Bycatch Mitigation FACT-SHEET 8 (Version 3)

Practical information on seabird bycatch mitigation measures

Pelagic Longline: Line weighting

Line weighting is a primary mitigation measure and a key component in all successful reductions in seabird bycatch in pelagic longline fisheries. Line weighting should be used in combination with streamer lines and night-setting.

Seabirds are vulnerable to mortality during the short period between when hooks leave the vessel and when they sink beyond their diving ranges. Preventing contact between seabirds and baited hooks at this time is crucial. In many pelagic longline fisheries, weights are added to branch lines (snoods) to deliver hooks to target fishing depths as efficiently as possible. The best practice weighting regimes are intended to take baited hooks beyond the diving range of seabirds while under the protection of a well designed and properly deployed bird scaring line (streamer or tori line), without compromising fish catch rates.

Reducing seabird mortality in pelagic longline fisheries with line weighting regimes is more complicated than in demersal longline fisheries because of 'secondary' interactions with baited hooks. Secondary interactions occur when seabirds with good diving capabilities, such as shearwaters and petrels, bring sinking bait back to the surface where they can be ingested by larger and more dominant species, such as great albatrosses. Secondary interactions rarely, if ever, occur in demersal longline fisheries because branch lines are extremely short (< 0.6 m) and the mainline is heavy. In contrast, pelagic branch lines can be 15–40 m in length and light-weight. Secondary interactions are implicated in a significant proportion of seabird bycatch in pelagic longline fisheries.

Important aspects of line weighting

Two aspects of branch line construction are critically important to achieving fast sink rates – the length of the leader (distance between lead weight and baited hook) and the weight of the added weight. Leader length is the main determinant of the initial phase of the sink profile, while the weight of the attached lead is the main determinant of the final phase of the sink profile. The initial phase starts when the baited hook lands in the water and ends when the leader becomes taut. In this phase the lead weight sinks much faster than the baited hook. The final phase of the sink rate occurs when the slack in the leader is taken up and the baited hook comes under maximum load (pull-down) of the lead weight. The initial sink rate occurs in the first few metres of the water column (depends on leader length) and is increased by adding weight close to the hook (more quickly reduces the slack in the leader). The final sink rate occurs at deeper depths and is increased by increasing the attached weight. To reduce the availability of baits in all depths of the water column it is important to increase both the initial and final phases of sink profiles. This is achieved by using heavier weights closer to hooks (Robertson *et al.*, 2010; Robertson *et al., Submitted*). Recent experiments indicate that a 60 g lead weight, placed either at the hook or within 1 m of the hook, and a 120 g lead weight < 2 m from the hook, is likely to achieve these sink rates under most operational conditions (Robertson *et al., Submitted*). Other experiments conducted on Japanese vessels, trialled branch lines weighted with 65–70 g lead weight within 3–3.5 m from the hook, using a double-weight configuration; two leads placed at either end of a 1–1.5 m section of wire trace inserted into the branch line 2 m from the hook. In combination with dual streamer lines, this system reduced bycatch by 86% compared with un-weighted lines, with mean target catch rates remaining equal (Melvin *et al.*, 2011).

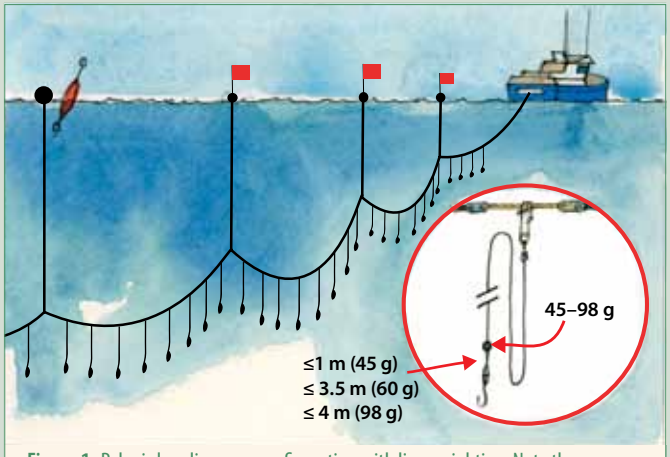

Figure 1. Pelagic longline gear configuration with line weighting. Note the distance between the weight and the hook.

Sink rate experiments

Sink rate experiments are currently being undertaken in many southern hemisphere countries. Over the next few years, new information will become available on the effectiveness of line weighting regimes in reducing seabird bycatch. In the meantime, the following prescriptions are relevant:

Swivel weights and leader lengths: Lead weights typically vary between 40 and 80 g. Leader lengths also vary, typically between 3–4 m. High seas fisheries either use minimal, if any, weight on branch lines to improve sink rates. In fisheries with high seabird interaction rates, line weighting options include: > 45 g lead weight at ≤ 1 m from the hook (to minimise gear loss from shark bite-offs); > 60 g lead weight at ≤ 3.5 m from the hook; or > 98 g lead weight ≤ 4 m from the hook. These line weighting regimes result in greatly improved sink rates in both phases of the sink profile without affecting the catch rates of target and non-target fish.

