Agreement on the Conservation of Albatrosses and Petrels

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Seabird mortality estimate and results of line weighting trials for the Namibian demersal Hake longline fishery

BirdLife International

SUMMARY

A new seabird mortality estimate for the Namibian demersal longline fishery for hake suggests 22,821 (14,351 - 32,675) birds are killed each year, of which 85.2% are White-chinned petrels. Line weighting experiments comparing 5 kg steel weights with the concrete weights currently used in this fishery imply that seabird bycatch could be reduced by 75% through the use of steel weights. Best practice mitigation measures for this fishery should include a combination of line weighting, night setting and the use of bird-scaring lines.

RECOMENDATIONS

Best practice mitigation measures for the Namibian demersal longline fishery should include a combination of line weighting, night setting and the use of bird-scaring lines.

Estimación de la mortalidad de aves marinas y resultados de las pruebas de uso de pesas en las líneas de la pesca con palangre demersal de merluza en Namibia

Una nueva estimación de la mortalidad de aves marinas para la pesca demersal de merluza con palangre en Namibia sugiere que mueren 22.821 (14.351 – 32.675) aves por año, de las cuales, el 85,2% son petreles de barba blanca. Los experimentos de colocación de pesas en la línea que comparan pesas de acero de 5 kg con las pesas de concreto que se usan actualmente en la pesca implican que la captura secundaria de aves marinas podría reducirse un 75% con el uso de las pesas de acero. Las medidas de mitigación de las mejoras prácticas para esta pesquería deben incluir una combinación de uso de pesas en la línea, lance nocturno y el uso de líneas espantapájaros.

RECOMENDACIONES

Las medidas de mitigación de las mejores prácticas para la pesca con palangre demersal en Namibia incluyen una combinación de uso de pesas en la línea, lance nocturno y el uso de líneas espantapájaros.

Mortalité des oiseaux de mer et résultats des essais de testage de la palangre dans la pêcherie de fond de la Namibie pour le merlu

Une nouvelle estimation de la mortalité des oiseaux de mer dans la zone de la pêcherie de fond de la Namibie pour le merlu s'élève à 22,821 (14,351 - 32,675) oiseaux de tués chaque année, 85.2% d'entre eux étant des puffins à menton blanc. Des essais de testage de la palangre ont été menés pour comparer des testages d'acier de 5 kg avec les testages utilisés de manière courante dans cette pêcherie, ce qui a résulté, pour les testages d'acier de 5 kg, en une réduction de 75% de la mortalité accidentelle des oiseaux de mer due à leur capture accessoire. Nous concluons que la meilleure pratique pour cette pêcherie, en ce qui concerne les mesures d'atténuation des captures accessoires, serait de combiner les testages de la palangre avec la pose de nuit et l'utilisation de lignes de banderoles.

RECOMMANDATION

La meilleure pratique pour la pêcherie de fond de la Namibie pour le merlu, en ce qui concerne les mesures d'atténuation des captures accessoires, serait de combiner les testages de la palangre avec la pose de nuit et l'utilisation de lignes de banderoles

1. INTRODUCTION

Demersal longline fisheries were found to be the cause of seabird mortality in the early 1990's (Ashford *et al*. 1995; Brothers, 1995; Cherel *et al*. 1996) at a level that was considered unsustainable for seabird populations (Croxall *et al*. 1990). This led to the development of simple and effective measures to mitigate this impact (Agnew *et* al. 2000; Brothers *et al.* 1999) resulting in the combined use of line weighting, night setting and bird-scaring lines as best practice (Løkkeborg 2011).

Despite this, many fleets are yet to adopt best practice measures. Petersen *et al.* (2009) suggested that the Namibian demersal longline fishery for hake could be responsible for approximately 20,200 birds per year, placing the Namibian demersal longline fishery at the top of the list of longline fisheries with a serious impact on seabirds (Anderson *et al*. 2011).

In 2011 we reported on the effect of using double or single bird-scaring lines and night setting in this fishery and indicated that line weighting experiments were necessary to define a best practice suite of mitigation measures.

The objectives of this report are to provide:

1. An update on the estimate of the level of seabird mortality associated with the demersal Hake longline fishery in Namibia based on data collected by the ATF since 2009 and;
2. Results from line weighting trials conducted in 2012 to define best practice mitigation for this fleet.

2. METHODS

2.1 Fishing gear and operation

Dedicated seabird observers conducted observations and performed experiments on board Namibian flagged fishing vessels from Walvis Bay that target Cape hake *Merluccious capensis* and Deep water hake *M. paradoxus*.

