Preliminary assessment of hook sink rates using two branchline types aboard F.V. *Ikatere*

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ABSTRACT

Time depth recorders (TDRs) were used to compare the rate at which baited hooks sank on two types of branchlines aboard the pelagic longliner, F.V. *Ikatere*. A normal monofilament branchline was compared with an experimental branchline which had a short terminal wire section with a lure. The mean depth of the hooks 30 seconds after deployment (i.e. at the end of the protection zone afforded by the tori line) was 8.31 ± 0.56 m (range 5–10 m) for the normal branchlines and 10.56 ± 64 m (range 8–13 m) for the experimental ones. The tori line coverage was estimated as 100–144 m behind the vessel (or c. 30–40 s) at the normal setting speed of 3.6 m/s, which appears to be above average for the vessel's size. Further research should investigate whether the gain in sink rate achieved with the experimental branchline can be replicated on other vessels.

Keywords: seabirds, pelagic, longlines, sink rates, time depth recorders (TDRs), tori lines, New Zealand.

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1. Introduction

A range of seabirds are vulnerable to incidental capture on baited hooks on brachlines set by longliners from the time the hook enters the water until it has sunk beyond their diving range. Of the albatrosses, the wandering albatross (*Diomedea exulans*) is the shallowest diver (maximum dive depth recorded is 0.06 m (Prince et al. 1994). Prince et al. 1994 also recorded light mantled sooty albatrosses (*Phoebetria palpebrata*) diving to 12.4 m. The diving ability of petrels varies considerably, with white-chinned petrels (*Procellaria aequinoctialis*) known to dive to 12.8 m (Huin 1994) and sooty shearwaters (*Puffinus griseus*) to 67 m (Weimerskirch & Sagar 1996).

Trials have been conducted on other pelagic longline vessels using time depth recorders (TDRs) and have proven to give reliable evaluations of the behaviour of the branchline upon deployment (O'Toole & Molloy 2000; Anderson & McArdle 2002).

During April 2001, a trip was undertaken on board F.V. *Ikatere* to compare the sink rate of two types of branchlines using TDRs. This report gives the results of those trials and makes some suggestions regarding future investigations.

1.1 OBJECTIVES

The objectives of this project were to:

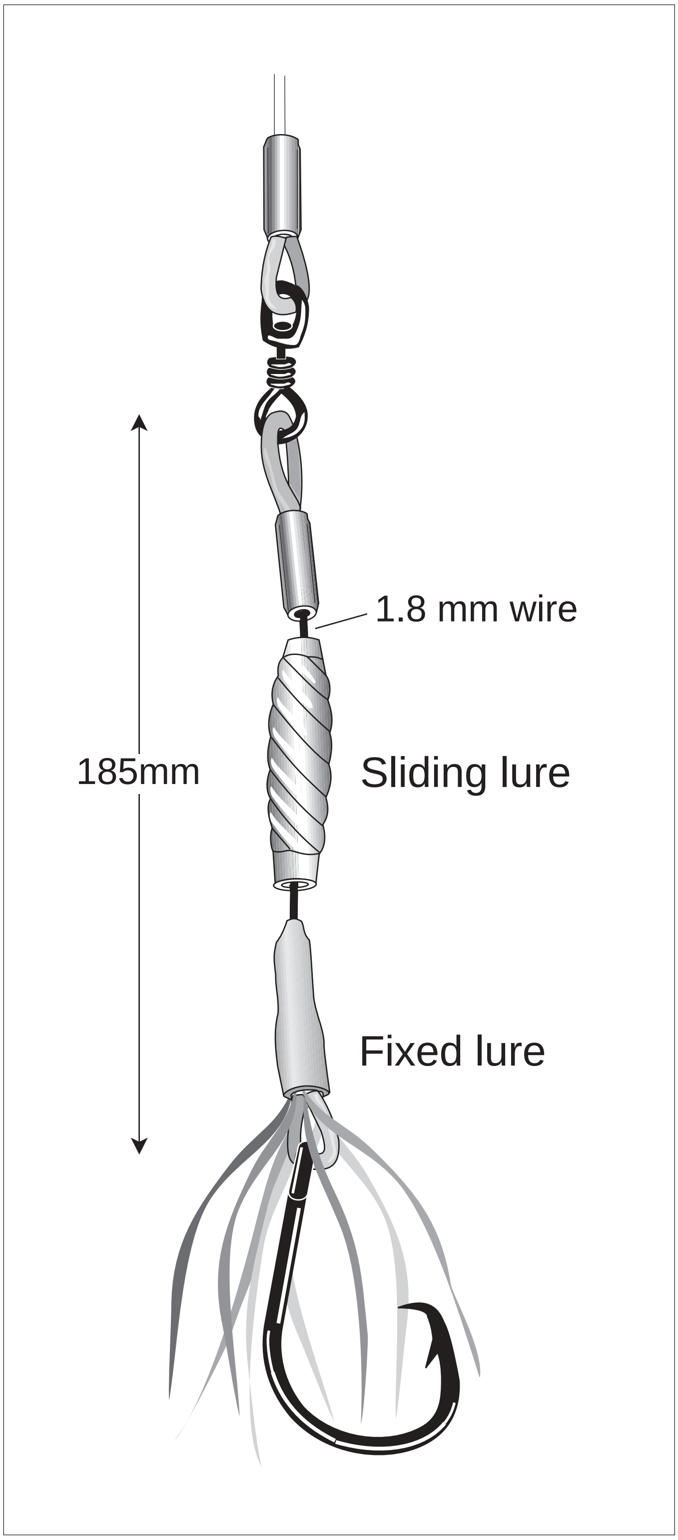
- Determine and compare the sink rates of the normal and experimental branchlines on the F.V. *Ikatere*
- Estimate the effective aerial coverage of its tori line
- Estimate the depth of baited hooks at the point at which the tori line enters the water

