UPDATES ON AT-SEA TRIALS INTO DIFFERENT LINE-WEIGHTING OPTIONS FOR KOREAN TUNA LONGLINE VESSELS

PREPARED BY: Yuna Kim[1], Zang Geun Kim[2], Sung Il Lee[2], Gi Chul Choi[2], Gyung Su Jo[2], Jaegu Jung[2], Hee Won Park[2], Jeong Yun Park[2], Dominic Rollinson[3] and Ross M. Wanless[3,4]

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[1] *Department of Biological Sciences, Faculty of Science, Macquarie University, Sydney, Australia*
[2]*National Institute of Fisheries Science, 216 Gijang-Haeanro, Gijang-eup, Gijang-gun, Busan, 46083, Republic of Korea*
[3] *Percy FitzPatrick Institute, DST/NRF Centre of Excellence, University of Cape Town, Private Bag, Rondebosch, 7701, South Africa*
[4]*Seabird Conservation Progamme, BirdLife South Africa, PO Box 7119, Roggebaai, 8012, South Africa*

Introduction

The Korean tuna longline fleet catches bigeye (*Thunnus obesus*), yellowfin (*T. albacores*), albacore (*T. alalunga*) and southern bluefin (*T. maccoyii*, hereafter SBT) tunas in the southern Indian Ocean south of 25°S, where there is an overlap with several vulnerable seabird species. Since 2013, the longline industries and National Institute of Fisheries Science (NIFS) in the Republic of Korea have investigated effectiveness of seabird bycatch mitigation measures in collaboration with BirdLife International. Data collected from at-sea trials in 2013 could not be statistically analysed due to small sample size, it was surmised that 45 g Lumo leads at placed at 5 cm from the hook could be incorporated into Korean fishing operations safely (Tamini et al. 2013). The positive results encouraged NIFS to conduct additional experiments subsequently. The primary objective of the 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

Four additional experimental tests have been conducted to date onboard Korean vessels with two colours (luminescent and black), two weights (45 g and 60 g) added to branchlines at distances ranging from 5 cm-3 m. Two of these were completed in September and October 2015, so analysis of combined results is not possible. Preliminary indications are mixed but are generally positive, with no safety incidents recorded, and some weighting regimes catching tunas at the same rate as unweighted lines.

Methods

Fishing operations

Trials of line weighting configurations were conducted onboard one Korean tuna longline vessel in 2014 and four vessels in 2015. 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.

Experimental trials

The experiments included lines with additional weights compared to lines with no changes from usual configuration. We used a proprietary-designed Lumo 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). The leads were nylon coated. The experiments used yellow luminescent nylon, additionally one vessel in 2015 used non-luminescent (black) coated leads (hereafter non-Lumos). Baskets were used to store branchlines, with 11 hooks per basket; all hooks in a basket were configured as either a treatment (weight added to individual branch lines) or a control (no weights added) as shown in Figure 1. In 2014, 45 g weights were positioned at 5 cm from the hook (i.e. over the steel leader). The weight configuration in 2015 was varied and the details can be found in Table 1.

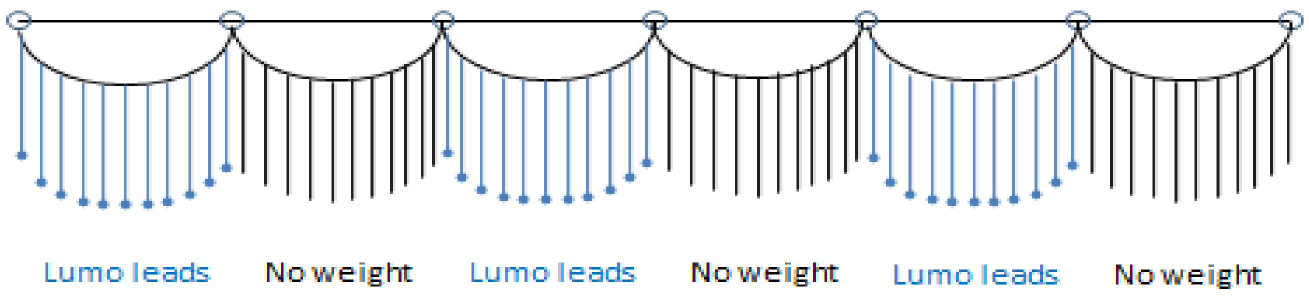

Figure 1. Experimental study design.

