East Coast Whale Entanglement Mitigation Project

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Acronyms

DFT	demersal fish trap
WEM	East Coast Whale Entanglement Mitigation Project
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FMS	Fishery Management Strategy
GTR	galvanic time release
LCR	lead core rope
MFP	OceanWatch Australia Master Fishermen Program
NBR	negatively buoyant rope
NSW NPWS	NSW National Parks and Wildlife Services
NSW OTL	NSW Ocean Trap and Line
NSW OTL CoP	NSW OTL Fishery Code of Practice
OceanWatch	OceanWatch Australia
PE	polyethylene
PFA	Professional Fisher's Association
PP	polypropylene
SL	demersal setline
SC	spanner crab
TEP	Threatened, Endangered and Protected species
Whale CoP	NSW OTL Fishery Code of Practice Whale Supplement
VET	Vocational Education and Training

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EXECUTIVE SUMMARY

As the population of Humpback whales on the East Coast of Australia has risen, the potential for interactions between whales and commercial fishing operations is increasing, with most entanglements occurring since 2006. The East Coast Whale Entanglement Mitigation Project (WEM) was initiated in NSW to assist fishers to reduce the incidence of, and risks associated with whale entanglements in NSW commercial fishing gear.

This project is focused on fisheries which utilise buoy lines and surface floats attached to set demersal fishing gear as an integral component of the fishing operation.

Two individual projects; OceanWatch's WetFEET Program funded by the Australian Government's National Landcare Program, and the PFA's East Coast Whale Entanglement Mitigation Program funded by the Australian Government Marine Park Fisheries Assistance Extension Program and delivered by OceanWatch, have supported a range of actions designed to mitigate risks associated with whale entanglement, including:

- an initial scoping workshop (WetFEET, see Section 3),
- development of a whale specific supplement to the existing NSW OTL Code of Practice (WetFEET, see Section 4),
- development of a whale specific module within the existing OceanWatch Master Fisherman training and assessment package (WEM see Section 5), and
- field trials of typical and modified fishing gears (WEM see Section 6).

Modified fishing gear field trials in the NSW OTL (Ocean Trap and Line) Demersal Fish Trap (DFT) and Spanner Crab (SC) fishing methods were initiated during the 2020 East Coast whale migration, as a proactive response by fishers and key stakeholders to information gathered from preliminary assessments of whale entanglements recorded in NSW waters.

Fishing gear trials, conducted by a select group of volunteer fishers, were designed to provide a subjective measure of modifications to existing gears used in the NSW Ocean Trap and Line (OTL) fishery. Importance was placed on understanding individual fishers' unique circumstances in relation to the practical utility of alternative gear configurations, impacts on crew and vessel safety, and the potential for uptake of modified fishing gear or practices. A central focus of the field trials was to trial modified gears and techniques which minimise the amount of rope (particularly slack rope) in the water column.

Demersal fish trap head gear field trials included a total of nine fishers and 14086 trap lifts.

- Negative buoyant rope was found to be useful in reducing slack and floating rope, with some operational issues related to the composition of the rope.
- Galvanic time release controlled head gears removed most of the head gear from the water column for the majority of the soak time. However, there are some operational drawbacks related to the time required to coil head ropes into mesh bags and the buoyancy of submerged head gear adversely impacting the accuracy of gear setting and trap stability on the sea bed. These drawbacks were found to be minimised in shallow water and exacerbated in deeper water with strong currents.

- Removing the head gear and retrieving traps by grappling a horizontal subsurface rope was found to increase gear retrieval times. The major benefit associated with this modification is the ability to weigh the subsurface rope to remain deep in the water column, close to the sea bed.

Future uptake of galvanic time release controlled head gears, acoustic release technology or subsurface grappling techniques within the NSW OTL fishery would require amendments to current management regulations.

There are no regulatory barriers for industry uptake of negative buoyant rope modified head gear.

Spanner crab head gear, trot line and hauling gear field trials included a total of five fishers and 2390 gear hauls.

- Negative buoyant rope was found to be useful in reducing slack and floating head rope, and its use within the trot line was found to keep the trot line in direct contact with the sea bed for the entire time the gear was set. Excess benthic debris becoming attached to the trot line and being hauled aboard the vessel was a major drawback.

- Sections of lead core rope spliced within the trot line was found to keep the trot line in direct contact with the sea bed for the entire soak time, without the benthic debris issues associated with the use of negative buoyant rope.

- Both negative buoyant rope and lead core rope have potential adverse impacts on crew safety and vessel stability due to their weight and handling characteristics.

