estas investigaciones deben informar al asesoramiento y la implementación de las mejores prácticas.
3. El manejo de desechos para reducir la captura secundaria de aves marinas en las pesquerías de arrastre continúa siendo una prioridad, y se requiere continuar trabajando para investigar y desarrollar opciones prácticas para la implementación.

Résultats préliminaires d'essais menés avec des dispositifs d'effarouchement des oiseaux attachés à des bômes de 14m de long sur un chalutier de pêche démersale

L'utilisation de dispositifs d'effarouchement des oiseaux a permis de réduire considérablement le nombre de décès accidentels d'oiseaux marin dans la pêche chalutière démersale des îles Falkland. Cependant, la mortalité accidentelle des oiseaux marins demeure un défi. On estime que, au cours des cinq dernières années, plus de 500 oiseaux sont décédés chaque année, en particulier des albatros à sourcils noirs qui ont été tués dans la pêche chalutière aux poissons à nageoires. Ce document présente les résultats préliminaires des premiers essais menés pour évaluer l'efficacité des dispositifs aériens d'effarouchement des oiseaux, conçus pour compenser les principaux défauts des dispositifs actuellement mis en oeuvre.

RECOMMANDATIONS

1. Ce document a pour objectif d'informer le GTCA des travaux en cours destinés à renforcer l'atténuation des captures accidentelles d'oiseaux marins dans les pêches chalutières des îles Falkland et de solliciter une réaction de la part du Groupe de travail.
2. Il est recommandé de poursuivre l'étude des options qui permettent d'améliorer l'efficacité des dispositifs d'effarouchement des oiseaux marins dans le but de réduire les interactions entre les oiseaux marins et les engins de pêche au chalut. Les résultats de ces études devraient être utilisés pour améliorer les recommandations des meilleurs pratiques et leur mise en œuvre.

3. Pour réduire les captures accidentelles d'oiseaux marins dans les pêches chalutières, la gestion des déchets reste la priorité. Il faut continuer à imaginer et développer des options pratiques à mettre en œuvre.

1. INTRODUCTION

Prior to the introduction of bird scaring lines (BSL) as a licence requirement, the estimated incidental seabird mortality in the Falkland Islands' demersal trawl fishery targeting finfish was more than 1500 birds per annum (Sullivan et al. 2006a), predominantly Black-browed Albatrosses. The introduction of BSLs has led to a large reduction in the number of seabirds incidentally killed, but the mortality estimates have remained at an average of more than 500 birds per annum from 2007 until present (Sancho 2009, Black 2010; Parker 2012; 2013). These are minimum estimates as it is known that some corpses become dislodged from fishing gear, and other birds can suffer injuries resulting in subsequent death; both these categories of birds are not accounted for in annual mortality estimates. Compliance with the use of BSLs according to required specifications is also an issue (e.g. vessels not using BSLs in inclement weather), especially for the >95% fishing effort that is not observed. Ongoing research and monitoring within the demersal trawl fishery of the Falkland Islands has shown that the relevant wind direction has a highly significant influence on the performance of the current BSL design used in this fishery (Parker 2012). This is predominantly due to two factors: (1) cross winds cause the BSLs to deviate away from warp cables and (2) Black-browed Albatrosses use headwinds (blowing from the bow to the stern) to land at the warp-water interface even when BSLs are not deviating from the warp cables. In both cases, birds gain access to the high risk area where the warp enters the water to feed on discards and are susceptible to making contact with the warp cables. Birds are also occasionally recorded entangled with BSL streamers or net floats, sometimes resulting in injury and occasionally, buy rarely, death. When birds are observed tangled in a BSL, the observer intervenes to free the bird, masking the true rate of injury or mortality that may occur from this sort of interaction. These factors highlight the need to continue investigating methods to reduce incidental seabird mortality in the trawl fishery.

Discard management, and specifically the prohibition of discarding whilst fishing (Wienecke and Robertson 2002), is considered to be the ultimate solution for reducing seabird bycatch in trawl fisheries. Batch discarding has also been shown to be effective at reducing the abundance of seabirds following trawl vessels (Pierre et al. 2012). However, there are significant constraints associated with discard management, especially in relation to current vessels that would need to have storage facilities retrofitted. Consequently, although it is important to investigate and pursue discard management options, methods that deter birds from entering the warp-water interface (e.g. BSLs), remain the most viable mitigation measures for the Falkland Islands' trawl fishery, at least in the short term. Following research which showed BSLs to be the most effective of the three bird scaring measures tested in the Falkland Islands trawl fishery (Sullivan et al. 2006b), and the introduction of BSLs as mandatory mitigation measure in the fishery, the approach in the Falkland Islands has been to assess the efficacy of BSLs and to introduce design modifications to improve performance (e.g. Snell et al. 2011).

