# FINAL REPORT (DEVELOPMENT AWARD)

**2011/407** Attending the international marine mammal - gillnet bycatch mitigation workshop

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**HOST ORGANISATION:** The Australian Fisheries Management Authority (AFMA)

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**ACTIVITY UNDERTAKEN**
In October 2011 I attended a workshop held by the Consortium for Wildlife Bycatch Reduction on marine mammal interactions in gillnet fisheries.

**OUTCOMES ACHIEVED TO DATE**
The Workshop provided an overview of world's best practice and understanding of the use of acoustic pingers to mitigate marine mammal impacts in gillnet fisheries. This information has been useful in considering management options and identifying research priorities for the Commonwealth Gillnet, Hook and Trap fishery.

**Acknowledgments**

The support of the FRDC and AFMA in providing funding to attend the workshop is gratefully acknowledged. Also I would like to acknowledge and thank the Consortium for Wildlife Bycatch Reduction for allowing me to attend the workshop.

**Background**
The Consortium for Wildlife Bycatch Reduction consists of Blue Water Fishermen's Association, Duke University, Maine Lobstermen's Association, New England Aquarium, and University of New Hampshire. The Consortium supports collaborative research between scientists and the fishing industry to identify practical bycatch reduction solutions for endangered species. The Consortium is administered through the New England Aquarium.

The Consortium's focus is in three primary areas:

- Understanding interactions between threatened non-target species and fishing operations
- Research and development of bycatch reduction approaches
- Facilitating global exchange of information on bycatch reduction techniques

The Consortium held a workshop in October 2011 to assess the state of the art in gillnet bycatch mitigation techniques, develop recommendations for best practices, and identify research priorities for the future. The workshop focused on technical and scientific aspects of bycatch reduction, and did not directly consider the application of bycatch reduction techniques in fisheries management.

The Consortium invited presentations from experts on the status of marine mammal bycatch in gillnets and mitigation techniques: acoustic deterrents, non-acoustic gear modifications, time-area closures, and gear switching. The workshop was by invitation only, and my attendance followed a request by me to attend, given the significance and relevance of the subject material to ongoing fisheries management issues faced by AFMA.

The Workshop was held at the National Oceanic and Atmospheric Administration (NOAA) facility at Woods Hole, Massachusetts between 17 and 20 October 2011.

This paper reviews the material presented at the workshop on the use of acoustic deterrents, specifically with regard to marine mammal interactions. While some presentations focused on the use of acoustic deterrents for shark interactions, this is outside my role with AFMA, and is not addressed in the report.

**Need**

The Australian Fisheries Management Authority (AFMA) manages several fisheries which have bycatch issues. The AFMA managed Gillnet, Hook and Trap (GHAT) sector of the Southern and Eastern Scalefish and Shark Fishery (SESSF) is currently dealing with significant marine mammal bycatch interaction issues. These issues have led to major changes in the management of the fishery over recent years which have greatly increased management costs and reduced the economic return from the fishery.

The use of acoustic pingers have been advocated by some fishing industry members and by conservation organisation as a method for mitigating interactions, however their effectiveness in the GHAT fishery is essentially untested.

Attendance at the Workshop gave me an opportunity to understand and discuss world leading scientific research on the use of acoustic pingers and an opportunity to personally evaluate whether they may be effective in the GHAT or similar fisheries.

## Objectives

My objectives in attending the workshop were:

- To increase my personal understanding and knowledge of the use of pingers
- To evaluate the likely effectiveness of pingers for the GHAT

- To understand what additional research might be required to demonstrate that pingers are part of the bycatch mitigation solution for the GHAT
- To make professional contacts that might assist if the use of pingers in the GHAT is to be further explored.

**Methods**

I attended the Workshop outlined above, as well as taking a number of informal opportunities to discuss aspects of gillnet fishing management and marine mammal bycatch reduction with world experts

**Results/Discussion**

Acoustic deterrents

Acoustic deterrents or 'pingers' are small self-contained battery operated devices that emit regular or randomised acoustic signals, at a range of frequencies, and typically are loud enough to alert or deter animals from the immediate vicinity of fishing gear. Typical noise volume for a pinger is between around 130 decibels (dB) and 174 dB. Pingers have been used in commercial fisheries since at least the 1980's, however their widespread use did not start until the 1990's.

