BirdLife INTERNATIONAL Partnership for nature and people

ACAP

Bycatch Mitigation FACT-SHEET 2 (Updated September 2014)

Practical information on seabird bycatch mitigation measures

Demersal Longline: Line weighting – external weights

Seabirds are vulnerable to mortality during the short period between hooks leaving the vessel and sinking beyond the bird's diving range. Line weighting is an essential component of seabird bycatch mitigation strategies, being one of the more effective known mitigation measures (a primary measure). Best practice weighting regimes should result in rapid initial line sink rates that will reduce the likelihood of seabird bycatch.

What is external line weighting?

In demersal longline fisheries, lines are weighted in order to deliver hooks to the target fishing depth as efficiently as possible and maintain the line on the seabed. Demersal longline gear can be configured in various ways, each with different weighting requirements. The methods discussed here rely on fishermen attaching individual external weights to the line as it is deployed.

The Autoline System

Autoline gear consists of a single line with baited hooks attached at regular intervals. The gear is highly automated and was designed for use without additional external weights, which makes any addition problematic. Further information concerning weighting strategies on autoliners can be found in Fact-sheet 3.

The Spanish System

This system is commonly used to target Patagonian toothfish. The gear consists of two, 'mother' and 'father', lines joined in parallel. The 'mother' line is usually thick (18 mm) polypropylene rope, which takes the weight during hauling. The hooks and weights are attached to the lighter 'father' line, which is joined to the 'mother' line by branch lines in a ladder-like arrangement (Figure 1). It is relatively easy to attach weights at regular intervals as the line is prepared for setting. The mass, density and distance between weights affect the line sink rate. Traditionally, demersal longlines have used stone cobbles encased in net bags as weights.

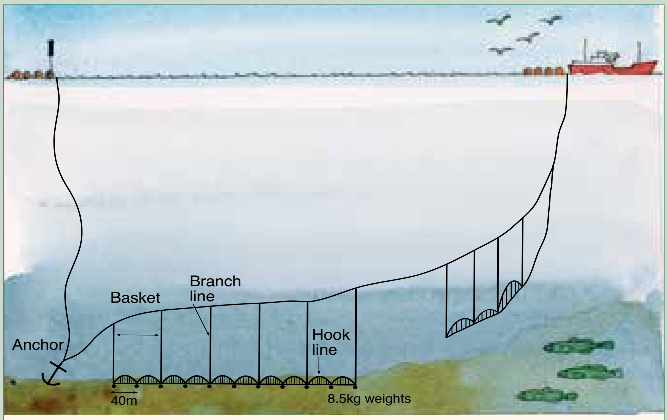

Figure 1. The Spanish System longline configuration.

Semi-pelagic

Semi-pelagic gear is designed to target species that travel from the seabed into the water column on a daily basis, such as hake. The lines are configured in such a way that hooks are suspended above the seabed. This is achieved by attaching a sequence of weights and floats to the hook line. Sink rates on these lines are highly variable, with hooks positioned near floats remaining accessible to seabirds for prolonged periods.

Effectiveness at reducing seabird mortality

Seabird bycatch experiments

Agnew *et al*. (2000) conducted controlled experimental trials on a longline vessel deploying Spanish System gear. These experiments took place in the summer months, near breeding colonies and sets were made during daylight hours, representing the worst-case scenario for seabird bycatch. Despite 4.25 kg weights placed every 40 m and the use of a streamer line to CCAMLR specifications, very high levels of bycatch were recorded (4.5 birds/1,000 hooks). Doubling the weight to 8.5 kg saw a significant reduction in bycatch (0.9 birds/1,000 hooks), although this is still unacceptably high. Additional weight did not result in further bycatch reduction. CCAMLR line weighting requirements in Conservation Measure 25-02 (8.5 kg per 40 m or 6 kg every 20 m) are based on the results of this experiment.

Sink rate experiments

In order to avoid the unnecessary capture of seabirds and allow robust statistical analysis, some experimental trials have used line sink rate to evaluate the potential for reducing seabird bycatch. Sink rate experiments use electronic time depth recorders (TDRs) or bottle tests to calculate sink rates under a range of weighting regimes.

Robertson (2000) experimented with various line weighting regimes on Spanish System gear. The results showed that to achieve a steady sink rate, weight spacing, as well as mass, is an important factor. Recorded sink rates were used to calculate the time taken for hooks to sink to specific depths. Combining this information with vessel speed allows the distance astern of the vessel at which specified depths are reached to be determined. Robertson concluded that a sink rate >0.3 m/s was desirable.

Semi-pelagic longlines

Petersen *et al.* (2005) experimented with semi-pelagic longlines targeting hake in South Africa. In line with the results of Agnew *et al.* (2000), they found a threshold above which adding further weight had little affect on sink rates. They recommend reducing the distance between weights to achieve a faster, more even sink rate. However, this is likely to affect the performance of the gear resulting in lower catch of target species and higher fish bycatch. In semi-pelagic lines, seabirds are far more likely to be caught on hooks positioned near floats than elsewhere. Seco Pon *et al*. (2007) found over 93% of all birds killed were caught within 30 m of a float.

