

# Bycatch Mitigation FACT-SHEET 4 (Version 1)

Practical information on seabird bycatch mitigation measures

## Demersal Longline: Line weighting – Chilean System

Seabirds are vulnerable to mortality on longline hooks during the short period between hooks leaving the vessel and sinking beyond the bird's diving range. The Chilean System was developed primarily to combat the problem of depredation by cetaceans, however, the configuration of the gear leads to very high initial hook sink rates, which results in near zero seabird bycatch rates.

### What is the Chilean System?

In commercial 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. The Chilean System was developed to combat the problem of depredation of fish by cetaceans (Moreno *et al.*, 2007). The system uses a configuration borrowed from Chilean artisanal fisheries. It consists of a single main line with secondary branch lines attached every 40 m. Each branchline is around 15 m long and has a weight (ranging from 4–10 kg) attached to the terminal end, hooks are attached directly to the branchline (Figure 1). The gear resembles that of the Spanish System minus the 'mother' line with hooks attached directly to branch lines, in clusters of up to ten.

The Chilean System differs from artisanal gear by the addition of a buoyant net funnel that shrouds fish during hauling, concealing them from predatory cetaceans.

### Effectiveness at reducing seabird mortality

In terms of seabird bycatch mitigation, the extremely fast initial sink rate (0.8 m/s) is the critical factor. Hooks are attached close to

weights, once deployed they literally sink like a stone until the branchline becomes taut, at a depth of 15 m. Once the branch line is taut the sink rate slows due to the buoyant effect of the mainline (Figure 2). Hooks sink out of sight within the propeller wash and do not attract foraging attempts from seabirds.

The Chilean System has been trialled in the Patagonian toothfish fishery in Southern Chile. When compared with unmodified demersal longline gear, the Chilean System performs extremely well. Baseline data suggest, prior to the introduction of mitigation measures, 1,555 birds were killed each year (98% albatrosses) in Chilean fisheries. The use of streamer lines and other mitigation measures reduced this figure to 448 birds per year (100% albatrosses). Following the introduction of the Chilean System observers recorded zero seabird bycatch; with over 39% of hooks observed (Moreno *et al.*, 2007).

### Effectiveness at reducing depredation by cetaceans

Associations between cetaceans (e.g. sperm and killer whales) and longline vessels have been recorded in longline fisheries around the world. The relationship is complex and difficult to quantify. Although the highest numbers of associating cetaceans can coincide with very high catch rates, it is generally accepted that the presence of toothed whales has a negative impact on fish catch. Several mitigation measures have been tried with little success, these include; acoustic harassment devices, magnets attached to fishing lines, turning off acoustic equipment, retaining offal and leaving an area when whales are present (Purves *et al.*, 2004). The driving force behind the development of the Chilean System was depredation by cetaceans. Trials indicate that this system successfully deters whales from taking fish from the lines.

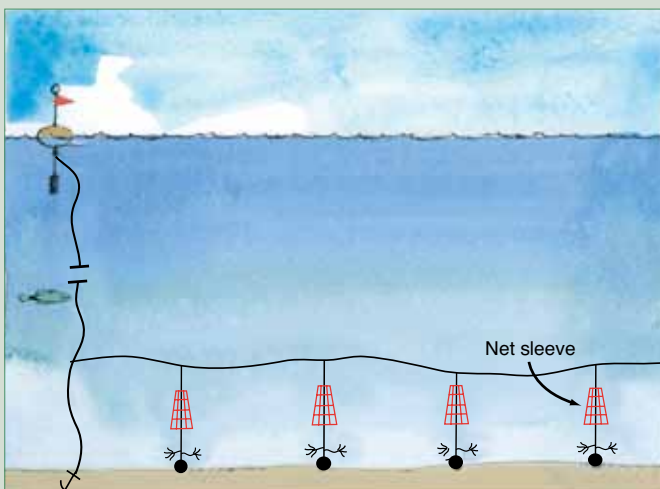


Figure 1. The configuration of Chilean System gear.

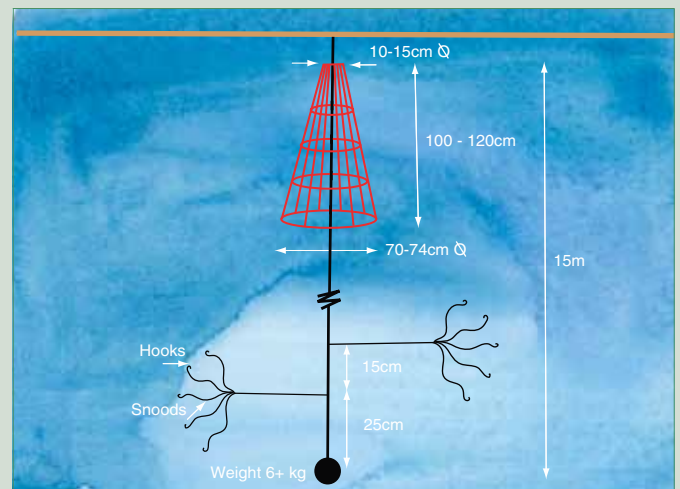


Figure 2. Branch line configuration.

