OUTCOMES OF AT-SEA TRIALS INTO DIFFERENT LINE-WEIGHTING OPTIONS FOR KOREAN TUNA LONGLINE VESSELS

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Introduction

The Indian Ocean Tuna Commission (IOTC) passed a resolution in 2012 (Res. 12/06) relating to measures to reduce seabird bycatch during longline operations for tuna. Res 12/06 changed significantly the range of options available for longline vessels, in brief requiring that vessels operating south of 25°S use two out of the following three measures: set lines only at night, deploy a bird-scaring streamer line, and add weight to branchlines. The implementation date of Res 12/06 was set for July 2014, to allow fleets to trial the different measures in an orderly fashion before that date.

The Republic of Korea's pelagic longline fleet catches big-eye (*Thunnus obesus*), yellowfin (*T. albacares*) albacore (*T. alalunga*) and southern blue fin (*T. maccoyii*) tunas in the southern Indian Ocean south of 25°S, where there is an overlap with several vulnerable seabird species. A collaboration was established between BirdLife International, the Republic of Korea's National Fisheries Research and Development Institute (NFRDI) and Sajo Industries to monitor seabird bycatch and conduct trials of line weighting options during production fishing.

Methods

Fishing operations

Trials of line weighting configurations were conducted onboard the *FV Oryong No. 37.3,* a 58-m Korean pelagic longline vessel. Fishing gear consisted of a braided monofilament mainline, 40 cm diameter floats, radio beacons and monofilament branchlines. The mainline was deployed via a line shooter from the stern at a vessel speed of 9.5 knots. The line shooter delivered the mainline slack into the water at 6.6 m/s. Branchlines were ~40-m long, attached to the mainline at intervals of approximately 38 m; the terminal section of the branchline was variable in length, always <5 m, and was unweighted; around 50% of branchlines ended with a 40 cm, monofilament-coated steel leader. The target fishing depth was estimated to be ~150 m.

Baskets were used to store branchlines, with 11 hooks per basket; all hooks in a basket were configured as either a treatment or a control. In each basket, 2-3 hooks were baited with Argentine squid *Illex argentinus,* 4-5 with whole pilchards *Sardinops sagax* and 4-5 with Round scad *Decapterus maruadsi*.

The *Oryong N°373* used a single bird-scaring streamer line, attached to a purpose-built pole positioned on the upper deck, 4 m from the stern, 3.5 m high and extending 2 m from the port side. The aerial extent of the bird scaring line over the water during setting was 50-80 m.

Experimental trials

The main objective of the trials was to investigate the effect of line weighting on fishing operation and the catch rate of target species and seabirds. The experiments included lines with additional weights compared to lines with no changes from usual configuration. We used a proprietary-designed sliding lead weight which has been configured to slide on monofilament line when under tension, thereby preventing dangerous flybacks when lines break under tension (Sullivan et al. 2012). Two weighting options were used, 75 g and 40 g weights, and they were positioned at 5 cm from the hook (i.e. over the steel leader), except for one set where 75 g weights were placed at 40 cm from the hook.

During line setting, environmental and operational data were collected. The latter included date, time, geographical coordinates, setting direction, setting speed and depth of seabed. Approximately ten minutes before the start of the haul, date, time and geographical coordinates were recorded. Hauling operations were observed from positions on the haul deck with a clear view of the hooks as they were brought to the surface and as they came aboard. For the experimental section of each line, all catch was identified to species level and size-class, including seabirds, target/retained species (tunas, swordfish, sharks) and non-target/discarded species. Additionally the hauling of at least half of all remaining hooks (i.e. from non-experimental sections) were observed for seabird bycatch.

Seabird diversity and abundance were recorded at least once for each haul, repeating during the daylight. The number of birds was recorded by species in a semicircle 200 m in diameter, from the hauling bay towards the stern.

RESULTS

Research effort

Nineteen experimental sets were conducted, with a total of 2,500-3,300 hooks per set. All sets were made in the Indian Ocean, between 30-35°S and 101-107°E. The experiment included 8430 paired experimental hooks, which consisted of 4215 treatment (weighted) and 4215 control (unweighted) branchlines. Of the weighted branchlines, 1970 were 75-g treatments and 2245 were 40-g treatments.

