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Review of mitigation techniques for gill net fisheries – preliminary summary for seabirds

New Zealand

SUMMARY

The attached report provides a preliminary summary of bycatch mitigation studies for gill net fisheries, relevant to seabirds, that have occurred or been published since earlier reviews in 2007.

Of all the reports that included some reference to bycatch or the mitigation of bycatch of seabirds in gill nets, only a subset provided any significant comment on mitigation techniques and many of these were reviews rather than original mitigation research.

The conclusions of this review are similar to previous reviews. That is, there is no single method that will work in all fisheries, for all areas, for all species and at all times. Therefore species- and fishery-specific solutions need to be explored. Based on a review of the literature, there have been no new techniques proposed since 2007 and there have been very few new experimental studies for seabirds that have tested existing mitigation options.

Based on this review of the literature, the most promising areas for mitigation in New Zealand set net (or gill net) fisheries for seabirds are spatial and/or temporal closures followed by gear modifications and/or pingers.

Revisión de las técnicas de mitigación para pesquerías de red de enmalle: resumen preliminar para aves marinas

El informe adjunto proporciona un resumen preliminar de los estudios de mitigación de la captura secundaria para pesquerías de red de enmalle relevantes para las aves marinas, que se han realizado o publicado desde las primeras revisiones realizadas en 2007.

De todos los informes que incluyeron alguna referencia a la captura secundaria o las medidas de mitigación de la captura secundaria de aves marinas en redes de enmalle, solo un subconjunto proporcionó algún comentario significativo sobre las técnicas de mitigación y muchos de estos eran revisiones en lugar de las investigaciones originales sobre las

medidas de mitigación.

Las conclusiones de esta revisión son similares a las revisiones previas. Es decir, no existe un solo método que funcione para todas las pesquerías, para todas las áreas, para todas las especies y todos los momentos. Por lo tanto, se precisa explorar soluciones específicas para las especies y pesquerías. Sobre la base de una revisión de la literatura, no existe ninguna técnica nueva propuesta desde 2007, y se han llevado a cabo muy pocos estudios experimentales sobre las aves marinas que hayan evaluado las opciones de mitigación existentes.

Sobre la base de esta revisión de la literatura, las áreas más promisorias para las medidas de mitigación en las pesquerías de redes caladas (o redes de enmalle) para aves marinas son los cierres espaciales y/o temporales seguidos de modificaciones en los equipos y/o transductores.

Passage en revue des techniques d'atténuation pour la pêche au filet maillant - Rapport préliminaire relatif aux oiseaux marins

Le rapport ci-joint est un résumé préliminaire des études portant sur les techniques d'atténuation des captures accidentelles d'oiseaux marins dans la pêche au filet maillant, qui ont été menées ou publiées depuis 2007.

De tous les rapports qui faisaient mention de captures accidentelles d'oiseaux marins ou de techniques d'atténuation de ces captures dans la pêche au filet maillant, seuls quelques-uns ont commenté ces techniques de manière significative et la plupart de ces rapports étaient davantage des passages en revue que de véritables recherches en matière de techniques d'atténuation.

Les conclusions de cette évaluation sont semblables à celles des évaluations précédentes. Aucune méthode ne peut fonctionner pour tous les types de pêche, dans toutes les zones, pour toutes les espèces et à toutes les époques. Par conséquent, il faut développer des méthodes adaptées à chaque espèce et à chaque type de pêche. Après avoir épluché les rapports, il apparaît qu'aucune nouvelle technique n'a été proposée depuis 2007 et que très peu d'études expérimentales se sont intéressées aux techniques d'atténuation existantes.

Par conséquent, les mesures d'atténuation les plus prometteuses dans le domaine de la pêche au filet maillant en Nouvelle-Zélande sont les fermetures spatiales et/ou temporelles assorties d'une modification du matériel et/ou de répulsifs acoustiques.