## Best practice recommendation

At present, the Chilean System has shown great potential as a deterrent to cetacean depredation of target catch and as a means of seabird bycatch mitigation.

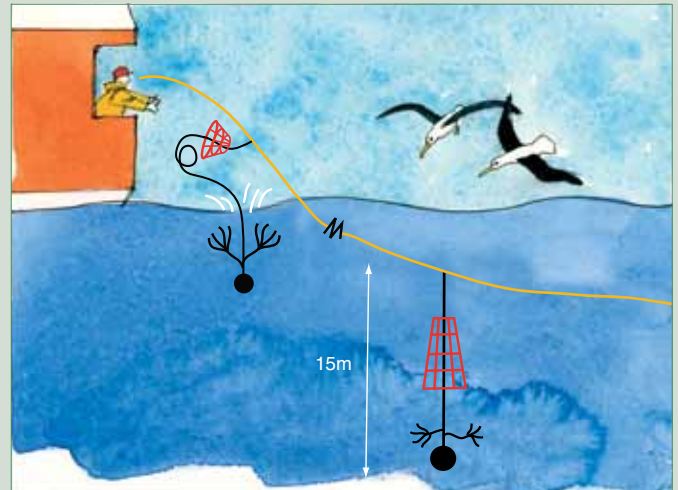
- The mass of weights used is highly variable, ranging from 4–10 kg, Moreno *et al.* (2007) report an average initial sink rate of 0.8 m/s. Although this far exceeds the sink rate reported for other demersal longline configurations, the relationship between weight mass, weight type and sink rate should be investigated to determine the minimum weight requirement.
- An unrelated consequence of the gear modifications to combat cetacean depredation is a very high initial sink rate of hooks during setting, which ensures zero, or close to zero, seabird bycatch.
- Most mitigation measures require minor modifications to fishing gear or practices, the Chilean System requires a considerable restructuring of the fishing gear. Once adopted, the mitigating effect of the gear is integral to the day-to-day fishing operations.

## Potential problems and solutions

- The configuration of the Chilean System more than halves the number of hooks set per metre of main line, although the simplicity of the Chilean System may allow a greater length of longline to be hauled per day. Under certain circumstances, when catches are good, this may reduce the number of fish caught. The distance between branchlines could be reduced to increase the number of hooks set but this is likely to result in more tangles between branchlines.
- Over time, cetaceans could become habituated to the net shrouds and resume fish depredation. Continued monitoring is required to observe the interactions between the Chilean System gear and cetaceans.
- A consequence of cetacean depredation is the unknown number of fish caught that are removed by whales before they reach the surface. Sometimes remains are left on the hook but the majority are likely to leave no trace. This unknown loss could have implications for fish stock assessment. Reducing the level of depredation will assist in the management of many fisheries.

## Combinations of measures

Initial trials indicate that the Chilean System alone is sufficient to eliminate seabird bycatch. If this proves to be the case, there is no need to use the Chilean System in combination with other mitigation measures.



**Figure 3.** The rapid initial sink rate means seabirds are unable to access baited hooks.

## Further research

The ability of the Chilean System to eliminate seabird bycatch is a by-product of efforts to prevent depredation by cetaceans. Trials are needed in other fisheries where depredation by cetaceans is regarded as a problem.

Long-term studies are needed to ensure the Chilean System continues to deter cetaceans.

## Compliance and implementation

The potential of the Chilean System to reduce cetacean depredation is likely to lead to high levels of voluntary uptake. The adoption of the Chilean System throughout Chile's toothfish longline fleet was largely down to word of mouth. Fishermen from comparable fisheries in the South Atlantic are already trialling the system.

### References

- Moreno, C.A., Costa, R. and Mujica, L. (2007) *Modification of fishing gear in the Chilean Patagonian toothfish fishery to minimise interactions with seabirds and toothed whales*. ACAP SBWG1-paper 8.
- Purves, M.G., Agnew, D.J., Balguerias, E., and Moreno, C.A. (2004) Killer whale (*Orcinus orca*) and sperm whale (*Physeter macrocephalus*) interactions with longline vessels in the Patagonian toothfish fishery at South Georgia, South Atlantic. *CCAMLR Science*, 11, 111–126.