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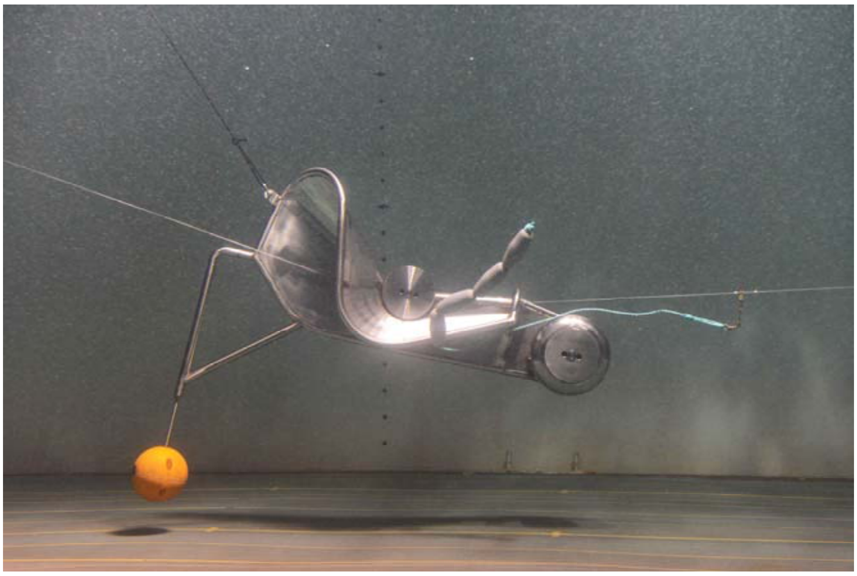
Kellian Line Setter Sea Trials

Initial Performance Testing



Report prepared for

Department of Conservation

Contract 4529

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1. Introduction

In 2011 quantitative seabird risk assessment work (Richard et al 2011) highlighted the high degree of potential risk that small vessel (inshore) bottom longline fisheries in New Zealand posed to a number of protected species, including the black petrel *Procellaria parkinsoni* and flesh-footed shearwater *Puffinus carneipes*. Although a suite of mitigation measures was mandatory in these fisheries, including the use of streamer lines, line weighting, night setting of longlines and restrictions on offal discharge during setting and hauling, bycatch of protected seabirds still remained a concern (Richard et al 2011). In ongoing experimental work to find solutions Goad et al (2011) and Pierre et al (2013) investigated the efficacy of operational practices in use in these fisheries for reducing seabird bycatch risk, reported on the influence of weighting regimes and float placement on sink rates of hooks, as well as describing some initial sea trials to test and develop a novel mitigation device, the Kellian line setter.

The Kellian Line Setter is an underwater setting device developed by Dave Kellian, a fisherman from Leigh, New Zealand. The initial concept involved running the mainline under a nylon roller towed behind the vessel at depth. The line then ran over second roller, behind and below the first one, to stop weights pulling the backbone off the bottom of the first roller. Snoods, floats and weights pass beside the rollers, rather than over them (Goad 2011; Figures 1 and 2). A lead ball on a wire cable holds the device at depth and allows for deployment and recovery with a small winch. Attached to the lead ball a steel tube holds the rollers behind the cable and a paravane on the steel tube assists in maintaining stability during towing. Once deployed, setting depth can be adjusted by increasing or decreasing the cable length.

The initial prototype had been developed through a series of at-sea trials which were conducted during 2011. While these trials had been encouraging, the issue of fouling on the rollers was identified as needing resolution before further testing should be considered (Goad 2011). In 2012, using funding from the New Zealand Department of Conservation's Conservation Services Programme, we refined the initial prototype at the Australian Maritime College (AMC), using the skills and expertise of engineers at the Circulating Water Channel (flume tank) facility of the College. This permitted critical examination of the hydrodynamic characteristics of the device, and re-design to eliminate operational impediments (line fouling) that were inhibiting proof of concept and the potential for uptake of the device by industry.

The new prototype (KLS 2) consisted of a stainless steel cowling and funnel arrangement that incorporated two rollers, and which was towed behind a vessel at depth. The mainline was fed through the cowling, under the first roller and over second roller to stop weights pulling the backbone off the bottom of the first roller. Snoods, floats and weights passed beside the rollers, rather than over them (Baker and Frost, 2013). The hydrodynamic attributes and functionality of the modified prototype were assessed in the controlled environment of a flume tank but further testing and evaluation at sea was required under normal fishing conditions.

Figure 1: Kellian Line Setter Prototype 2 in the flume tank.

Figure 2: Kellian Line Setter Prototype 2.

In December 2013 Latitude 42 Environmental Consultants was awarded Contract 4529 to conduct seat trials of the Kellian Line Setter 2. The overall objective of this project is to test the at-sea feasibility, and to the extent possible, the effectiveness, of reducing the availability of hooks to seabirds by using the improved Kellian line setter, in inshore bottom longline fisheries.

Specific Objectives are:

1. To identify the range of bottom longline gear configurations and conditions that allow effective and safe use of the device by conducting experimental at-sea trials

2. To describe line sink profiles of bottom longlines set through the device, as a proxy for mitigation effectiveness.

3. To provide recommendations on any further development and refinement of the device that may be required to enable reliable, effective and safe use in commercial bottom longline fishing operations.

Here we report on initial performance testing of the KLS 2, which has been carried out over the last six months near Tauranga, New Zealand.

2. Progress with Sea Trials

Review of Prototype 1

A total of 6 trips were conducted on board the fishing vessel *Kotuku*, a 10 m bottom longliner fishing from Tauranga. Each trip involved a series of deployments and test runs, generally in calm sea conditions. GoPro cameras were employed to record the attitude of the setter in the water and the passage of fishing gear through the setter.