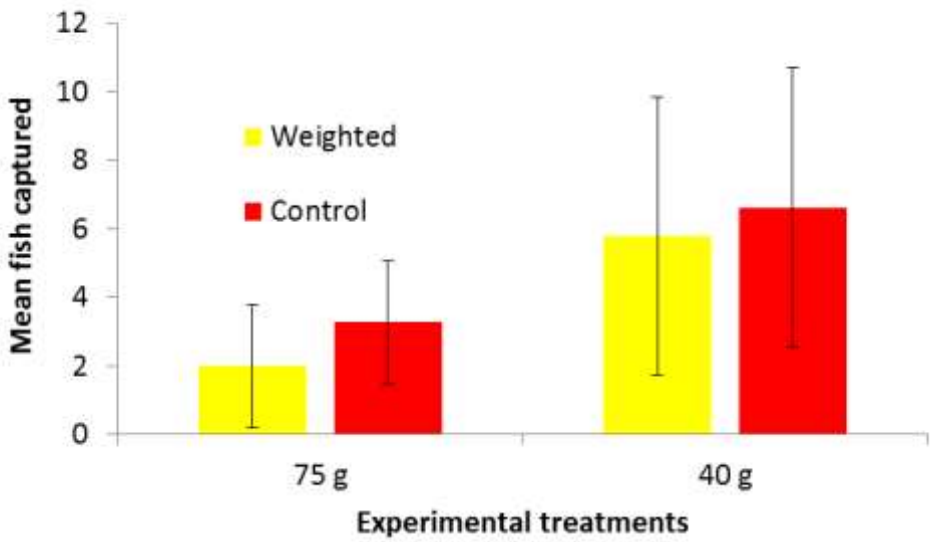

Figure 1. Total tuna catches on paired weighted and unweighted branchlines from 19 experimental sets on a Korean longline vessel operating in the southern Indian Ocean. Vertical bars represent one standard deviation.

Interactions of gear with baited hooks

The captain preferred keep the distance between hook and weight short, due to concerns that the weight would cause entanglements on setting. Initially, 330 weighted branchlines were set using 75 g leads placed approximately 45 cm from the hook. The bait caster caused weights to interact with baited hooks and bait loss was especially noticeable for squid baits. These data are excluded from all analyses. Thereafter weights were placed ~5 cm from the hook, and there were no problems encountered during setting. The number of experimental lines per line varied considerably, ranging from 110-303 each of treatment and control lines.

Initially 10 sets were conducted with 75 g weights, and then weights were cut down to ~40 g for the next eight sets. One set was conducted with a mix of 75 g and 40 g weights, with catch statistics recorded separately for each treatment. In total 163 tunas and 20 sharks were caught on experimental lines. Sample sizes are too small to report statistical analyses. However a visual inspection of Figure 1, showing target catch totals (numbers of fish) on treatment and control lines for both 75 g and 40 g weighting configurations, shows little difference in catch when 75 g weights were used and no discernible differences in catch rates between 40 g weighted and unweighted branchlines.

Seabird abundance

The species composition around the vessel was dominated (numerically) by pintado petrels *Daption capense (*mean 14.2 birds; range 5-40), Indian yellow-nose albatross *Thalassarche carteri* (mean 5.9 birds; range 3-10), softplumaged petrel *Pterodroma mollis* (mean 2.6 birds; range 1-6), great-winged petrel *Pterodroma macroptera* (mean 1.5; range 1-5) and black-browed albatross *T. melanophrys* (mean 1.3 birds; range 1-6). Other species were observed infrequently, in small numbers.

DISCUSSION

The primary objective of this research was to explore options for adding weight to branchlines, ultimately to reduce seabird bycatch, with key indicators of success being that

1. they could be incorporated into production fishing in a manner that was safe (for crew) and operationally efficient,
2. the impact of weighting regimes on target catch rates be neutral or positive, and
3. catch rates on seabirds and other non-target species be reduced

The first objective was achieved through reconfiguring the equipment onboard during production fishing. The first set included 75-g weights placed at 40 cm from the hooks. This was abandoned after the first set because the weights interacted with the baited hooks and caused noticeable bait loss during setting. Thereafter weights were placed at 5 cm from the hook, and preliminary results indicate that 40 g lead sliding weights, once built onto lines, do not interact with baited hooks, do not require additional crew time to use and there were no safety concerns. For the second objective, despite the small sample sizes there appeared to be no impact on catch rates. For the third objective, although we are encouraged by the fact that no seabirds were caught, seabird abundance was very low and we cannot draw firm conclusions about the effectiveness of the regime in reducing seabird bycatch. However, work conducted elsewhere on sinking rates of various line weighting regimes is relevant here. ACAP (2011) indicated that current best practice for achieving good sink rates includes a regime of 45 g within 1 m of the hook.

This collaborative research, which involved the government of the Republic of Korea, Sajo Industries and BirdLife International, was highly successful. The results demonstrate that Korean-style branchlines can be optimized for a fast sink rate with a weighting regime that appears to have a very low risk of impacting negatively catch rates of target species, with no safety risks to crew and with no operational difficulties.

The establishment of a positive working relationship between collaborators, and the continued need to improve seabird mitigation in pelagic tuna fisheries is highlighted. Further work is required, preferably in areas of high seabird abundance, to achieve robust sample sizes for assessing the impacts of weights on target and non-target catch rates.

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