Review of mitigation techniques for gill net fisheries – preliminary summary for seabirds

BPM-TAS-13-New Zealand gill net mitigation review - seabirds v 1.0

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1. Introduction

One of the most significant and global anthropogenic threats to marine wildlife conservation is the incidental bycatch of non-target marine species through fishing activities (Read et al. 2006). In 2007 two reviews summarised domestic and international studies on mitigation measures for the bycatch of marine species and how these measures may be applied to New Zealand's fisheries (Bull 2007a, Rowe 2007). This report summarises bycatch mitigation studies for gill net fisheries that have occurred since these 2007 reviews. It includes information regarding the efficacy of mitigation measures and their relevance for application in the New Zealand gill net fishery (referred herein as 'set net' to acknowledge term most commonly used by New Zealand fishermen). Based on these studies, recommendations on mitigation measures that may potentially be applied to New Zealand set net fisheries and areas where further research is required are discussed. This preliminary report only includes a summary of gill net mitigation techniques for sea birds. A separate, complete report will be produced that includes mitigation techniques for all protected species as part of the Conservation Services Programme (CSP) Project 4438 Review of Mitigation Methods in Setnet Fisheries.

Fishery observer records show that even with the current mitigation measures in place in New Zealand, cetaceans, pinnipeds, seabirds and other marine species have been observed interacting with the commercial set net fishery, resulting in entanglement and death (Abraham and Thompson 2011). Diving seabird species appear to be most a risk from set net fishing, with various species of petrel, shag, shearwater and yellow eyed penguins (Rowe 2009, 2010a, Ramm 2010, 2011) being observed entangled.

2. Methods

The current review examined a wide range of resources on fisheries bycatch, including domestic and international peer reviewed articles, industry documents and unpublished reports. Any study conducted or published after the last reviews in 2007, and which related to field trials and reviews of various mitigation measures for marine mammals, seabirds and other marine species during set netting fishing operations similar to those practiced in New Zealand, were reviewed.

3. Results

3.1 Summary

A total of 68 reports were obtained through various online resources including online journal library services, the Bycatch Reduction Techniques Database, Project Global website, Google Scholar and Web of Science. A number of the reports covered more than one species or group (n=19) and of the remainder, the majority of the literature focused on investigation of bycatch mitigation measures for cetaceans (n=27), particularly dolphins, but there was also some limited information for seabirds including penguins (n=9 studies), turtles (n=6 studies), pinnipeds (n=2 studies), and sharks (n=2 studies). For the purposes of this report, we will only consider the reports that had included specific reference to seabirds (n=16; i.e. including reports that specifically referred to seabirds or had reference to seabirds).

Overall, of all the reports that included some reference to bycatch or the mitigation of bycatch of seabirds in gill nets, only a subset provided any significant comment on mitigation techniques and many of these were reviews rather than original mitigation research. A summary of the key findings of these papers are provided below.

3.2 Specific findings relevant to the review

The most relevant conclusions of the reports reviewed are provided below.

Bull (2007b) concluded that, "*Few seabird bycatch reduction methods have been developed for gillnet fisheries, although increasing the visibility of the net has been shown to reduce seabird bycatch. Further studies are required to determine the efficacy of this technique and its influence on target species catch rates*".

Cardoso et al. (2011) reported significant mortality of Magellanic penguins (*Spheniscus magellanicus*) in gill net fisheries in southern Brazil but did not identify any mitigation options other than those previously proposed by Melvin et al. (1999), which included "…*three complementary tools to reduce seabird bycatch in the Puget Sound drift gillnet fishery-gear modifications, abundance-based fishery openings, and time-of-day restrictions for a possible reduction in seabird bycatch of up to 70- 75% without a significant reduction in target fishing efficiency*."

Lokkeborg (2011) provided a review of best practice to reduce seabird bycatch in longline, trawl and gill net fisheries. His overall conclusion was that "*Efficient mitigation methods that maintain target fish catch still have to be identified for gillnet fisheries*" but he did identify three mitigation methods that had been trialled: "*Technical mitigation measures that have been tested in gillnet fisheries are few. This review identified only 3 measures that have been proposed and tested, of which two are based on alerting seabirds to the presence of gillnets and one is based on reducing encounters with gillnets by setting nets deeper than the diving depth of seabirds (Melvin et al. 1999, Trippel et al. 2003): Visual alerts. Traditional gillnets are modified with visual alerts to increase their visibility, e.g. by dyeing the nets with an opaque colour (Melvin et al. 1999, Trippel et al. 2003). Seabirds should be able to detect these nets at greater distances and may thus avoid collision and entanglement. However, increased visibility of gillnets may also lead to reduced catches. Acoustic alerts. Acoustic pingers that emit a sound signal within the hearing frequency of sea birds are attached to traditional gillnets (Melvin et al. 1999). The sound signal serves to scare off seabirds from gillnets. Subsurface setting. Setting gillnets at greater depth could potentially reduce sea interactions and bycatch (Hayase and Yatsu 1993 cited by Melvin et al. 1999)."*

