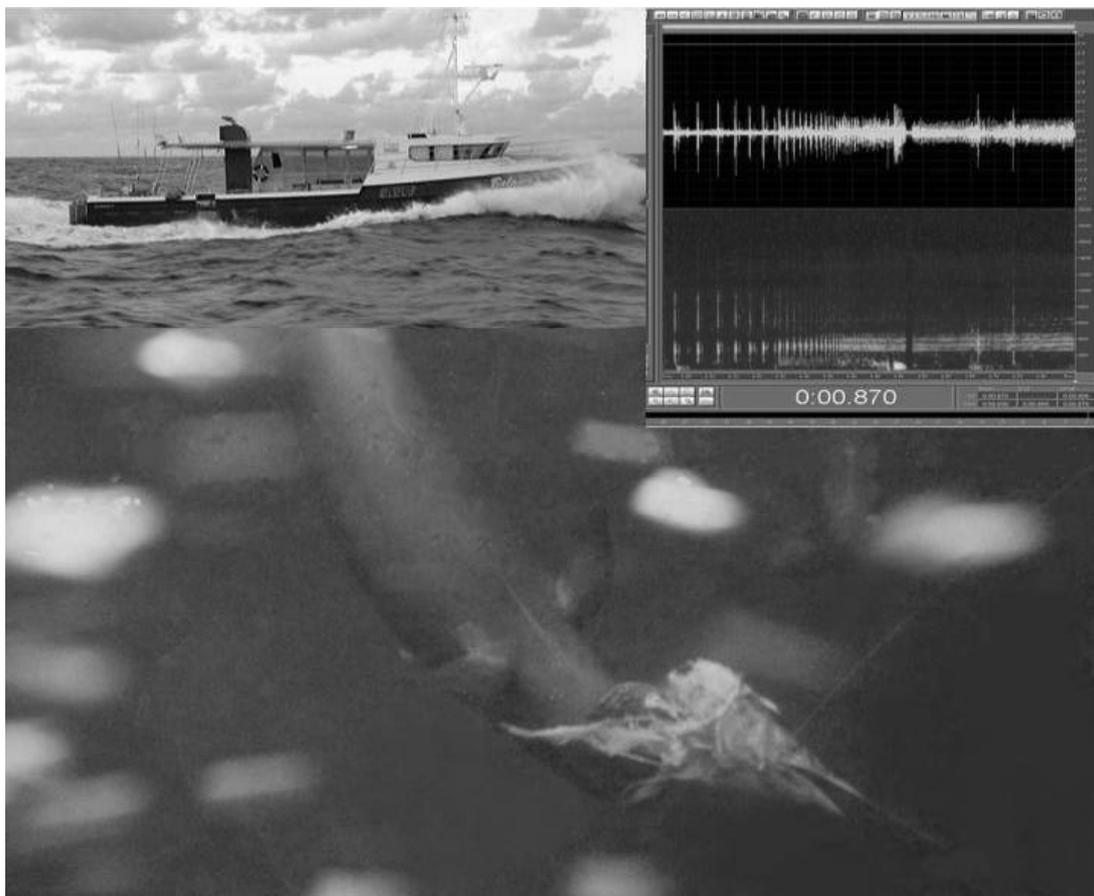


Reduction of interactions by toothed whales with fishing gear.

Phase 1. Development and assessment of depredation mitigation devices around longlines.

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FRDC Project No. 2003/016

1. NON-TECHNICAL SUMMARY

2003/016 Reduction of interactions by toothed whales with fishing gear. Phase I. Development and assessment of depredation mitigation devices around longlines.

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SUMMARY OF OBJECTIVES:

1. To achieve a three dimensional acoustic tracking capability for toothed whales around longline fishing gear to assess depredation mitigation approaches.
2. To determine the acoustic nature of depredation behaviour, to develop an appropriate project device, and to assess project and commercial devices for depredation mitigation.
3. To develop and test passive acoustic / mechanical depredation mitigation devices.
4. To review options to reduce interactions between toothed whales and fishing gear.

OUTCOMES ACHIEVED TO DATE

This project was established to develop and assess depredation mitigation devices for toothed whales around longlines as Phase I, with a possible Phase II to utilise the marine mammal monitoring and depredation and bycatch mitigation techniques for inshore Queensland fisheries where interactions with toothed and baleen whales, and sirenians, occur. The project recognised toothed whale *avoidance* and *minimisation* strategies for coping with depredation.