2. Methods

2.1 VESSEL AND BRANCHLINES

The F.V. *Ikatere* is an ex-government research vessel currently set up for pelagic longlining. The vessel is 19.3 m in length with a beam of 4.2 m and a 3.0 m draft. The vessel consistently sets the longline backbone (to which branchlines are attached) at 7 knots (3.6 m/s) without a line shooter. (A line shooter is a hydraulic device which pulls the mainline off the drum to allow the line to lay slack in the water.) During the trial, the vessel used two types of branchline (normal and experimental) within each basket. (A basket is a hanging curve of line between two floats on the backbone). The branchline normally used by the vessel was monofilament, 1.8 mm in diameter and 11.5 m

Figure 1. Terminal wire section on experimental branchlines.



long. The other, experimental branchline was similar but had a fixed and sliding lure on a short, 185-mm wire section on the terminal end of the branchline (Fig. 1). This short wire section increased the overall weight of the branchline by 25 g.

2.2 TORI LINE

The tori line was towed from a point 12 m above sea level. It was connected to a mast amidships on the centre line of the vessel. The overall length of the tori line was 265 m. From the towing point, the initial section was 250 m of 3-mm diameter rope with the last 15 m made up of progressively larger diameter sections of rope to create further drag. Streamers were placed at 4-m intervals.

2.3 TIME DEPTH RECORDERS

TDRs were used to collect information on the hook depth over time. Each TDR measured 95 × 24 × 17 mm and weighed 12 g (in water). The Mk7 TDRs used in this trial were manufactured by Wildlife Computers (Redmond, Washington, USA). Prior to deployment, TDRs were soaked for 30 min in a bucket of seawater. (Soaking minimized erroneous readings caused by the rapid expansion or contraction of the pressure plate on the depth sensor.) TDRs were set to record depth every 2 s at a resolution of 0.5 m. Upon retrieval, data were downloaded from the recorders onto a PC, and then converted into Microsoft Excel files.

2.4 EXPERIMENTAL DESIGN

As in Anderson & McArdle (2002), TDRs were attached to the branchlines at a point approximately 1 m from the hook and deployed during the set as part of the normal fishing operation. Each basket had 16 branchlines with a small 18 cm float placed in the middle of the basket (Fig. 2). The sink rate of both types of branchline was investigated over 4 sets. A pair of TDRs was placed in each of two baskets during each set, alternating between sets. One empty basket was left between those with TDRs. In the first basket, a TDR was attached to the first (experimental branchline, TDR X) and fourth branchlines (normal branchline, TDR Y). In the second basket, TDRs were attached to the ninth (normal