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.

It is important to note that no statistical analyses could be undertaken as datasets were not available in time for the preparation for this paper, so results are confined to broad impressions and indicative or likely outcomes.

Table 1. Weight configuration

Year	2013	2014	2015			
Vessel	A	B	C	D	E	F
Weight (g) / type	75 & 45/ Lumo	45/Lumo	45/Lumo	45/Lumo	45 / Lumo	45 / Non-lumo 60 / Lumo
Distance from the hook (cm)	40 & 5	5	50	5	5	5, 60, 100, or 200
Number of experimental sets	19	48	36	81	59	85
Area observed	30~35°S, 101~107°E	37~39°S, 100~103°E	42~44°S, 1~7°W	38~44°S, 0~21°W	30~38°S, 83~103°E	19~29°S, 36~37°E

RESULTS

Crew safety and operational issues

No safety incidence occurred in both 2014 and 2015. However, some operational issues were noted during the trials in 2015;

1. Vessel C: Wire leaders were bent or broken (presumably due to adding weights) so crews had to straighten or replace these. Increased bait loss on weighted branchlines was reported by the observer but no data collected. When setting weighted branchlines using the line shooter, some hooks pivoted mid-air when the weight was cast, causing hooks to fly back to vessel where crews were standing.
2. Vessel F: There was a noticeable reduction in tuna catches using non-lumo leads at the hook (but this has not been statistically tested yet). This effect appeared to reduce as the weight was moved to 1 m, and seem to disappear completely when weights were moved to 2 m, but there appeared to be an increase in the numbers of knots in

branchlines as weights were moved further from the hook. Readers are cautioned that these are impressions from the observer, from inspecting the datasets, and are not yet supported with statistical tests.

Incidental mortality of seabirds

In 2014, there was a Black-browed Albatross caught on an unweighted line while there was no bird caught on weighted lines. In 2015, onboard Vessel C 6 Black-browed Albatrosses, 7 Grey-headed Albatrosses and 2 Light-mantled Albatrosses were caught on weighted lines, but it did not make an experiment on unweighted lines. Onboard Vessel D, a Indian Yellow-nose Albatross and a Wandering Albatross were caught on unweighted line while there was no bird caught on weighted lines. Onboard Vessel E, a Black-browed Albatross and a Grey-head Albatross were caught on weighted lines and unweighted lines, respectively. Vessel F did not catch any seabirds but the fishing area was not seabird-rich.

DISCUSSION

The results from the six cruises showed inconsistent results, some of which conflict with similar trials conducted in other fleets elsewhere. Where we suspect that there are significant reductions in target catch rates, these findings happened in a context of very low seabird abundance (as supported by the observer reporting zero seabird bycatch during the entire cruise). It is important to recall that line weighting is designed to move baited hooks rapidly out of the reach of seabirds, and thereby reduce bait loss and seabird bycatch. Thus apparent negative impacts on target catch rates using weighted lines could be offset to negligible levels, or reversed to positive impacts, when used in areas of high seabird abundance.

This collaborative research, which involved the government of the Republic of Korea, all Korean longline Industries operating in Indian Ocean, BirdLife South Africa and BirdLife International, was highly successful. It represents significant effort, trust and strong desire to resolve the matter of adding weights to branchlines, to provide fishers with more options when seeking to be compliant with the IOTC's conservation measure. 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. However they also show idiosyncratic, vessel-specific effects that conflict with findings from other Korean vessels and from other fleets. The IOTC resolution 12/06 provides three options for different line-weighting regimes, and we conclude that this provides sufficient scope for individual vessels to trial different regimes to find a system that works best for their particular circumstances.

The establishment of a positive working relationship between collaborators, and the continued need to improve seabird mitigation in pelagic tuna fisheries is highlighted. Further data analyses are being conducted. The analyses will enable us to assess impact of weights on target and non-target catch rates and will enable us to draw a firm conclusion about effectiveness of line weighting in reducing seabird bycatch.

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