Gillnet fisheries

Gillnets are panels of netting with diamond or square shaped mesh that are held vertically in the water column and anchored either so that the net touches the bottom or so it is suspended above the ocean floor. Fish swim into the net and are entangled by the gills, fins and spines. The nets are kept vertical by floats along the top and weights along the bottom (AFMA website). AFMA only permits the use of bottom set gillnets in Australia, however the use of midwater or pelagic set gillnets continues worldwide.

The great variety of gillnet design and species targeted by gillnets was apparent at the workshop, with discussion of nets with very small mesh sizes (2 to 3 cms in some cases), to nets with very large mesh sizes designed to fold over when set, creating a horizontal trap for fish. Also the variety of fishing practices with gillnets was illustrated at the workshop, with the time nets were deployed varying greatly by fishery. In some cases net were deployed for more than seven days, while in other cases nets were 'soaked' for only a few hours. It was also clear at the workshop that there are significant differences in the way gillnets are made, with some nets designed to be set in a rigid line, while others are designed to billow and entangle target species. In a number of cases gillnets discussed at the workshop would be considered trammel nets in Australia.

Previous studies

Before the 1990's most studies of pinger effects on cetacean bycatch were poorly designed and there was no clear evidence of positive effects (Dawson 1991). In 1995 however Dr Scott Kraus (Kraus et at 1997) tested pingers in a real world fishery, the New Hampshire sink gill-net fishery. The research was conducted as a double blind study using independent observers and was designed to have sufficient statistical power to identify the effect of pingers and. The research concluded that the use of pingers reduced the incidental catch of harbor porpoises in sink gillnet fisheries by an order of magnitude. Dr Kraus noted in his finding that recent attempts to apply his research to local experimental fisheries had not been rigorously controlled and some had produced mixed results. He suggested that the testing of pingers in other situations where odontocetes are threatened by gillnets should proceed with careful experimental design and appropriate controls.

There were seven specific presentations at the workshop on the use of the use of acoustic deterrents in gillnets fisheries.

- Experiences in implementing acoustic pingers in US and Canadian fisheries- Dr Debra Palka

- Catch rates and the effectiveness of pingers in reducing Indo-Pacific bottlenose dolphin, *Tursiops aduncus*, incidental capture in the protective nets of KwaZulu-Natal, South Africa- Dr Vic Peddemors

- Review of the efficacy of acoustic deterrents for reducing marine mammal bycatch in the Baltic region, North Seas and East Africa- Per Berggren

- Efficacy of pingers in North Pacific salmon and squid gillnet fisheries - Tomonari Akamatsu

- Acoustic deterrents in UK gillnet fisheries Simon Northridge

- To ping or not to ping? That is the question: A global review of the effectiveness of pingers in reducing gillnet bycatch of cetaceans- Dr Steve Dawson

- Bycatch mitigation of Harbour porpoise (*Phocoena phocoena*) in Dutch set net fisheries: a pilot to study the workability and efficiency of several pinger types- Marije Siemensma

At the time of writing Dr Per Berggren's presentation of his review of the efficacy of acoustic deterrents for reducing marine mammal bycatch in the Baltic region, North Seas and East Africa was not yet available to workshop participants. Given the wide ranging nature of this work, and the complexity of the results, I have not included this presentation in this paper.

A further presentation by Dr Christine Erbe provided an acoustic characterization of bycatch mitigation pingers, and this is discussed briefly later in the report.

The presentation by Dr Siemensma is also not covered in this report due to its preliminary nature. The presentation outlined work to be conducted in Dutch set net fisheries evaluating several pinger types. At present no conclusions are available from this work.

It is intended that all the presentations from the workshop will be available on the Consortium for Wildlife Bycatch website http://bycatch.org/publications and will be published in early-2012 in Endangered Species Research journal.

