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Innovation in mitigation of seabird bycatch in trawl and set net fishing gear

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SUMMARY

An expert forum is considering new approaches for mitigation of seabird bycatch in trawl and set net fishing gear. This work is being led by the Southern Seabird Solutions Trust. A Technical Net Mitigation Workshop (Christchurch: 30-31 October 2013) undertook a review of known effective seabird mitigation approaches for trawl and set net fishing gear, emergent potential approaches, as well as approaches that have been tested and discarded. Eight potential mitigation technologies were identified concerning: *trawl net mitigation*—net chokes, lasers, mesh colour, and drones; and *gillnet mitigation*—net rollers, mesh height/size, pingers, and mesh colour. The potential of these mitigation technologies is now the subject of further consideration within the expert forum.

Innovación en la mitigación de captura secundaria de aves marinas para artes de pesca de arrastre y con redes de enmall

Un foro de expertos está considerando nuevos métodos de mitigación de captura secundaria de aves marinas en artes de pesca de arrastre y con redes de enmalle. Esta tarea está dirigida por la fundación para la conservación de aves marinas del sur (Southern Seabird Solutions Trust). Se efectuó un taller técnico sobre mitigación para la pesca con redes (en Christchurch, Nueva Zelandia, del 30 al 31 de octubre de 2013), donde se revisaron los enfoques efectivos actualmente conocidos para la mitigación de captura secundaria de aves marinas en pesquerías de arrastre y con redes de enmalle, los futuros enfoques posibles, así como también otros enfoques que se probaron y descartaron con anterioridad. Se identificaron ocho posibles técnicas de mitigación, a saber: *para la mitigación en pesquerías de arrastre*: obstrucción de redes, dispositivos láser, coloración de redes y vehículos aéreos no tripulados (drones); y *para la mitigación en pesquerías con redes de enmalle*: tambores de red, tamaño/altura de redes, emisores de ultrasonido y coloración de redes. El potencial de estas técnicas de mitigación es ahora objeto de un nuevo estudio por parte del foro de expertos.

Innovations en matière d'atténuation de la capture accessoire d'oiseaux de mer liées aux équipements de pêche au chalut et à filets fixes

Un forum d'experts se penche sur les nouvelles approches relatives à l'atténuation de capture accessoire d'oiseaux de mer liées aux équipements de pêche au chalut et à filets fixes. Ces travaux sont menés par le Southern Seabird Solutions Trust. Un atelier technique sur l'atténuation liée aux filets (Christchurch : 30-31 octobre 2013) a passé en revue les différentes approches efficaces connues en matière d'atténuation de capture accessoire d'oiseaux de mer relative aux équipements de pêche au chalut et à filets fixes, les nouvelles approches potentielles ainsi que les approches ayant été testées et écartées. Huit technologies d'atténuation potentielles ont été identifiées concernant : *l'atténuation liée aux chaluts* — resserrement des filets, lasers, couleur du filet, et drones ; et *l'atténuation liée aux filets maillants* — enrouleurs de filets, hauteur/taille des mailles, échosondeurs, et couleur du filet. Ces technologies d'atténuation potentielles font maintenant l'objet d'un examen approfondi du forum d'experts.

1. INTRODUCTION

An expert forum is considering new approaches to mitigation of seabird bycatch in trawl and set net fishing gear. This initiative is being led by the Southern Seabirds Solutions Trust, with sponsorship of the Convention on the Conservation of Migratory Species of Wild Animals (CMS), New Zealand Ministry for Primary Industry and the Deepwater Group Ltd, as well as in kind support from many organisations and companies.

ACAP has developed best practice advice concerning mitigating seabird bycatch in trawl fisheries (ACAP 2013). That advice considers net binding, net weights, net cleaning, reducing mesh size, net jackets, acoustic deterrents, and net restrictors as potential mitigation methods for trawl fishing operations. Zydelis et al (2013) conducted global review of the incidental catch of seabirds in gillnet fisheries. They estimated that at least 400,000 birds die in gillnets each year and that the magnitude of this phenomenon is poorly known for all regions. Zydelis et al (2013) noted that knowledge of proposed ways to mitigate seabird bycatch in gillnet fisheries is limited. Potential mitigation measures encompass spatiotemporal closure, use of visual and acoustic alerts, applying restrictions on fishing depth, and changing to alternative fishing gear. Feasible, practical and effective ways to mitigate seabird bycatch across both fishing gear types remain limited.