- The phosphor bronze hauler plates were found to be more robust than typical alloy plates while hauling grit filled negative buoyant or lead core trot lines.

There are no regulatory barriers for industry uptake of negative buoyant rope modified head gear and trot lines or lead core rope trot lines.

Recommendations

1. Hold a follow up Workshop.

Workshop agenda items may include:

- the initial Whale CoP,

- the results of the field trials,

- issues identified as challenges to overcome (see Table 4 and 5),

- current NSW OTL management arrangements,

- whale entanglements 2020 East Coast migration, and

- further research topics and funding sources.

2. Extend the Whale CoP and Field Trial Results.

Review and extend the initial Whale CoP and field trial results to NSW OTL fishers and wider marine stakeholders.

3. Conduct a Fishery-wide Gear Survey.

With the great diversity of fishers and gear applications within the NSW OTL fishery, an initial survey of the gear used within the fishery was given a high priority at the scoping workshop by NSW DPI Fisheries as important baseline knowledge. A fishery wide gear survey would:

- assist in determining the source of observed entanglements,
- allow the impact of gear changes on rates of entanglement to be estimated or assigned a likely risk reduction rating,
- allow realistic costing to be developed to understand cost of fleet-wide adoption of modified gears, and
- allow cross referencing for all future entanglements to quantify risk vectors.

4. Investigate further strategies to minimise the number of floats and length of head rope.

- Extend the findings of field trials to fishery managers and compliance officers to evaluate the efficacy of current management arrangements, particularly those related to surface head gear.
- While floats are a factor involved in many entanglements, field trials related to float types and configurations have not been undertaken through this project.

5. Assess the requirements and specifications for a compliance arrangement to meet the needs of NSW OTL fishers, and NSW DPI Fisheries managers and compliance officers.

- Identify solutions that address management and compliance concerns while reducing entanglements and loss. Examples could include gear location apps and supporting trap tagging systems.

6. Conduct field trials of alternative negative buoyant rope with characteristics similar to the PE and PP ropes in typical use within the fishery.

- The use of NBR has been identified as an area where some risk can be mitigated relatively easily and cost effectively. Expanded trials of NBR with similar handling and wear characteristics to typical PE and PP ropes, using extended variables of fishing gears and operations, may influence many NSW OTL fishers to adopt this risk mitigation measure.

7. Conduct an evaluation of the utility of acoustic technology for use in the DFT, including field trials of Fiobuoy acoustic release technology.

- The Fiobuoy system uses a bobbin like design which enables the rope to be rapidly wound onto the device. This design feature may contribute to overcoming a major hurdle in the practical use and uptake of acoustic release systems in the NSW OTL fishery.

1. Introduction

The East Coast Whale Entanglement Mitigation Project (WEM) was initiated in NSW to assist fishers to reduce the incidence of, and risks associated with, whale entanglements in NSW commercial fishing gear.

The WEM is a collaborative project bringing together NSW OTL fishers, the Professional Fisher's Association (PFA), OceanWatch Australia (OceanWatch), NSW DPI Fisheries and NSW National Parks and Wildlife Service (NPWS).

Two individual projects; OceanWatch's WetFEET Program funded by the Australian Government's National Landcare Program, and the PFA's East Coast Whale Entanglement Mitigation Program funded by the Australian Government Marine Park Fisheries Assistance Extension Program and delivered by OceanWatch, have supported a range of actions designed to mitigate risks associated with whale entanglement, including:

- an initial scoping workshop (WetFEET see Section 3),
- development of a whale specific supplement to the existing NSW OTL Code of Practice (WetFEET see Section 4),
- development of a whale specific module within the existing OceanWatch Master Fisherman training and assessment package (WEM see Section 5), and
- field trials of modified fishing gears (WEM see Section 6).

Restrictions associated with the COVID-19 health emergency have impacted the delivery of the WEM through:

- restrictions on travel, international, interstate and intrastate.
- increased complexity within gear trial equipment supply chains.
- changes in fisher behaviour related to market disruptions.

2. Background

As whale populations in the southern hemisphere recover from past commercial whaling, there has been increasing community interest and economic activity associated with observing whale migrations, accompanied with a heightened community awareness of broader animal welfare issues. Concurrently, there has been an increase in media reports and community concern relating to whale entanglements in fishing gear.

Whale entanglements are complex and often dangerous incidents to respond to. Due to the size of whales, disentanglement operations require staff to have specialist training and skills. While disentanglement provides a means for dealing with incidents as they arise, the optimum solution to the problem involves reducing the risk of entanglement.