The longline fleet uses a variety of gear configurations to target hake at variable depths off the seabed. The configuration used most frequently in Namibia is represented in Figure 1. The double line 'Spanish system' includes a thick (15 mm) buoyant main line which supports a thinner braided monofilament nylon 'hook line'. The hook line is divided in to 48 m sections via connecting 'dropper' lines. Dropper lines are spaced c. 96 metres apart, with 3.69 ± 1.1 kg cement weights ('stones') placed midway between them. Approximately 60 hooks are attached between dropper lines. A 10 kg weight is placed every 1,920 hooks to anchor the line.

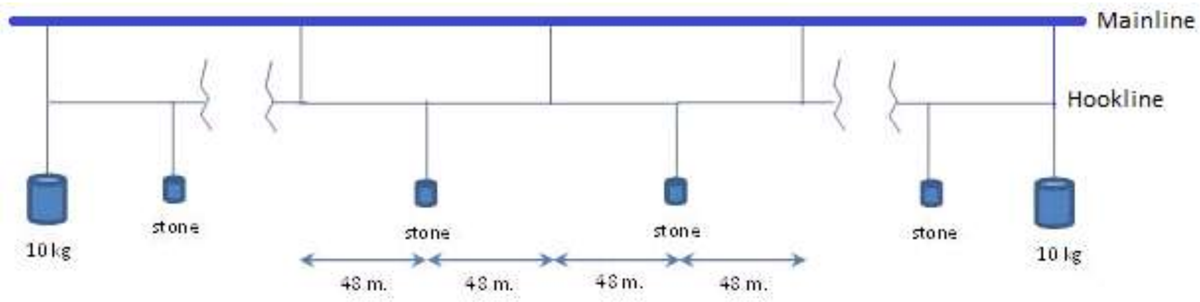

Figure 1: Namibian demersal longline gear configuration

Setting operations start before dawn and continue for up to two hours, the majority of setting operations being completed in darkness. Setting operations were performed from two different decks. The top line was deployed from the upper deck where two crew members prepared and passed dropper lines to a third who attached them to the top line every ± 96 m, the free end of the dropper line was passed down to the lower deck to the hook line setters. They comprised a six man team centrally positioned on the lower aft deck. The first crewmember was dedicated to joining the hook lines from the pre-prepared plastic hook boxes (pots), each of which contained three 48 m sections of hookline with ± 90 baited hooks. This man also attached the weights and dropper lines on alternating connections. The remaining crew members supported role by ferrying the weights and hook boxes as required. The weight was placed placed on the setting tray and pulled off by the hook line. This always created varying degrees of tension on the hook line pulling the already set hooks towards the surface.

Line hauling began between 10:00 and 11:00 and continued until all gear had been retrieved, usually at around 24:00 to 01:00. As the gear was retrieved the snoods were repaired, the hooks baited and hook boxes prepared for the next set. Lines were always hauled from north to south.

2.2 Data collection

Seabird bycatch estimate

Monitoring of line hauling operations for seabird bycatch was conducted between 2009 and 2012. Seabird mortality was recorded to species level and was based on specimens retrieved on hauling only. The observation effort during the haul was estimated by counting the weights as they came on board, giving a total number of hooks observed per haul.

Environmental information was noted including moon phase, wind speed (Beaufort scale), and cloud cover.

The position of where a bird was hooked in relation to a weight or dropper was noted. This was done by counting the number of hooks to the next dropper or stone. Each is 1.5 m apart so the number of hooks from a dropper or stone as multiplied by 1.5 m.

Line weighting

Sink rate measurements were first obtained for fast and slow sinking sections of standard fishing gear by placing CEFAS G5 Time Depth Recorders (TDRs) proximal to concrete weights (fast) and dropper lines (slow) respectively. We performed nine repetitions on each of these sections over two days at sea.

TDRs were set to record depth (pressure) and time at 1 second intervals. Before each set the internal TDR time was synchronised with an observer laptop and wrist watch. The time TDRs entered the water during the set was recoded to the second.

Subsequently, to compare the effect of line weighting on seabird mortality, two gear configurations were used (Figure 2):

1. 5 kg steel weights
2. Standard concrete weights (control)

The placement of line weighting was as indicated in Figure 1 for both treatments. Steel weights were deployed randomly on either the first or second half of a single long line (50% of the line) or on 100% of two shorter lines set back-to back. Lines were set in a north-south or south-north direction.

Sink rates were obtained for the slowest sinking hooks of each treatment (steel weights vs concrete) by attaching TDRs to the dropper line (the mid-point between weights). We performed 24 repetitions on each treatment.

