Bycatch Mitigation FACT-SHEET 8 (Version 1)

Practical information on seabird bycatch mitigation measures

Pelagic Longline: Line weighting

Line weighting is one of the most effective known mitigation measures (a primary measure). It is widely applicable to pelagic longline fishing, and has been demonstrated to lead to reductions in seabird bycatch. It is recommended that it be used in combination with streamer lines, night setting and other measures as required.

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 diving seabird species, such as *Procellaria* petrels and *Puffinus* shearwaters, 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 snoods/branch lines are extremely short (<0.6 m) and the mainline is heavy. In contrast, pelagic branchlines can be 15–40 m in length and lightweight. Secondary interactions are implicated in a significant proportion of seabird bycatch in pelagic longline fisheries.

What is line weighting?

Seabirds are vulnerable to mortality on pelagic longline hooks during the short period between hooks leaving the vessel and sinking beyond the diving range of foraging seabirds. Preventing contact between seabirds and baited hooks at this time is crucial. In many pelagic longline fisheries, weights are added to branchlines to deliver hooks to target fishing depths as efficiently as possible. The best practice weighting regimes recommended here are intended to take baited hooks beyond the diving range of seabirds while under the protection of a well designed and properly deployed streamer line (tori line), without compromising fish catch rates.

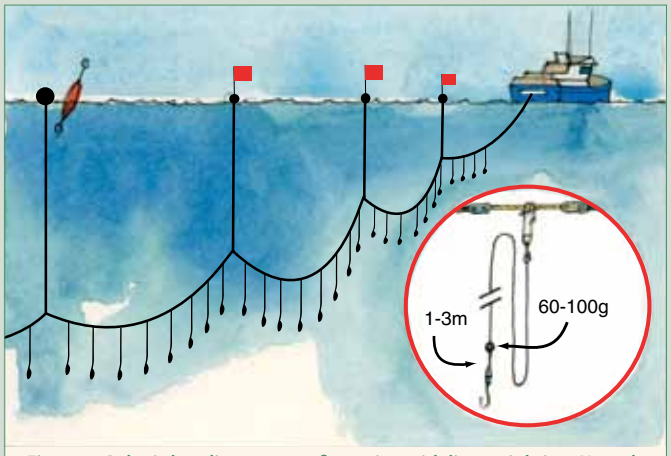

Figure 1. Pelagic longline gear configuration with line weighting. Note the distance between the weight and the hook.

Important aspects of line weighting

Two aspects of pelagic branch line construction are critically important to achieving fast sink rates – the length of the leader (length of monofilament line joining leaded swivel to baited hook) and the weight of the leaded swivel. Leader length is the main determinant of 'initial' sink rate, whereas swivel weight is the main determinant of 'final' sink rate. The initial sink phase occurs immediately upon baited hooks landing in the water, when the leaded swivel sinks at a faster rate than the baited hook. At this stage, the sinking swivel has not begun to influence the sink rate of the baited hook. Final sink rate occurs when the slack in the leader length has been taken up and the leader becomes taut. Only then is the hooked bait placed under maximum load (pull-down) by the swivel. The initial sink phase, which occurs in the 0–1 m, 0–2 m, or 0–3 m ranges (depending on leader length), is expedited by moving the swivel closer to the hook, which more quickly exhausts the slack in the leader. The final sink phase occurs at deeper depths (e.g. 3–5 m and beyond) and is hastened using heavier swivels or adding alternative weights. To minimise seabird interactions, it is important to increase both the initial and final phases of sink profiles; this can be achieved by using heavier swivels closer to hooks.

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 provisional conclusions are relevant, along with that above dealing with leader lengths and swivel weights.

Swivel weights and leader lengths: Swivels used in southern hemisphere pelagic longline fisheries vary between 0–80 g, with 60–80 g being most common. Leader lengths also vary; but are usually between 3–4 m. High seas fisheries either use no additional weight in branch lines or amounts that are unlikely to result in improved sink rates. In fisheries with high seabird interaction rates, much heavier line weighting regimes – perhaps as much as 120 g placed <2 m from hooks – may be required, in combination with effective streamer lines, to effectively reduce seabird mortality.

Propeller turbulence: Turbulence created by propeller wash produces an upwelling effect that slows sink rates. The fastest sink rates are achieved by deploying the mainline away from water affected by propeller turbulence. For this reason, baited hooks should not be deployed into propeller turbulence but into the wake zone of vessels.

Bait thaw status: In fisheries where leaded swivels as light as 60 g are used, 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 used (e.g. the high seas), bait thawed to the point that allows a hook to be inserted, results in slower sink rates than bait

that is fully thawed. However, the difference is slight and less important than other factors that affect gear sink rates.

Best practice recommendation

Line weighting is recommended as a primary measure for reducing seabird bycatch, and there is increasing understanding of how it works in combination with other measures. The effectiveness of line weighting on pelagic longlines should be measured, taking into account both initial and final hook sink rates, as well as vessel speed. With the protection of an effective streamer line (i.e. an aerial extent of at least 100 m), sink rates of ≥0.3 m/s to 2 m depth and ≥0.5 m/s to 5 m depth should be sufficient to take hooks beyond the reach of most surface-seizing birds (in the absence of diving species returning baited hooks to the surface). Different fisheries and gear types will require different weighting regimes to achieve this standard.

To achieve the best possible sink rates, several vessel and operational effects need to be considered:

- ***Vessel effects:*** The length of streamer line deployed and speed at which lines are set will vary between vessels. These factors influence the time available to foraging seabirds to target baited hooks. 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 streamer line/s.

Other benefits

Target species catch rates

There is some speculation that applying weights to pelagic longline gear results in higher catch rates of target fish. Further experimental trials are needed to investigate this relationship.

Potential problems and solutions

Fishermen are rightly concerned about the safety implications of using weighted lines. When the line is stretched during hauling and suddenly breaks (a 'bite-off', usually due to shark bycatch), the lead weights attached to branch lines can be launched back towards fishermen on deck, and in a few cases serious injury and even death have resulted. In some fisheries, protective helmets are worn to reduce the risk of injury. To combat the safety issues associated with lead swivels, new weighting systems are in development (see Further research).

Combinations of measures

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

- ***Streamer lines*** (Fact-sheet 7)
- ***Night-setting*** (Fact-sheet 5)
- ***Side-setting*** (Fact-sheet 9)
- ***Blue-dyed squid*** (Fact Sheet 10).

Further research

Research is urgently required to determine the effects of heavier line weighting regimes on a) the catch rates of target and non-target fish species, and b) the incidental capture of seabirds. Research is also required to investigate options for minimising the safety concerns of fishermen associated with using line weighting. One new weight type under development by Fishtek (Ltd, UK) and BirdLife International is the **Safe Lead**. Safe Leads are not crimped onto the line but are designed to slide on and off. If the line breaks under tension, the weight slides down the line, dissipating the energy in the stretched line. It is hoped that with further testing and development Safe Leads will prove a safe alternative to weighted swivels and increase the uptake of effective line weighting regimes.

Compliance and implementation

Compliance with specific line weighting requirements can be monitored through in-port and at-sea inspections. However, the safety concerns associated with the use of weighted swivels must be addressed before line weighting in pelagic longline fisheries becomes universally accepted.

Figure 2. Fishermen can be injured by weights when the line suddenly breaks. Inset, shows the *Safe Lead*, a new weighting system being 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.

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