Waugh et al. (2011) summarised existing reports and reviews on potential mitigation options and came to the following conclusions: "*Mitigation measures included visual alerts, acoustic alerts, seasonal or area closures or changes to net configuration. However, mitigation methods were found to either reduce fishing efficiency considerably, or had little documented bycatch reduction effect. Seasonal or area closure therefore appears to be the most effective way of avoiding bycatch of non-target species in gillnet fisheries*."

Sonntag et al. (2012) developed spatially and temporally explicit models to assess the potential conflict and vulnerability of birds to bycatch in gillnets. They recommended that this approach can, "… *enable the development of appropriate conservation and management options. A suite of measures including temporal or spatial restrictions can be derived, despite a scarcity of real data*".

4. Discussion

Perhaps unsurprisingly, the conclusions of this review are similar to previous reviews. That is, there is no silver bullet and no single method that will work in all fisheries, for all areas, for all species and at all times. Therefore species- and fishery-specific solutions need to be explored. Based on a review of the literature, there have been no new techniques proposed since 2007 and there have been very few new experimental studies for seabirds that have tested existing mitigation options.

Globally, mitigation research has focused on: (i) acoustic deterrents, (ii) spatial and temporal closures, (iii) gear modifications and (iv) operational modifications. The general consensus in the recent literature is that, at present, an integrated approach to mitigation is likely to be the most promising in reducing seabird bycatch. Based on a review of the literature, the most promising areas for mitigation in New Zealand set net fisheries for seabirds are spatial and/or temporal closures followed by gear modifications and/or pingers. The effectiveness of spatial and/or temporal closures is well demonstrated and understood but can reduce overall fishing effort. In contrast, gear modifications (e.g. barium sulphate, mesh panels) are generally fishery-, species- and seasonally-specific and so while there have been some promising results, it is difficult to assess whether the conclusions from one study are relevant to another fishery or for another species.

Some positive examples include the use of visual alerts, using decreased mesh size in the top part of the net, which have been shown to reduce sea bird bycatch by up to 45% (Melvin et al. 1999). The mechanism for this is presumably that it increases the ease with which the net can be seen by seabirds, who can then avoid it (Bull 2007b). The trade-off of this approach is that it can lead to a significant decrease in target fish catch. In addition, pingers have been shown to reduce bycatch of some seabird species by 50% but they have been shown ineffective for others (Melvin et al. 1999). One potential advantage of using pingers as a mitigation tool is that they may also be effective for reducing bycatch in other protected species such as dolphins.

There are no reports on testing the effectiveness of any mitigation techniques for reducing the bycatch of seabirds in New Zealand gill net fisheries. The implementation of any new mitigation technique would need to be proceeded by the completion of dedicated experimental trials to assess the effectiveness of any technique - ideally over a range of sites, species and times. Such a trial in New Zealand may be hindered by a relatively low bycatch rate for some species in gill nets, which may make it difficult to establish any quantitative effect with sufficient statistical power. Furthermore, any such study would ideally include recreational and commercial fisheries since both contribute to seabird bycatch but have quite difference operational characteristics.

In order to understand what mitigation is likely to be effective it is necessary to (i) understand the fishery and the protected species, and (ii) have clear management goals for protected species and fisheries. For most techniques, establishing this information will be time consuming and expensive. For rare events, it will also be extremely challenging. Prior to experiments, the effectiveness of any mitigation measure should be evaluated against what reductions may be achievable, and if these are going to be sufficient to meet management goals. In some cases, it is possible that even if large reductions in actual bycatch levels can

be achieved, these may still be in excess of sustainable removals for highly threatened species.

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