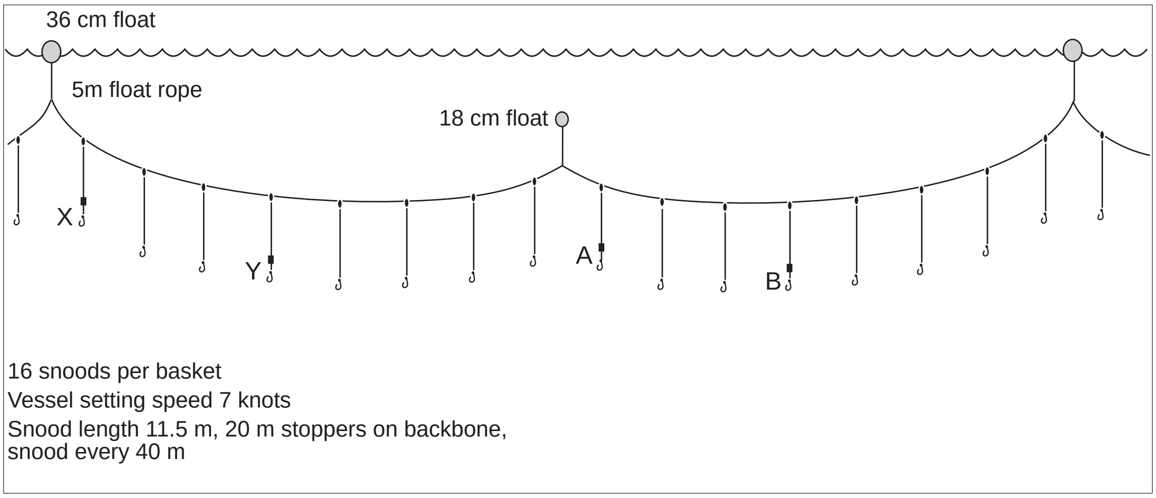


Figure 2. Trial vessel longline configuration (X, Y = TDR positions within one basket; A, B = alternative TDR positions within a subsequent basket).

branchline, TDR A) and twelfth branchlines (experimental branchline, TDR B). Previous trials have shown no effect on sink rate in relation to branchline position (shallowest or deepest) within a basket (Satani & Nozumi 1998; O'Toole & Molloy 2000).

The sink rate of baited hooks over the first 30 s of deployment was calculated. To determine hook depth at the end of the protective coverage afforded by a tori line, hook depth at a point approximately 100 m (30 s after deployment) was calculated.

2.4.1 Tori line aerial coverage

The length of the aerial coverage of the tori line was determined by timing 10 surface floats (during part of one set) as they were released from the stern until they passed the point where the tori line met the water. Timing further floats on other days was not possible because all other sets were made during the hours of darkness.

2.4.2 Bait

To keep the sampling regime as consistent as possible, squid (*Nototodarus* spp.), was the only bait used for the branchlines in these trials. The mean weight of the squid bait was 100 g with bait temperature varying between –0.5 and 13°C (partially to fully thawed).

2.4.3 Environmental conditions

The environmental variables were consistent for the four sets. Wind speed was 10–15 knots (5.1–7.7 m/s) with the vessel deploying the line downwind. Swell height was < 1 m.

3. Results

3.1 TORI LINE

The mean time for a float to reach the point where the tori line met the water was 39.9 s. At the vessel's usual setting speed of 7 knots (3.6 m/s)the estimated average aerial coverage on this one set was 144 m. However, because of the small number of recordings this estimate must be treated with caution. To calculate the depth of baited hooks at the end of the tori line aerial coverage, a conservative value of 100 m (or 30 s post-deployment) tori line coverage was chosen.

3.2 HOOK SINK RATE

The mean ± SD depth of the baited hook (± 1 m) after 30 s on normal monofilament branchlines was 8.31 ± 1.6 m (range 5–10 m) compared to 10.56 ± 1.82 m (range 8–13 m) for the experimental branchline (Table 1). Some hooks on the normal monofilament branchlines were still at a shallower depth than 4 m, 25 s after deployment (Fig. 3) whereas, all hooks on the experimental branchlines were 7 m or deeper at this time (Fig 4).

TABLE 1. HOOK DEPTH (m) 30 s AFTER DEPLOYMENT ON NORMAL AND EXPERIMENTAL BRANCHLINES.