**Experiences in implementing acoustic pingers in US and Canadian fisheries- Dr Debra Palka**

Dr Palka reviewed the use of pingers to reduce marine mammal bycatch in US and Canadian gillnet fisheries. Dr Palka's paper noted that prior to the regular use of pingers in commercial fisheries several small scale controlled experiments had been conducted to explore their efficacy. These experiments showed that pingers reduced bycatch of cetaceans and pinnipeds by 70-95% in the New England groundfish sink gillnet, Bay of Fundy demersal groundfish gillnet, the Washington salmon gillnet, and California drift gillnet fisheries. These finding led to regulation mandating the use of pingers in the New England set and California gillnet fisheries at specified times in selected areas. Dr Palka found that these regulations had led to varied levels of success including eliminating beaked whale bycatch in the California drift gillnet fishery, substantially reducing harbor porpoise bycatch in the New England set gillnet fishery to in fact increasing California sea lion bycatch in the California drift gillnet fishery. Dr Palka noted that previous research highlighted some potential drawbacks from the use of pingers, including the 'dinner bell effect' potential increased depredation and habituation, lack of compliance by fishers and not fully being able to predict how pingers reduce bycatch. Dr Palka suggests that research remains unclear on how, and concludes that scientists still do not have a clear and unambiguous understanding of why pingers work.

Dr Palka overall conclusion based on US and Canadian work is that pingers reduce the bycatch of marine mammals when used properly, however she concludes that the 'dinner bell effect' may be real, but that 'habituation' while theoretically possible, has not been evident in commercial fisheries. She also finds that depredation of some target fish species may have increased as a result of the use of pingers for a few species.

**Catch rates and the effectiveness of pingers in reducing Indo-Pacific bottlenose dolphin, *Tursiops aduncus*, incidental capture in the protective nets of KwaZulu-Natal, South Africa- Dr Vic Peddemors**

Dr Peddemors provided an overview research on the use of pingers to mitigate the catch of Indo-pacific bottlenose dolphins in shark control nets. The efficacy of pingers was tested by comparing the catch rate of dolphins before and after pingers were deployed on a number of beaches off KwaZulu-Natal South Africa. Data was also compared between beaches where pingers were deployed and 'control' beaches where pingers were not used which were interspersed.

The research found that there was no difference in sex or age categories for capture before or after pinger deployment. The research also found no relationship in captures with regard to pinger location, finding that all dolphin sizes and sex categories were captured haphazardly in relation to pingers. The research also found that catch rates remained stable at the level they had reached in 1999 at beaches with pingers, where catch rates at beaches without pingers fell sharply.

Dr Peddemors concluded that pingers at best do not reduce incidental capture of bottlenose dolphins in coastal set nets.

**Efficacy of pingers in North Pacific salmon and squid gillnet fisheries – Tomonari Akamatsu**

Dr Akamatsu gave a presentation of research undertaken in Japan to examine the use of pingers in mitigating gillnet bycatch and depredation by cetaceans in longline fisheries. Cetaceans included bottlenose dolphins, Pacific white-sided dolphins, false killer whales, Risso's dolphins and Dall's porpoises. Reactions to noise emitted by pingers were observed in a pool, net enclosure and in the open sea.

Exposure to noise above 170dB resulted in a clear response, with animals leaving the source of the sound. Reaction to sound below 160dB were not consistent with dolphins becoming accustomed to noise after multiple projections. However the use of pingers with frequency and amplitude modulation appeared to be effective, even at 120dB.

**Acoustic deterrents in UK gillnet fisheries Simon Northridge**

Dr Northridge's presentation focused on the use of louder pingers in UK set net fisheries for hake, monkfish and cod/ pollock. The use of pingers in the European Union is already mandated by Council Regulations, however fishers have called for louder devices so that fewer pingers were required.

A louder pinger was identified and trialled over a three year period in the fishery. Dr Northridge found that while the results of the research were somewhat equivocal, fishing fleets using the louder deterrent device had 66% lower porpoise bycatch compared to fleets without the louder devices. Dr Northridge noted however that fleets using nets of less than 4 kilometres caught 1 porpoise compared to 13 taken in unpingered nets of similar length. Dr Northridge suggests that keeping net length to a maximum of 4 kilometres and using a louder acoustic device at each end of the net would reduce porpoise bycatch by 95%.

**To ping or not to ping? That is the question: A global review of the effectiveness of pingers in reducing gillnet bycatch of cetaceans- Dr Steve Dawson**

Dr Dawson presentation provided an overview of the use of pingers to reduce the bycatch of small cetaceans or to reduce depredation in fisheries by dolphins.