Both the mass of weights applied to lines, and the spacing between weights, are equally important. To achieve a uniform sink rate, weight should be evenly distributed along the entire line. A number of other factors influence the line sink rate, including:

Hydrodynamics

The drag created by the fishing line and the weights themselves retard the speed at which lines sink. Research by Robertson *et al.* (2007) indicates that netted stone weights are far less efficient than torpedo shaped metal weights. Due to better hydrodynamics, the same sink rate can be achieved with lighter metal weights (a 5 kg metal weight is equivalent to a 8.5 kg stone weight).

Operational

Longlines are usually deployed into the propeller wash at the stern of the vessel. The turbulent upwelling created by this wash reduces the initial sink rate. Tension on the line, caused by hook fouling or improper deployment of weights, reduces the sink rate.

Environmental

In rough seas, heavy swell can maintain the line close to the surface and expose it in the troughs between waves. The pitching of a vessel increases tension in the line and can bring hooks back to the surface.

Buoying effect of caught birds

Seabirds are often caught in clusters, several birds over a short distance. Once a bird is caught, it acts as a buoy, exposing adjacent hooks to foraging birds. Along with reducing the probability of catching birds, good weighting regimes limit the time hooked birds are on the surface and reduce the likelihood of multiple hook ups.

ACAP Best Practice Advice

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 standard streamer line, without compromising catch rates. Specifying a desired sink rate should be an integral part of any performance standard. It is currently recognised that a sink rate of 0.3 m/s is desirable (Robertson, 2000). To achieve this, the prescribed weighting regime will depend on the type and configuration of gear used. CCAMLR specify two line weighting options, 8.5 kg at 40 m intervals or 6 kg weights at 20 m intervals, following the aforementioned trials by Robertson *et al.* (2007). CCAMLR subsequently adopted a third line weighting option of 5 kg metal weights spaced at 40 m intervals. Achieving a desired sink rate is not just a matter of adding sufficient weight to a line. The way in which gear is handled and deployed influences the sink rate.

Line tension

- During setting, external weights should be pushed from the setting table to avoid tension in the line.
- Lining hook boxes with metal reduces the likelihood of hooks snagging and results in less tension in the line.

Line lofting

When the distance between weights is too great, the hook line tends to loft immediately before the deployment of a weight. This leaves hooks vulnerable to seabird attack. Reducing the distance between weights reduces this problem and leads to a more even sink rate.

With **semi-pelagic gear**, hooks positioned near floats have a lower sink rate than those elsewhere on the line and are responsible for nearly all the seabird bycatch. Removing hooks adjacent to floats or increasing the length of the line connecting the float to the hook line would help to reduce seabird mortality in these fisheries.

Problems and solutions

- Traditional netted stone weights or concrete blocks are notoriously variable in weight. Cast metal weights would give a far greater consistency in the distribution of weight along the line. Additionally, streamlined metal weights achieve a faster sink rate than stone weights of the same mass.
- Adding weight to longlines does slightly increase the workload for the crew and can potentially increase the strain on hauling gear and the risk of line breakages. The adoption of lighter metal weights would help lessen these concerns.

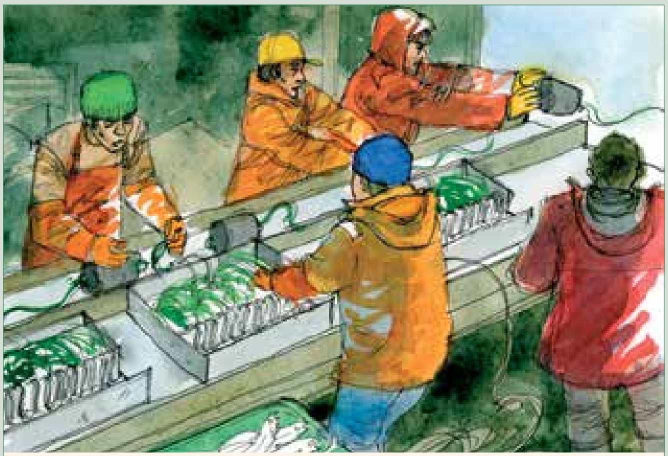

Figure 2. Pushing weights from the setting table and using metal lined boxes helps to reduce tension and improve line sink rate.

Combinations of measures

Adequate line weighting is critical to the prevention of seabird bycatch in demersal longline fisheries. However, to be effective line weighting must be used in combination with other measures, including:

- ***Streamer lines*** (Fact-sheet 1)
- ***Night-setting*** (Fact-sheet 5).

Further research

There has been considerable research to determine the influence of line weighting on sink rates and seabird bycatch. Where line-weighting regimes of 8.5 kg per 40 m are applied, along with a suite of other measures, seabird bycatch is consistently low.

The inter-relationship between line weighting, vessel speed and streamer line extent should be further investigated in order to refine the best practice recommendations.

Compliance and implementation

Fishing gear is deployed manually. Weights are attached by hand during line setting and removed during line hauling. Distance between weights and the mass of the weight used may vary in accordance with fishing strategy and for operational reasons. Observer presence on vessels is required to assess implementation. Electronic monitoring can also serve as a useful tool to monitor implementation.

References

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