	NORMAL	EXPERIMENTAL
N	8	8
Mean	8.31	10.56
Standard deviation	1.6	1.82
Range	5-10	8-13
Confidence level (95 %)	1.34	1.52

4. Discussion and recommendations

The tori line on the F.V. *Ikatere* appeared to give an effective aerial coverage of at least 100 m, and possibly 144 m, behind the vessel. The protection afforded by the tori line appears to be above average for the size of this vessel (Nelson 1998; Keith 1999). However, the small sample size means that we should interpret this result with caution.

The normal monofilament branchlines on the F.V. *Ikatere* sank faster than branchlines measured on other New Zealand boats. In a recent study of four NZ tuna longliners, the range of depths of baited hooks 30 s after deployment was between 0.5 and 8.5 m with a mean depth of 3.79 m (Keith 2003). Anderson & McArdle (2002) found the mean depth of hooks at 30 s (or 100 m) after deployment on the vessel they undertook trials on to be 5.57 m. Hooks set on experimental branchlines on the F.V. *Ikatere* were found at least 2 m deeper at 30 s post-deployment (i.e. c. 100 m behind the vessel) than normal branchlines (Table 1). This increase in depth is quite notable given that it involves a relatively simple modification of the fishing gear.

Those hooks that were shallower than the mean are of special significance in that they are the hooks most available to seabirds. While our results have to be treated with caution due to the small sample size, the branchline with the experimental wire terminal section consistently outperformed the normal branchline and had fewer outliers. Branchline configurations that keep shallow outliers to minimum as well as increasing the hook sink rate may decrease the incidental catch of seabirds from longlining. Anderson & McArdle (2002) also

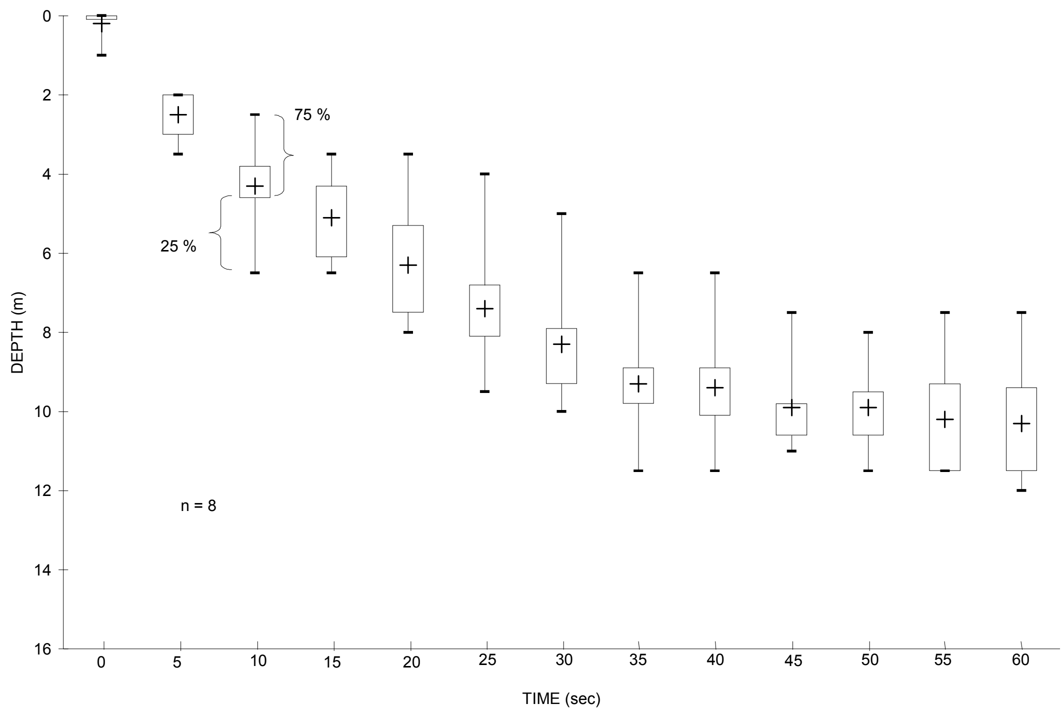


Figure 3. Box plot showing upper and lower quartiles and median (+) hook depth, together with minimum and maximum values (vertical lines) on normal branchlines on the F.V. *Ikatere* (n = 8).