Propeller turbulence: The fastest sink rates are achieved by avoiding setting gear in the area behind vessels most affected by propeller turbulence. Bird scaring lines should be deployed in line with the edge of the vessel wake or outside of this area. Baited hooks should be deployed so as to land beneath the bird scaring lines, either into the vessel wake zone or outside of this area (depends on the position of the streamer line).

Bait thaw status: In fisheries where lead weights are added to branch lines, as long as bait (fish, squid) are thawed to an extent that permits hooks to be inserted without undue force, bait thaw status has no effect on sink rates. In fisheries where leaded swivels are not added to branch lines, the use of unthawed bait slows sink rates. However, the difference is minor and less important than other factors that affect gear sink rates.

Best practice recommendation

Line weighting is a primary measure for reducing seabird bycatch and there is increasing understanding about its effectiveness in combination with other measures. If used with an effective bird scaring line and night-setting, weighting regimes that sink hooks at ≥ 0.3 m/s to 2 m depth and ≥ 0.5 m/s to 5 m depth, should take hooks beyond the reach of most surface-seizing birds. Extensive work is currently underway to determine the most effective line weighting regime, however current minimum standards for branch line weighting configurations are:

- > 45 g lead weight at ≤ 1 m from the hook (to limit gear loss from shark bite-offs); or
- > 60 g lead weight at ≤ 3.5 m from the hook; or
- > 98 g lead weight ≤ 4 m from the hook.

- ***Leader length:*** Positioning the weight further than 4 m from the hook is not recommended, as this increases the length of time for the baited hook to sink below the diving depth of seabirds.
- ***Crew safety:*** To improve crew safety issues associated with the use of a point source of weight (e.g. leaded swivels), use of Safe Leads is strongly encouraged. These leads slide down the branch line during bite-offs or when the line breaks under tension, thereby greatly reducing the incidence of dangerous fly-backs towards the vessel (Sullivan *et al.,* 2012)
- ***Vessel effects:*** Large industrial and small artisanal vessels may require different weighting regimes to attain the same reduction in seabird bycatch.
- ***Operational effects:*** In order to achieve the fastest practicable sink rates, hooks must be cast beyond the propeller wash, and yet remain under the protection of the bird scaring line/s.

Other considerations

Target species catch rates

Recent research reveals that adding weight to pelagic branch lines does not affect the catch rates of target and non-target fish. (Melvin *et al*., 2011, Robertson *et al*., *Submitted*).

Combinations of measures

Line weighting is arguably the most important mitigation measure, but to ensure effectiveness it is recommended that it be used in combination with other measures, including:

- ***Streamer lines*** (Fact-sheet 7a and 7b)
- ***Night-setting*** (Fact-sheet 5).

Further research

Safe Leads and hook leads are available from Fishtek Ltd, UK (http://www.fishtekmarine.com/).

Compliance and implementation

Compliance with specific line weighting requirements can be monitored through in-port and at-sea inspections. Assessments of compliance by port inspections are greatly facilitated by the use of lead weights < 1 m from the hook, as these will be visible in the gear bins (not buried under the bulk of the monofilament). Also line weights crimped into branch lines are technically very difficult to remove at sea, so may be a means of ensuring greater compliance levels.

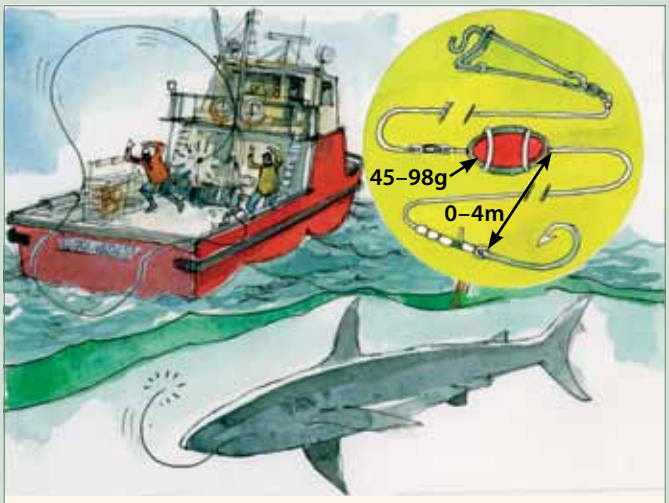

Figure 2. Fishermen can be injured by weights when the line suddenly breaks. Inset shows the Safe Lead, a new weighting system developed to reduce the risk of injury.

Thanks to Dr Graham Robertson (Australian Antarctic Division) for his contributions to the content of this Fact-sheet.

References

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Robertson, R., Candy, S., Wienecke, B. and Lawton, K. (2010) Experimental determinations of factors affecting the sink rates of baited hooks to minimise seabird mortality in pelagic longline fisheries. *Aquatic Conservation: Marine and Freshwater Ecosystems*. 20: 419–427.

Robertson, G., Candy, S. and Hall, S. (*Submitted*). New branch line weighting regimes reduce risk of seabird mortality in pelagic longline fisheries without affecting fish catch.

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