A major project outcome was industry-based recognition of the potential for a depredation *avoidance* system to utilise existing transmission systems for radio buoy localisation currently used in the longline fishery. This would provide operators with information to make specific fishery operation decisions to avoid interaction. The RSM Systems (Sydney) CDSB-4 prototype depredation activity *proximity detector* radio buoy for longline operations, at ranges commensurate with the extended gear, is a significant outcome though requiring further developmental support. Vessel-based detection systems have demonstrated potential in killer whale and sperm whale depredation fisheries, the JCU Signal Analysis Toolkit offers an algorithm for increased range of detection.

Commercial acoustic approaches to depredation *minimisation* continued during the project with further development of the Seamaster pinger (Taiwan). This device has a long-term capability to maintain bottlenose dolphins to outside a wide radius. The pinger was progressively modified for use with longline gear and has been trailed during 2007 for use with false killer whales in the Indian Ocean. SaveWave depredation mitigation pingers are not recommended due to a lack of response from large toothed whales from limited trials and uncertainty over their acoustic performance.

For a direction for industry to pursue for depredation *minimisation*, the concept of associating streamers of acoustically reflective material around fish simulating entangled gear to deter depredation, continues to receive reinforcement from industry experience in Australia and overseas in various forms. An investigation of the sonar basis for toothed whale depredation provided the simplest, lightest, cheapest and acoustically most reflective components that could be incorporated into streamers attached to fishing equipment. The components may approach the sonar Target Strength of the entire tuna, more than sufficient to highlight the presence of entangled equipment and dominate the presumed acoustic highlights of interest for depredating whales. The components were in theory optimised for false killer whale sonar. Fishing trials with an International fisheries agency are scheduled for the Indian Ocean.

Several species of toothed whales are considered to be responsible for depredation in the Coral Sea. In this study, false killer whales were observed to be the main species responsible during the project, though short-finned pilot whales may have been in the past.

Major toothed whale depredation mitigation project results include,

- Development of an interactive, *i.e.* toothed whale sonar activated, acoustic device intended for hook by hook deployment, developed to a trial stage that offered further potential for limited hook deployment fisheries.
- A review of the acoustic capability of two commercial and one project acoustic depredation mitigation devices. The Seamaster pinger has the most potential with a 16 channel output that provides wide area ‘shielding’ capability for delphinids. In Coral Sea trials an early version of the pinger had little effect, although in Indian Ocean trials industry demonstrated confidence in the pinger by purchasing substantial numbers. For use with false killer whales.
- A passive acoustic reflector streamer that meets the industry and scientific concept of a gear entanglement device, designed primarily for known acoustic attributes of false killer whales, is recommended for further trials in open ocean and demersal dropline fisheries.
- Acoustic toothed whale tracking systems with signal enhancements suited to industry.

This project commenced with objectives specifically relating to mitigation of depredation of longline caught fish, with considerable effort directed toward the development of a novel methodology to quantify the effectiveness of the mitigation systems to be trialled. The project rapidly evolved to a dual strategy a) **avoid** depredation on a broad scale area, and b) **minimise** the problem on a more close-in scale. Depredation reduction initiatives within industry have already demonstrated that mitigation systems should include a combination of methods. No single method would provide 100% reduction of depredation and there should be recognition that few, if any, mitigation systems for anything would consistently offer 100% effectiveness.

To meet the **avoidance** objective, improvements in acoustic localisation and tracking of vocalising toothed whales were achieved by collaborative studies with Madry Technologies, Thales Underwater Systems, Electrical and Electronic Engineering James Cook University, RSM Systems and Defence Science and Technology Organisation. The project designed and assembled two and three dimensional acoustic localisation devices, capable of fine scale monitoring of toothed whale swimming trajectories (Sonamon and 3DLOC). The project made considerable investment in the development of methods for commercial vessels to conduct marine mammal mid-range and long-range proximity detection for longline, purse seine and gillnet operations to minimize interactions including with humpback whales.

A major project recommendation is that radio direction finding buoys used to locate segments of longline gear could be fitted with acoustic sensors (RSM Systems) as a first line of defence by detecting the presence of vocalising toothed whales within a preset radius of buoys along a longline. Their presence would be indicated by coded pulses within the radio buoy hardware sent to the longline vessel in order that the skipper could take appropriate action to **avoid** depredation. The concept is applicable to detection of whales detecting offshore gillnets.

To meet the **minimisation** objectives, a single active acoustic device by Seamaster offered potential. A variety of mechanical depredation mitigation devices (streamers) are evolving worldwide. This project developed a passive acoustic streamer design and focussed on the theoretical basis for the observed mitigation effect of entangling gear. Recommendations for components are given, optimised for false killer whale biosonar attributes. Streamer components would compliment international mitigation approaches.

KEYWORDS: Longline, toothed whales, false killer whales, short-finned pilot whales, depredation, depredation mitigation, acoustic localisation, pingers, Target Strength.