In this paper, we report early results from trials conducted to test a modified bird scaring technique that was designed to overcome some of the shortcomings of previous and current designs.

2. METHODS

2.2. The current BSL design and specifications

The current licence requirements and BSL design comprises two 30m bird scaring lines positioned 2m distant, across and above, from the warp cables (Figure 1a). These standard BSLs have six, double length high visibility streamers positioned evenly along the 30m length of the BSL and a net covered float at the terminal end to create drag (Snell et al. 2012).

2.3. The new design: aerially mounted BSLs

Two 14 m, approximately 500 kg, booms were attached to the stern of the vessel extending astern immediately above the warp cables (**Error! Reference source not found.**1b, Figure 2). Ropes were fixed to the terminal end of the booms, extending to the inside centre of the vessel with small booms extending port and starboard. Seven double lengths of high visibility streamers extended to the water's surface were positioned evenly along the ropes on the seaboard side and six streamers on the inboard side.

The new design was based on the following informants and considerations: (1) BSLs fixed aerially to the vessel may not deviate as much as towed BSLs in cross-winds, (2) aerial BSLs may prevent birds from landing at the warp-water interface regardless of wind direction, (3) BSL tension, and thus the aerial position of streamers required to deter seabirds, will not depend on sufficient drag being created by the tow device positioned at the end of the BSL, (4) aerially mounted BSLs may not need to be hauled onboard when shooting and hauling the net, affording protection to the warp area during this time (although discarding is prohibited during these periods, it may still occur from time to time and discharge of factory waste-water alone provides sufficient olfactory incentive for birds to congregate at vessels), (5) if aerially mounted booms can remain in position throughout all fishing effort then compliance with this measure will be more detectable from airplane surveys, (6) birds will not become entangled with BSL main lines, streamers or net floats and lastly, (7) crew will not have to spend valuable time or risk of injury when working aft of the trawl blocks to free entangled BSLs. Importantly, reduced risk to crew, or perceived risk by ships officers, may improve the use of mitigation when an observer is not present on the vessel.

The obvious comparison to the aerially mounted BSL design trialled here is the Brady Baffler. Trials in the Falkland Islands found the Brady Baffler to be less effective than BSLs at reducing seabird contact with warp cables (Sullivan *et al*. 2006). However, at 6 m in length, streamers mounted on the Brady Baffler do not deter birds from entering the critical warp-water interface. In addition the Brady Baffler utilised bird scaring devices hanging vertically directly above the warp cables. The aerially mounted BSL presented here is designed to provide a protective curtain around the entire warp area, including if not all then as much as possible of the warp-water interface. Melvin *et al.* (2011) trialled a similar system with booms 6.3 and 7.6 m in length on two separate vessels in North Pacific trawl fisheries and expressed confidence that the method could be effective with further modifications.