Initial performance: trip 1

The setter was deployed and vessel speed was gradually increased from 2 - 4.5 knots, and the tow rope was gradually payed out to a maximum length of 15m. The linesetter sat reasonably straight at low speeds (< 2 knots), pulling slightly to starboard. With a longer tow rope and at higher speeds the setter ran progressively further off to starboard and at a shallower angle, before breaking the surface at about 4 knots. The KLS 2 also appeared to roll over at speed, such that the ball was further out to starboard than the top.

Modifications and developments: trips 2-5

Over the following four trips a series of systematic changes were made to the setter to improve its performance. Changes included adding an adjustable paravane beside the funnel, increasing the weight of the ball, increasing the length of the stud above the ball, moving the towing point, and adding a second paravane above the ball.

For each of the trips a series of test runs were performed with different settings. Speed through the water (4.5 knots) and tow rope length (10 m) were kept consistent for all runs. The horizontal angle of the setter behind the boat, the depth it was running at, its attitude in the water (angle of pitch and roll) and the loading on the towline were recorded. Following each trip data was analysed, modifications to the setter made, and a 'run sheet' or test plan was formulated to trial different settings for the subsequent trip.

This iterative approach involved balancing of the various forces acting on the line setter so that it ran at depth and straight behind the boat. The extra weight further below the setter also provided more stability, making it less sensitive to small adjustments and less susceptible to towing at large angles of roll. During trip 5 a small amount of gear was deployed through the setter with a couple of momentary hook catch ups, and on examining the video footage it was thought that a more normal set with a longer longline, and more tension in the backbone, would produce a more representative and consistent indication of performance.

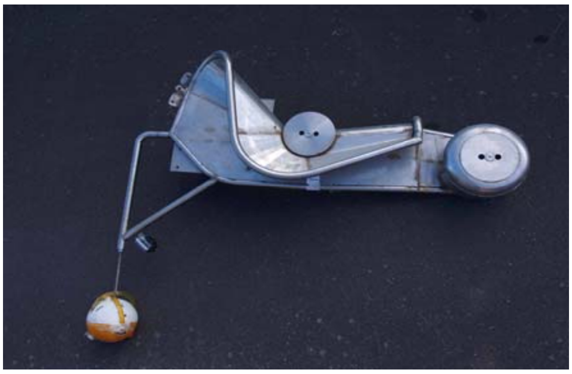	
Port side	**Starboard side**

Figure 3: Kellian Line Setter with modifications used to improve performance during initial performance testing. Modifications included:

- an adjustable paravane beside the funnel;
- increasing weight of the ball;
- increasing length of the stud above the ball;
- moving the towing point; and
- adding a second paravane above the ball

Setting a longline – trip 6.

A short set through the linesetter was performed with reasonable tension in the backbone, slightly more than would be used under normal fishing conditions, as it was thought that this would help keep the line in the setter. A 15 m tow rope was used, such that the setter ran at an estimated depth of 4 - 4.5 m, and speed through the water was initially 4, and then increased to 5, knots. Hooks were initially set slowly but as no problems were noted they were clipped on at normal (4 m) spacing for the majority of the set. Three hundred baited hooks were set through the device with three weights and 2 floats added to the line after the hooks. On examination of the video footage from the set the line came out of the back roller as the setter was lowered into the water. Therefore the set was conducted with the line running under the back roller. The setter tracked straight behind the boat with minimal (< 5 degrees) clockwise roll and a pitch angle of approximately 15 degrees nose down. The longline rubbed the front edge of the funnel but generally the passage of hooks was clean, either under or beside the funnel. A couple of traces were lost, and a couple of baits were seen coming off on the video, but overall the setter performed well and allowed the line to be set at depth and to catch some fish.

3. Discussion and Recommendations

Modifications to improve performance

• The iterative approach taken has resulted in two paravanes on the device, and these could potentially be combined, or at least simplified while still providing the desired forces to maintain an appropriate depth and angle of pitch for effective fishing. Retaining some adjustment in the paravanes would allow for fine tuning of the device in further sea trials.

- The funnel shape could be refined slightly to stop the line rubbing on its leading edge and to guide the traces around the outside of the funnel. This would also help when deploying floats, particularly intermediate surface floats, through the setter.

- Similarly, a guide needs to be made to send weights around the side of the rear roller so that weights on 'dropper' ropes can be deployed. Modifying the rear roller cheek could also help the passage of weights through the setter.

The developments outlined above may be best achieved by taking the setter back to the Australian Maritime College where modifications could be made and subsequent performance assessed in the flume tank. Ideally the setter could then be briefly taken to sea in Australia to confirm that the results from the flume tank can be then be achieved behind a vessel at speeds of 5 - 6 knots. Further development in the flume tank would also provide the opportunity to fine tune the funnel shape and paravane settings to optimise performance, prior to continuing further sea trials in New Zealand where operational performance and workability of the setter can be assessed under normal fishing conditions.

4. Acknowledgements

Alan Faulkner, Dave Kellian, Graham Robertson, Igor Debski and Kris Ramm provided advice and encouragement during the various phases of the development of this project.

We are also grateful to Janice Molloy and members of the Southern Seabirds Solution Trust Mitigation Mentor Programme's Technical Advisory Group for advice on the initial prototype and how to progress further development of the device.

The Australian Maritime College provided facilities and support which was essential to developing and refining Prototype 2 and developing solutions during the initial performance testing.

Funding was provided by New Zealand Department of Conservation's Conservation Services Programme (http://www.doc.govt.nz/csp), principally through a levy on the quota owners of relevant commercial fish stocks.

5. References

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