On hauling, bird mortality was recorded to species level and the hook position noted relative to the nearest dropper line. Seabird bycatch was compared as the rate of birds caught per 1,000 hooks set. Target species catch rate was also recorded for each treatment.

Figure 2: 5 kg steel (left) and concrete (right) weights used in experimental trials in the Namibian demersal longline fleet.

2.3 Data analysis

Mortality estimate

Fleet effort data for 2010 was provided by the Ministry of Fishery and Marine Resources and was used to calculate mortality rates for the whole fishery. Data were first stratified to obtain fishery effort data by season: summer and winter.

Mortality rate was calculated for summer and winter strata from observed data. Seabird mortality estimates were then extrapolated for each level of stratification using these observed rates before combining to derive an annual bycatch estimate for the fleet. A non-parametric model, using bootstrap resampling (Shotwell, 2012) was used to reduce the effects of zero inflated data.

Sink rate analysis

Sink rate data were compiled from TDRs taking the water entry time as the start time (zero seconds) for each repetition. The average time to a depth of two, four and six metres was extracted from the data and used to calculate the sink rate (± standard deviation).

3. RESULTS

Mortality estimate

From a total on board observation effort of 201 sets (3,011,978 hooks) between 2009 and 2012 146 sets (73 %) were deployed in the absence of mitigation.

Our estimate suggests 22,821 (14,351 - 32,675) birds are killed each year in the Namibian demersal longline fishery. The observed proportions of birds killed are as follows: 85.2 % (539 birds observed killed) are White-chinned petrels *P aequinoctialis*, 6.95 % (44) Yellow-nosed albatross *T chlororynchus*, 3.74 % (24) Black-browed albatross *T melanophris* and 1.74% (11) unknown albatross species. The remaining 2.37 % included Sub-Antarctic Skua *Catharacta Antarctica* (6), Sooty shearwater *Puffinus griseus* (7) and Cape gannet *Morus capensis* (2).

Sink rate analysis

For the identification of the sink rate of standard fishing gear in the Namibian demersal longline fishery, the results from TDR deployments indicated that there is a distinct difference between the sink rates of the two sections of the line. The fast sinking gear (next to weights) reaches a depth of two meters within five seconds of deployment at a sink rate of 0.43 m/sec where as slow sinking gear (next to dropper lines) takes five times longer at a sink rate of 0.08 m/sec (Table 1).

Table 1: Average (± SD) time to depth and sink rate (m/s) for hooks sets adjacent to concrete weights and dropper lines in the Namibian demersal longline fishery.

	Concrete weights			Dropper lines		
Depth (m)	2	4	6	2	4	6
Time to depth (sec)	4.7 ± 0.5	10.0 ± 1.4	18.4 ± 5.5	25.0 ± 8.0	37.3 ± 7.9	47.0 ± 7.5
Sink rate (m/sec)	0.43	0.40	0.33	0.08	0.11	0.13
Distance astern (m)*	19.3	41.1	75.7	102.8	153.5	193.4

* Assumes a setting speed of 8 knots.

The slowest sinking hooks reach a target depth of 6 m at a distance of approximately 190m astern compared with 76 m for faster sinking hooks.

Repeating this procedure for comparative trials between concrete weights and steel weights, a total of 222,671 hooks (on 16 lines) were set with steel weights and 142,489 hooks (on 13 lines) were set with concrete weights.

Steel weights reached a depth of 2, 4 and 6 m faster than lines set with concrete weights by 6, 10 and 14 seconds respectively. AT a setting speed of 8 knots, this represents baited hooks reaching a depth of six metres at a distance astern of 131.6 m for hooks set on lines with steel weights compared to 189.3 m astern for hooks set on lines with concrete weights (Table 2, Figure 3).

Table 2: Average (± SD) time to depth and sink rate (m/s) for hooks set at the mid-point between weights on lines deployed using steel and concrete weights in the Namibian demersal longline fishery.

	Steel weights			Concrete weights		
Depth (m)	2	4	6	2	4	6
Time to depth (sec)	16 ± 0.6	24 ± 0.9	32 ± 1.25	22 ± 0.6	34 ± 1.1	46 ± 1.4
Sink rate (m/sec)	0.13	0.17	0.19	0.09	0.12	0.13
Distance astern (m)*	65.8	98.7	131.6	90.5	139.9	189.3

* Assumes a setting speed of 8 knots.