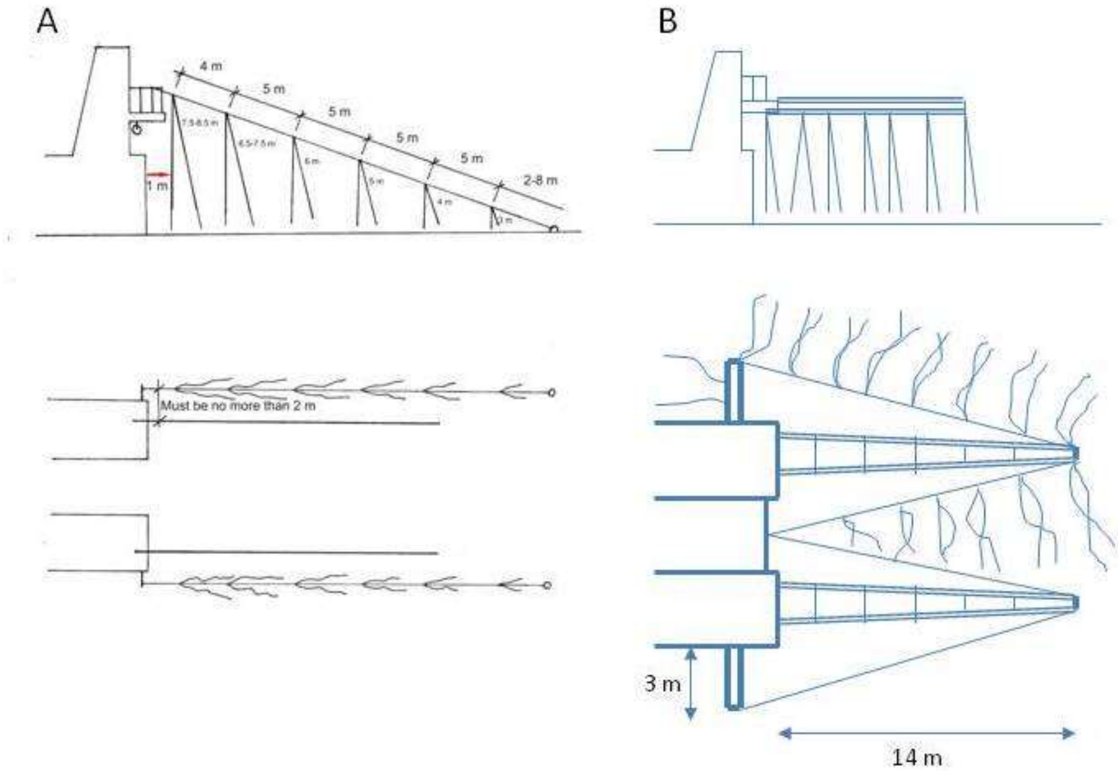

Figure 1. (A) Standard bird scaring lines (BSLs) as currently required by licence and (B) aerially mounted bird scaring lines (BSLs) experimentally trialled in this report. Note streamers were attached to both sides but in this diagram only the starboard streamers are shown.

Figure 2. Aerially mounted BSLs attached to booms astern of the vessel

2.4. Trials

Trials were conducted on a 78m stern trawling vessel targeting finfish over a ten day period, from 12 to 21 February 2013. The vessel processed all catch as it became available. Discards exited the vessel approximately 18 m forward of the stern. As required by licence conditions, discarding ceased during shooting and hauling of the net.

The experimental, aerially mounted BSLs were trialled for the first four days. After this period the two mitigation methods were used on alternate days for the remaining six days. The number and type of contacts between seabirds and fishing gear (light or heavy, in the air or on the water) as well as the environmental and discharge conditions were recorded for all trawls. These form part of the standard seabird-trawl gear interaction data collection protocols used the by the Falkland Island Fisheries Department (FIFD), and have been adapted from Wienecke and Robertson (2000). Observations began once the net entered the water and continued during the trawl until the vessel stopped discharging waste. Observation periods were a maximum of 60 minutes long and contacts were summarised by 10 minute periods. If any of the environmental factors or discharge volume changed, a new observation period was initiated.

Seabird abundance was estimated during the initial 1-5 minutes of observations by scanning the area and identifying species present in an area 500m astern and 500m abeam (250m to both starboard and port sides) of the fishing vessel. Bird abundance was recorded in five abundance categories: 1-10, 11-50, 51-200, 201-500 and >500 individuals.

Seabird bycatch was calculated from the number of dead birds recovered during hauling. All warp splices were checked for feathers during every shoot and haul. If the splice was positioned at more than 40m depth during the trawl and if it contained feathers at a haul which were not present in the preceding shoot, this was also recorded as evidence of seabird mortality.

3. RESULTS

The vessel conducted 44 trawls in 10 days of fishing. Seventeen of the trawls were made using the standard FIFD BSLs. The remaining 27 trawls were conducted with the aerially mounted BSLs. Discarding only occurred during trawling. Consequently, there were very few seabird contacts with fishing gear during shooting and hauling operations, none of which were classified as heavy. Seabirds were present in very low numbers, and were distant from the vessel, during periods when the vessel was not discarding. Observations were therefore restricted to periods of discarding. A total 14 trawls using the standard BSLs and 19 with aerially mounted BSLs were monitored for seabird interactions during periods of discarding.

The standard BSLs were trialled in Beaufort sea-states of 3 to 5 and wind speeds ranging from 15 to 25 knots. The aerially mounted BSLs were trialled in Beaufort sea-states of 2 to 6 and wind speeds ranging from 10 to 25 knots.