2. TECHNICAL NET MITIGATION WORKSHOP

Southern Seabird Solutions convened a Technical Net Mitigation Workshop (Christchurch: 30-31 October 2013) involving trawl and gillnet fishing companies, fishing operators, fisheries consultants, seabird scientists, research companies, conservation non-governmental organisations, a net maker, and officials from Australia and New Zealand. The workshop undertook a review of known effective seabird mitigation approaches for trawl and set net fishing gear, emergent potential approaches, as well as approaches that have been tested and discarded. The workshop provided impetus regionally on sharing information and innovation to underpin the development of mitigation options.

The proposed workshop complemented identified priorities for future work under the *Agreement on the Conservation of Albatrosses and Petrels* (ACAP) including:

- giving priority to actions that most benefit conservation status of ACAP species, in particular by reviewing mitigation technologies available for trawl and set net fishing, and by increasing the level of practical conservation actions and cooperation by Parties
- improving ACAP's knowledge of threats posed by trawl and set net fishing to species
- developing best practice advice for avoiding and mitigating fisheries bycatch during trawl and set net fishing operations.

The scope of the Technical Net Mitigation Workshop was broad and optimistic. A range of fishing gear is classified as net fishing gear. This includes both active and passive nets. The basis of bird interactions with nets varies considerably depending on the fishing gear, as will effective mitigation measures for that class of fishing gear. The workshop noted the difficulty in classifying fishing gear of concern, ensuring that the myriad forms of artisanal fishing gear are covered, identifying data sources of seabird interactions (and any gaps), understanding the nature of interactions across gear types (and any knowledge gaps), identifying the range of research undertaken thus far (and any gaps), identifying potential mitigation options relevant to each fishing gear that are feasible, practicable and effective (particularly for artisanal fisheries), and prioritising future work. Noting these issues the workshop focused its work on how to mitigate the impact of a smaller range of net gear on seabirds, recognising that this approach may lead to more productive outcomes.

The workshop participants canvassed a broad range of ideas and innovation. These were prioritised leading to identification of eight mitigation concepts that the workshop participants considered as holding the most promise. These were as follows:

Trawl net mitigation measures

1. **Net choke**—restricting the mouth of the net when it nears the surface using a noose that can be winched tight.
2. **Lasers**—using laser beams pointing towards the mouth of the trawl net.
3. **Mesh colour**—using mesh colours that are more visible to seabirds.
4. **Drones**—using unmanned aerial vehicles (UAV) to fly over the mouth of the net.

Gillnet mitigation measures

5. **Net roller**—using a roller that shortens the time that the gillnet is on the surface or in the air.
6. **Mesh size/height**—using different mesh sizes and net heights.

7. **Pingers**—using acoustic pingers to alert seabirds of the presence of the net.
8. **Mesh colour**—using mesh colours that are more visible to seabirds.

The workshop participants identified the steps that would need to be taken to explore the potential of each of the identified mitigation concepts. It was agreed that ongoing work would be undertaken on each of the eight concepts and that the expert forum would continue to liaise with each other about the progress of this work.

3. POST-WORKSHOP FOLLOW-UP

A post-workshop meeting (including teleconference) was convened by Southern Seabird Solutions (Port Nelson: 5 June 2014). The participants reviewed progress on the mitigation concepts.

Trawl net mitigation measures

1. **Net choke**—the physics of the choking process during hauling needs to be determined, as well of the mechanism to constrict the net. Noting the net circumference of mid-water trawl nets (measured in hundreds of metres), the forces involved in choking are considerable. Adding lazy ropes/wires to enable choking risks changing the net configuration. Although choking the net mouth potentially reduces seabird interactions with side panels, this action potentially increases the risk of drowning for seabirds entering the mouth of the net. Unintentional deployment of the net choke would close the trawl mouth (or alter its configuration) with significant implications for fishing operations.
2. **Lasers—**stern-mounted laser sources that are aimed at the area of fishing activity are being commercialised for auto-longline fishing vessels (e.g. SaveWave and Mustad Longline). These technologies show promise for use in trawl fishing operations. Seabirds react to the physical presence of the laser beam, responding by avoiding contact, such as by flying away. Current commercial configurations widen the emitted laser beam to optimise visibility, prevent damage from eye exposure, while optimising its strength for at sea use. The wavelength is calibrated to seabird sightability. A range of issues will need to be resolved concerning the technology, including safety of humans, animal welfare, maritime navigation considerations, and effectiveness in varying conditions at sea. There is a need for at-sea experimental trials of the technology, and an assessment of statutory controls concerning using lasers in the industrial setting of a fishing vessel. Trials of laser technology will occur in Australia in late 2014.
3. **Mesh colour—**see discussion below under *gillnet mitigation measures*
4. **Drones—**unmanned aerial vehicle (UAVs) technologies and applications are rapidly evolving including in commercial and industrial settings. Drone technologies may potentially provide a visual (and other) deterrent to seabirds that are attracted to trawl nets while the net is on the surface. This deterrence depends on whether seabirds consistently react to the presence of a drone to avoid the area the drone patrols—above the net. There are various operational considerations that will need to be resolved before drones would be a practical option for seabird deterrence, including safe handling during deployment and retrieval, flying effectiveness and reliability in varying conditions at sea (in varying sea and wind states), patrolling capability relative to the vessel and net, animal welfare considerations (particularly from collisions), capacity for dynamic responses to changing conditions, potential for deploying additional deterrence (acoustic, visual, etc), and potential for habituation. There is a need for at sea experimental trials of