Dr Dawson found that for three species, Harbour porpoise, common and Franciscana dolphins, a significant reduction in bycatch had been demonstrated with the use of pingers. Dr Dawson notes that for Harbour porpoise, this result had been replicated in nine controlled experiments in North America and Europe, and appears to be the result of porpoises avoiding the area in which pingers are deployed.

In two gillnet fisheries, the California-Oregon driftnet swordfish fishery and the New England groundfish fishery, more than a decade of study has indicated that pingers have reduced dolphin and/or porpoise bycatch by about 50-50 percent, and both fisheries have shown significantly higher bycatch in nets in which pingers have failed or incorrectly deployed. However Dr Dawson notes that these bycatch improvements occurred where pingers were used as part of a broader mitigation strategy which included time and area closures and gear modification

Dr Dawson concludes that the most promising candidate fisheries for bycatch reduction using pingers will be gillnet fisheries in developed countries in which cetaceans species involved are generally neophobic (are easily ‘spooked’), behaviourally inflexible and have large home ranges and low site fidelity. He suggests this includes Harbour porpoise, Beaked whales, Common dolphins, Striped dolphins and Franciscana dolphins.

Dr Dawson further concluded that the mechanism by which pingers reduce bycatch of small cetaceans appeared to remain unknown and was likely to differ between species. He concluded that pinger sounds were intrinsically aversive and caused displacement in Harbour porpoise, but not Hector’s, Tucuxi or Bottlenose dolphins. He further found that pingers are not proven to encourage echolocation thus making net detection more likely in Harbour porpoise, Bottlenose dolphins or Hector’s dolphin. He also found that for Harbour porpoise, pingers did not appear to work by changing the distribution of prey species.

**Acoustic characterization of bycatch mitigation pingers- Dr Christine Erbe**

Dr Erbe gave a presentation based on her research on a range of pinger which examined sound variability, sound propagation and acoustic footprint. Pinger contribution to ambient noise budget was also determined and minimum pinger spacer recommendations made.

Dr Erbe concluded that there is approximately 10% variability between ‘pings’ for Fumunda devices (Fumunda is one of the 4 or 5 main pinger manufactures worldwide), suggesting that pingers may naturally provide a degree of variability. Dr Erbe also found that for the use of 3 or 4 pingers every 200 m in shark nets resulted in all pingers being audible to marine mammals anywhere along the net and this was sufficient, taking swimming speed in consideration, to give enough warning for all marine mammals, except for high burst speeds of dolphins.

Responding to concerns about the addition of noise to the marine environment, Dr Erbe’s research found that individual pingers (that is arrays of pingers designed to operate at a particular noise level) contributed around 14% energy and negligible power by way of noise. This compared to natural noise (sandshrimp etc) of 19%, boat energy of 19% and 73% power, and other anthropogenic sources of noises such as sand pumping (17% energy). Dr Erbe concludes that pingers therefore do not contribute significantly to the marine noise budget.

**Personal benefits from attendance**

Attending the workshop provided an opportunity to quickly and efficient gain an understanding of worldwide research on pingers and the situations where they may or may not be effective. Attendance at the workshop also allowed me to understand the scale and nature of research undertaken worldwide to validate the effectiveness of pingers.

Prior to attending the workshop, and based on a literature review of pinger research I had formed a view that they were likely to be of only marginal effectiveness in the GHAT, however attendance at the workshop caused me to reconsider this position and gave me some reason to believe that they may be an effective and relatively low cost mitigation technology.

Attendance also allowed me to meet and interact with some of the world's most respect marine mammal and bycatch reduction experts and provided me with an invaluable opportunity to form professional relationships and networks which will be useful over time.

**Benefits and Adoption**

The GHAT fishery has immediately benefited in two ways from my attendance at the workshop. Firstly, as manager of the fishery I am now more open to the use of pingers and more prepared to commit AFMA resources to support research or other trials of the technology in the fishery.

Attendance at the workshop has also given me a practical understanding of some of the issues around the effective use of pingers. This should assist me in helping the fishing industry identify the most effective technology and techniques and to ensure that

**Further Development**

N/A

**Appendices**

Workshop Announcement-
http://www.bycatch.org/sites/default/files/Workshop%20Announcement.pdf

Workshop Agenda- http://www.bycatch.org/sites/default/files/Agenda.pdf