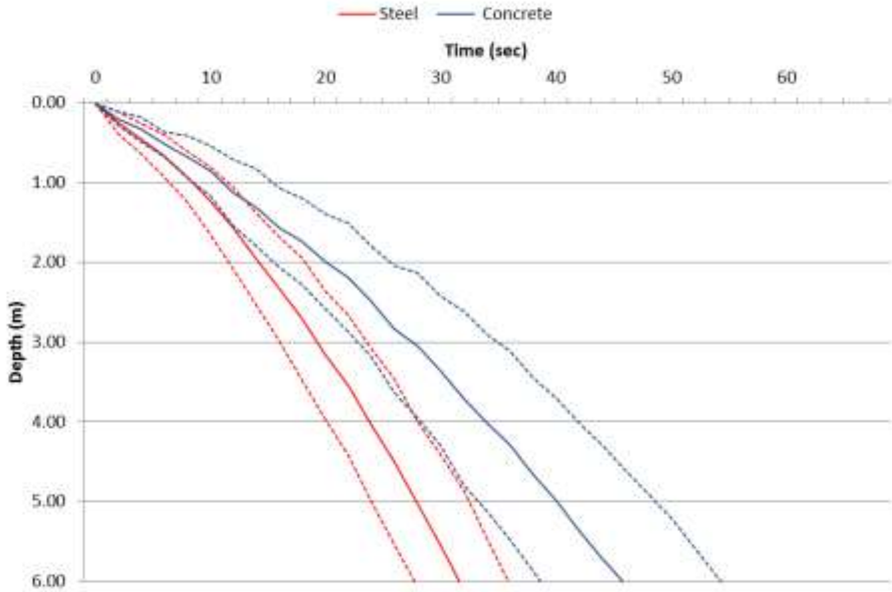

Figure 3: Mean sink rate profiles plus standard deviation of the slowest sinking longline sections for each treatment (concrete and steel weights).

From the retrieval of dead birds during hauling operations, the average seabird mortality rate was 0.16 birds / 1,000 hooks for sections of line set with steel weights. This is significantly lower (χ^2 test: P <0.000) than the average rate of 0.62 birds / 1,000 hooks from lines set with concrete weights. The overall bycatch rate was reduced by 75% when using steel weights (Figure 4).

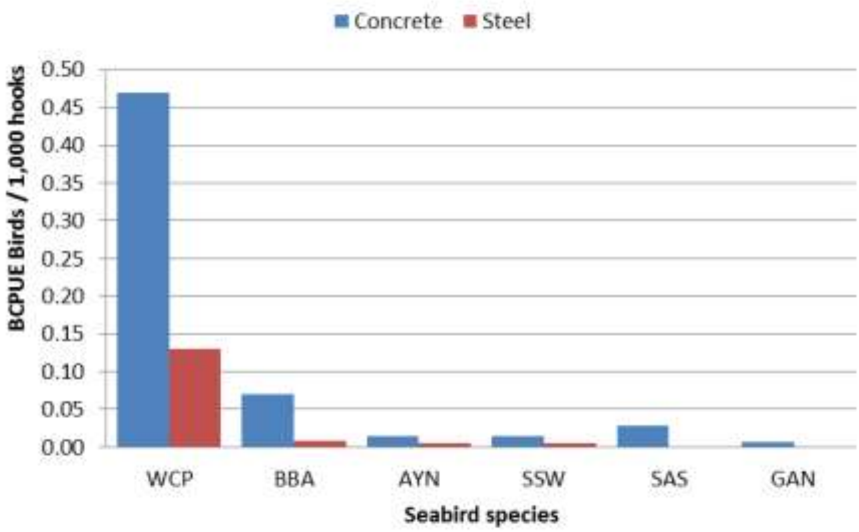

Figure 4: Seabird mortality rate (birds / 1,000 hooks) by species for sets with 5 kg steel and concrete (control) weights. WCP: White-chinned petrel, BBA: Black-browed albatross, AYN: Atlantic yellow-nosed albatross, SSW: Sooty shearwater, SAS: Sub-Antarctic skua, GAN: Cape gannet.

During weighting experiments with steel weights all mortality occurred on sections of the set deployed after nautical dawn which further demonstrates the importance of night setting.

Position on line where birds are hooked

It was possible to identify the distance at which birds were captured from a dropper line for 76 birds. Over 90% of those birds were within 20 m (1 – 13 hooks) of the dropper. The furthest point at which birds were observed hooked was 28.5 m (19 hooks) from the dropper (Figure 5).