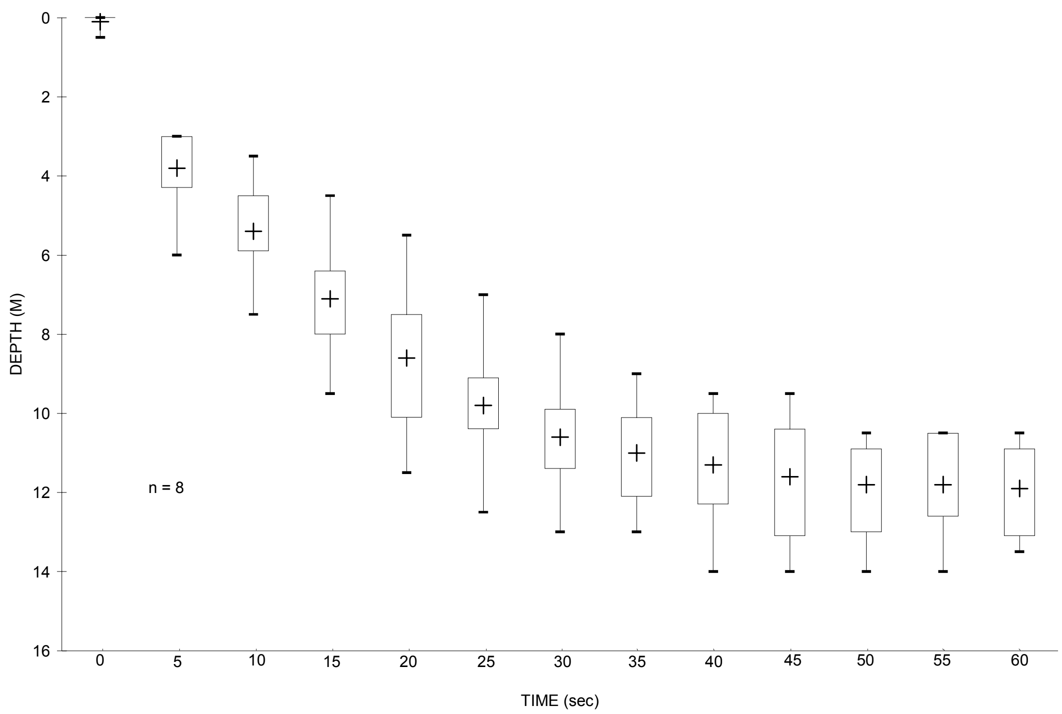


Figure 4. Box plot showing upper and lower quartiles and median (+) hook depth, together with minimum and maximum values (vertical lines) on experimental branchlines on the F.V. *Ikatere.* (n = 8).

experimented with a 60 g lead weighted swivel placed 5 m from the hook and found this increased the mean hook depth at 30 s to > 13 m. The 10.56 m hook depth that F.V. *Ikatere* achieved at the same time point, using a small wire terminal section, weighing just 25 g is encouraging. Trials using experimental branchlines on other vessels and in different weather conditions will be necessary to determine what influence the vessel and operating environment may have on the sink rate of the baited hook.

Although we recorded no hard data on target fish catch rates using the experimental branchlines, the skipper of the F.V. *Ikatere* was confident that his catch was as good if not better than when using the normal branchline. Another benefit of using the experimental wire section may be less line maintenance, since there is no monofilament wear near the hook. Issues such as increased shark catches as a result of these modifications still need to be investigated.

Any modification of fishing gear, such as the experimental branchline described in this report, that can achieve a better sink rate without adverse effects on fishing is worth investigation.

4.1 RECOMMENDATIONS

Based on the data presented in this report, the author recommends:

- Further research into whether the gain in sink rate achieved with the experimental branchline on the F.V. *Ikatere* can be replicated on other vessels.
- Further research into whether the fast hook sink rate (with its normal branchline) and the protection afforded by the tori line achieved on the F.V. *Ikatere* can be repeated using similar materials and construction on other vessels.
- Further research into the diving speed of seabirds (since if seabirds are able to move faster than a sinking hook, sink rates may be irrelevant to mitigating their incidental bycatch).

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