A total of 53 light and 8 heavy contacts between seabirds and warp cables were recorded when using standard BSLs in 14 stations. For the aerially mounted BSLs 104 light contacts and 20 heavy contacts were recorded from the 19 monitored stations. Mean rates per trawl were thus 3.8 light contacts and 0.6 heavy contacts for standard BSLs and 5.1 light contacts and 1.1 heavy contacts for the aerially mounted BSLs. Mean contact rates per hour were 5.1 light and 1.1 heavy for standard BSLs and 5.7 light and 0.9 heavy for the aerially mounted BSLs.

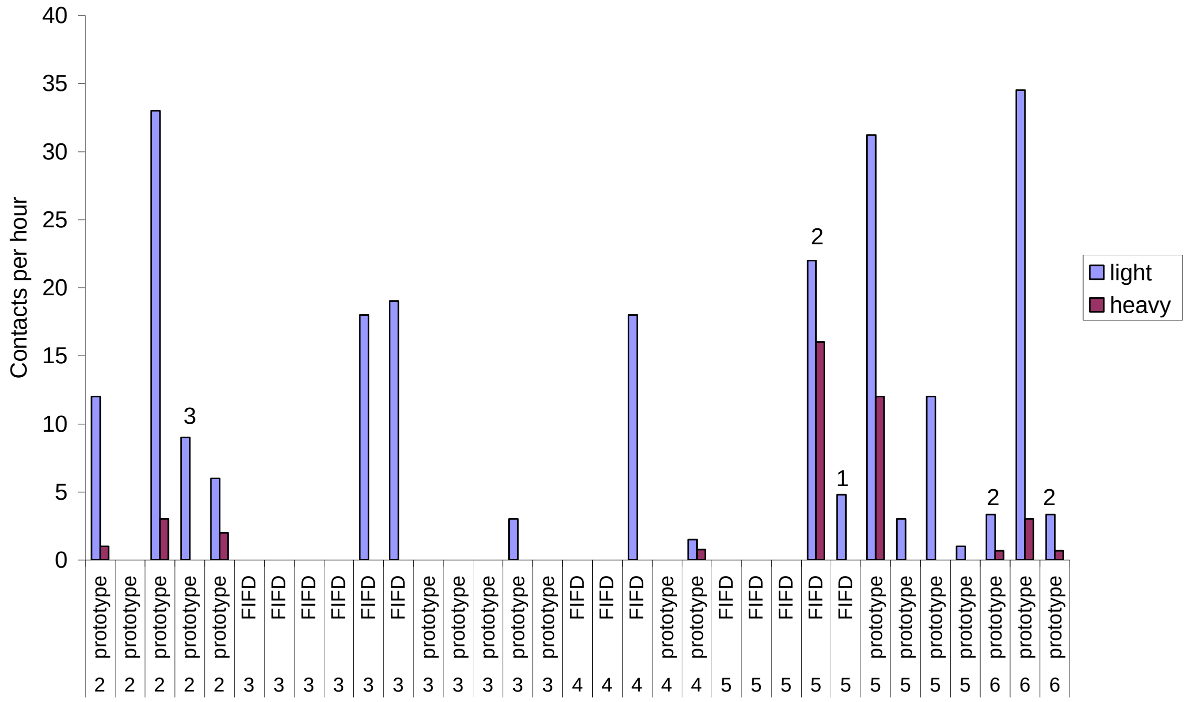

Figure 2. Contacts per hour between seabirds and trawl gear using standard FIFD BSLs (FIFD) (n=14) and experimental aerially mounted BSLs (prototype) (n=19) relative to sea state (2-6). The figures above the bars represent the number of seabird mortalities recorded from that station. Stations with no discarding occurring during the trawl are not included in this figure.

Ten incidental seabird mortalities were recorded during the ten days of fishing, all of which were Black-browed Albatrosses. The warp cables had multiple, rough and open splices that at all times were far too deep to capture a live seabird. Very few and in most cases no contacts were recorded during shooting and hauling. All mortalities were thus due to birds becoming entangled in the warp during trawling, drowning, remaining entangled on the warp and sliding down the warp until the dead bird became lodged on a splice and was hauled aboard. Three mortalities occurred while using both the standard FIFD BSLs and seven while using the experimental aerially mounted BSLs.

Table 1. Incidental seabird mortality recorded from ten days of fishing. All mortalities were Black-browed Albatrosses.