the technology, and an assessment of statutory controls concerning using drones in the industrial setting of a fishing vessel.

Gillnet mitigation measures

5. **Net roller—**net rollers (and net tubes) are already in use. They reduce the risk of tangling allowing the gillnet to set/retrieve more evenly. The height the net is set from the deck is determines the angle of attack of the gillnet entering and leaving the water, which affects the aerial extent and therefore the risk of seabird interactions. The presence of fish in the retrieved net and hauling delay when removing catch are the main risk. Innovation would lead to adjustable net rollers that can be moved from an optimum setting position to an optimum hauling position. Sink rate testing would determine if the angle of attack affects the sink rate during setting and risk of capture during hauling. Feedback from fishing operators suggests that aerial interactions with gillnets are a very low risk already, and so they have reservations about the effectiveness of this mitigation method.
6. **Mesh size/height—**some fish species targeted with gillnets are bottom dwelling and it may be possible to reduce the head height for gillnets without affecting fish catch (Kirkwood and Walker, 1986). Potentially, seabirds would be less likely to get caught using this gear configuration. Mesh size (both diameter of the mesh and size of the mesh holes) may also affect likelihood of seabirds getting entangled by gillnets. Discussions are being pursued with fishers about current gear configurations and the potential for innovation to mitigate seabird bycatch without affecting catch rates.
7. **Pingers—**as a method of mitigating seabird bycatch, acoustic pingers, by transmitting seabird-specific acoustic signals, may alert seabirds to the presence of a net. This technology will be the subject of trials by Birdlife International in Europe and the Eastern Pacific Ocean (Humboldt Current) later in 2014 using 3-5 kHz dual frequency pingers. The trials will assess the effectiveness of variable outputs and assess the effect of signal strength (decibels).
8. **Mesh colour—**to date no studies have examined the spectral properties of gillnet materials or quantified how seabirds (and fish and marine mammals) perceive the netting material. It is assumed that if netting material appears more visible to the trichromatic vision of humans then the visibility will also hold for seabirds that have higher visual acuity and tetrachromatic vision (Lythgoe, 1979; Maier, 1992). This assumption needs to be confirmed through experimental research. Further work, involving post-graduate research projects, is underway or planned in conjunction with the University of Tasmania, Australia. This work will seek collaborations with gillnet and trawl net manufacturers and research funding bodies to support the manufacture and testing of coloured nets. Red mesh is considered a priority for testing, as it is likely to be visible at the surface, but is the first colour to disappear in the water column as depth increases.

4. COMMENT

Innovation in seabird mitigation technologies is fraught with difficulties and there are many instances of potential technologies falling by the wayside. The approach of the expert forum to trawl net and gillnet seabird bycatch mitigation accepts that maybe only one or two of the mitigation concepts will prove feasible, practicable and effective in commercial, recreational and artisanal fishing operations. The expert forum is committed to keeping the Seabird Bycatch Working Group of ACAP informed of the outcomes of its work.

REFERENCES

ACAP (2013). *ACAP summary advice for reducing impact of pelagic and demersal trawl gear on seabirds.* Available at: http://www.acap.aq/index.php/en/bycatch-mitigation/cat_view/128-english/392-bycatch-mitigation/391-mitigation-advice

Kirkwood GP and Walker TI (1986). Gill net mesh selectivities for gummy shark, *Mustelus antarcticus* Günther, taken in south-eastern Australian waters. 37 *Aust J Mar Freshw Res* 689

Lythgoe JN (1979). Ecology of vision. Oxford University Press, New York.

Maier EJ (1992). Spectral sensitivities including the ultraviolet of the passiform bird *Leiothrix lutea*. 170 *J Comp Physiol* 709

Zydelis R, Small C and French G (2013). The incidental catch of seabirds in gillnet fisheries: A global review. 162 *Biol Cons* 76