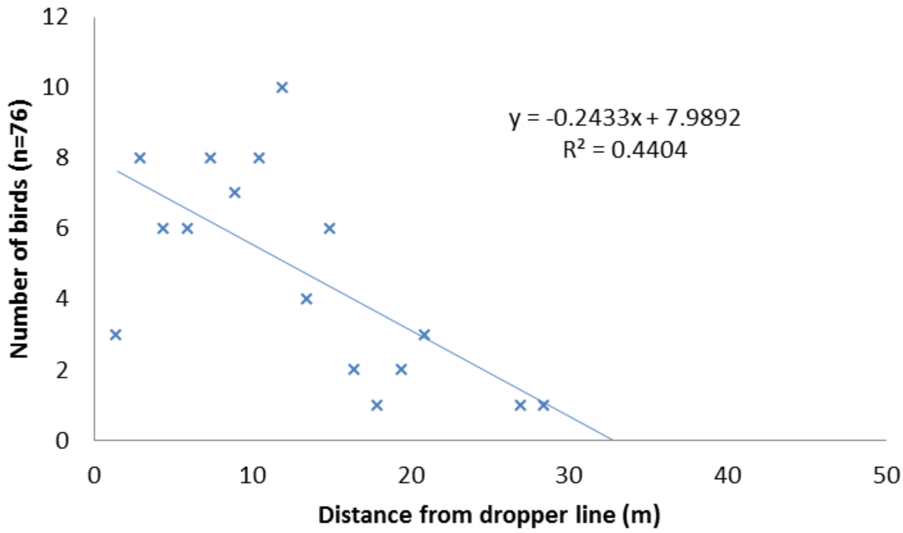

Figure 5: Position of seabirds recovered on hook lines in relation to dropper lines in the Namibian demersal longline fishery

Target species catch

We found no significant effect of using increased mass of weight (steel weights) on hake catch per unit effort compared to the traditional concrete weights (Students T-test: $P > 0.05$).

4. DISCUSSION AND CONCLUSIONS

Mortality estimate

This data provides an update to the seabird mortality estimate for the Namibian demersal hake longline fleet of 20,200 birds reported by Petersen (2008). While the level of observer coverage has been improved substantially, the new estimate of 22,821 (14,351 - 32,675) birds per year is very similar to the original and represents an alarming level of seabird bycatch in this fishery.

Line sink rate

The sink rate of standard fishing gear in this fishery is extremely slow. The average mass of the concrete weights currently used in this fishery is 3.69 kgs which are deployed at minimum intervals of 96 m. Our TDR analysis suggests this results in a sink rate of 0.12 m/s to a depth 4 m and 0.15 m/s to 10 m. By adding 5 kg steel weights it was possible to increase the sink rate of baited hooks to 0.17 m/s down to a depth of 4 m and 0.22 m/ s to 10 m. This compares poorly in comparison with the recommendation by Robertson (2000) for a sink rate of >0.3 m / s on demersal longline gear and the 8.5 kg every 40 m or 6 kg every 20 m that is recommended in CCAMLR following Agnew *et al*. (2000).

The reason for the longer distance between line weighting compared to the Patagonian toothfish fishery is that the Namibian fishery for hake targets fish that migrate vertically in the water column and thus fishing captains prefer to have sections of line that loft above the seafloor. This in turn requires greater space between weights. From trawl catch rate, both *M. capensis* and *M. paradoxus* feed off the seafloor at night although the difference is relatively small (Gordoa and Macpherson, 1991). This produces a situation which complicates the provision of effective mitigation of seabird bycatch as best practice would be to set fishing gear at night in combination with a shorter distance between line weighting. This greater distance between weights allows for lofting of the hook line during setting reflected in birds being caught at the slowest sinking point of the line in close proximity to the un-weighted dropper lines.

However, we found in 2011 that bird-scaring lines (preferably paired) and night setting are effective at reducing seabird bycatch in this fishery and here we have shown that the use of improved line weighting (steel instead of concrete which has the propensity to break down rapidly at-sea) also reduces seabird bycatch. Our initial results suggest there is no effect on target species catch rates.

In addition, the fishing master on the vessel where we conducted the experimental trials suggested that the heavier steel weights helped prevent the gear from drifting across the seabed, and therefore were beneficial in avoiding gear loss and entanglements. This could serve as an additional conservation benefit in terms of reducing plastics waste and ghost fishing. A long-term experiment would be necessary to determine such effects.

In Namibia a draft National Plan of Action-Seabirds and Hake Management Plan have been developed and both recommend the adoption of tori lines as mitigation measures. The draft NPOA-Seabirds calls for a seabird bycatch reduction of 80% in this fishery. However, despite positive stakeholder consultations the draft NPOA-Seabirds is still awaiting formal adoption by the Ministry for Fishery and Marine Resources.

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