Station	Observed day (n=10)	Mitigation method	Mortality	Sea state (Beaufort)	Wind speed (knots)
647	4	Experimental BSLs	3	3	20
661	6	Experimental BSLs	2	5	25
670	9	Experimental BSLs	2	6	20
671	9	FIFD BSLs	2	5	20
672	9	FIFD BSLs	1	5	15
		Total mortalities	10		

4. DISCUSSION

This paper presents interim results from only ten days of fishing, and so should not be seen as a definitive assessment of the relative performance of the different measures tested. Further replication is required, and is planned, to enable a more robust assessment of the efficacy of aerially mounted BSLs in reducing incidental seabird mortality. However in the absence of further data, the preliminary results are discussed below.

The seabird bycatch rate recorded in our study (10 mortalities from 10 days of fishing) is greater than the mean rate recorded for this period using the standard BSLs (FIFD, unpubl. data). However, clustered mortality events of similar mortality levels have been recorded four times in the last three years (FIFD unpubl. data). During our study, all mortalities occurred during trawls that had very high rates of Rock Cod discard (>50% of the catch), at times resulting in an estimated discarding rate greater than 1500-2000 kg per hour of trawling. This high discard rate occurred when the vessel was targeting Rock Cod 30-40 miles northwest of the Jason Islands, where a substantial proportion of the large Falkland Islands' Black-browed Albatross population breed (Wolfaardt 2012). While fishing in this area large numbers of Black-browed Albatrosses (>500 birds) were recorded around the vessel. In addition inclement weather and rough seas caused the vessel to pitch heavily resulting in significant warp movement (warps slicing through the water > 8m a second). Consequently, the combination of very high volumes of discards, large numbers of Black-browed Albatrosses around the vessel, strong winds and rough seas likely led to the higher than expected levels of bycatch. In addition, the warps on the vessel were brand new and therefore covered in a thick layer of grease. This may have increased the likelihood of birds becoming entangled on the warps. Alternatively, the thick grease may have increased the probability that seabirds that collided with the warp and subsequently drowned were retained on the warp splices until hauling. The grease also blemished the streamers, and even though they were cleaned periodically, within a few hours of cleaning, they were quickly blackened, possibly reducing their effectiveness as seabird deterrents.

The contact rates between seabirds and fishing gear were similar for the aerially mounted BSLs and standard FIFD BSLs. Overall contact rates were low, averaging 1 heavy contact per hour. It is important to note that the calculated contact rates do not take into account the total duration of discarding. For example, two trawls may have similar contact rates, but if discarding takes place over six hours in one trawl and 30 minutes in the next, there is a lower probability of incidental seabird mortality in the latter trawl. By chance the aerially mounted BSLs were used in trawls with very high discard volumes and when the warps were moving more violently due to the increased sea state. When a warp is moving rapidly up and down as the vessel pitches a bird that comes into contact with the warp is more likely to be injured or drowned than when the warp is moving consistently through the water at a constant distance from the stern. Contact rates recorded in our study, for both standard FIFD BSLs and aerially mounted BSLs, were much lower than the contact rates recorded previously from the same vessel, when no mitigation measures were used (Sullivan 2003).

The aerially mounted BSLs were preferred by the fishermen as they did not have to deploy and retrieve the BSLs for every trawl. The vessel shot, trawled and hauled with the aerially mounted BSLs in place and experienced no problems with entanglements. Standard FIFD BSLs tangled with the warps on six occasions, all of which occured in large seas and strong cross winds. Streamer deviation was a problem for both BSL systems, but more so for the standard FIFD BSLs. Deviation of the warp relative to the bird scaring mechanism was more problematic for the aerially mounted BSL system. The aerially mounted BSLs come to an apex above the warp-water interface in calm conditions. When the warp moved out of this area, due to currents and swell direction, the warp water interface was left unprotected. The aerially mounted BSLs were least effective when the vessel was pitching in large seas. The aerially mounted BSL was highly effective at protecting the warp-water interface in calm to moderate seas, but with severe pitching the warp-water interface was beyond the 14m reach of the streamers on the aerially mounted BSLs.

In calmer conditions when using the aerially mounted BSL system birds stayed aft of the warp-water interface, but only by 1-2 m. It possible that a bird diving for discards in this area could dive beneath the warp and become entangled under the water's surface. This may explain the first three mortalities detected, in station 647, in which a low contact rate was recorded.

We have identified a number of ways in which the aerially mounted BSLs could be improved, and these will be investigated further throughout trials conducted in the 2013 austral winter.

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