Humpback whales (*Megaptera novaeangliae*) migrate through NSW waters between March and November, with a high percentage of the population found between 1 and 5 nm of the coast.

The exact timing of the migration period can change from year to year and may be influenced by water-temperature, the extent of sea-ice, predation risk, prey abundance and location of feeding grounds[1].

The population of Humpback whales on the East Coast of Australia has risen from an estimated 2,000 to 35,000 individuals from 1994 to the present[2].

Unique to Humpback whales are wart like round protuberances (bumps or tubercles) that occur on the head forward of the blowhole and on the edges of the flippers.

Southern Right whales (*Eubalaena australis*) are typically encountered in NSW waters between June and September, spending most of their time in waters less than 10m depth.

Their migration may extend north to Forster or Port Macquarie, with most records of sightings occurring south of Sydney.

Although entanglement incidences involving Southern Right whales rare, they are of conservation interest due to their low population level estimated at less than 300 individuals in the South Eastern Australian population.

2.1 Whale Protection Measures

International

The Humpback whale is afforded a degree of international protection through listing:

- on Appendix I of the Convention on International Trade in Endangered Species,
- on Appendix II of the Convention on Migratory Species, and
- as vulnerable under the World Conservation Union's Red List.

[1] Humpback Whale Recovery Plan 2005-2010

[2] NSW NPWS scoping workshop presentation

In addition, Australia participates in several other international agreements that directly or indirectly relate to the conservation of marine mammals.

Australia is also a founding member of the International Whaling Commission, is the host country of the Convention on the Conservation of Antarctic Marine Living Resources, and a key player in Antarctic Treaty Consultative Meetings[3].

National

All cetaceans (whales and dolphins) are protected in Australian waters through the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Humpback whales are listed as a Vulnerable species within the EPBC Act and NSW Biodiversity Conservation Act 2016.

Southern Right whales are listed as an Endangered species within the Commonwealth EPBC Act and NSW Biodiversity Conservation Act 2016.

2.2 NSW Ocean Trap and Line Fishery

A comprehensive Fishery Management Strategy (FMS) has been prepared for the NSW OTL Fishery and was approved by the Minister for Primary Industries in November 2006. Prior to finalisation, the FMS was subjected to a wide-ranging Environmental Impact Assessment process under the NSW Environmental Planning and Assessment Act 1979.

There are six types of NSW Ocean Trap and Line (NSW OTL) endorsements, with the WEM being focussed on NSW OTL Demersal Fish Trap (DFT) and NSW OTL Spanner Crab (SC) fishing methods which utilise buoy lines and surface floats attached to set demersal fishing gear as an integral component of the fishing operation.

Current NSW DPI Fisheries management regulations require DFT and SC set fishing gear to be marked with a buoy of minimum 100 mm diameter at the surface.

Demersal Fish Trap

A DFT endorsement authorises the holder to take fish from ocean waters by means of a fish trap set on the sea bed. DFTs are permitted in all NSW waters excluding Marine Parks.

The DFT sector of the NSW OTL fishery is managed by input controls which limit the fishing capacity of fishers, thereby indirectly controlling the amount of fish caught. These controls include restrictions on the number of endorsements, number of traps, design and dimensions of traps and the waters that may be worked.

There are strong regional differences in catch and effort. Effort reported in the fishery has been steadily declining, with 75% of current effort reported by 24 fishers. On average approximately 40% of the total value of the fishery is landed between July and September each year.[4]

[3] Humpback Whale Recovery Plan 2005-2010

[4] NSW DPI Fisheries scoping workshop presentation

Many OTL DFT fishers have fishery shareholdings that permit them to work more traps than is practical or efficient for their business.

Spanner Crab

A NSW OTL SC Northern Zone or Southern Zone endorsement authorises the holder to use a spanner crab net, commonly referred to as a dilly, to take spanner crabs from ocean waters.

The SC sector of the NSW OTL fishery operates from Hat Head to the NSW/Queensland border and is managed through a Total Allowable Catch and input restrictions.

SC fishers are restricted to operating a maximum of 40 dillies. Fishers generally operate with between 10 and 14 dillies attached to a demersal trot line.

Seasonal closures are in place to protect spawning females between 21st October and 20th January the following year, and males between 21st November and 20th December.

Recently there has been a large decline in fishing effort, measured by both days fished and gear lifts. Currently, there are less than 650 days fishing reported from less than 20 fishing businesses per annum. On average, over 40% of the total value of the fishery is landed between July and September each year.[5]

2.3 Whale Entanglements

NSW Context

Humpback whales are vulnerable to entanglement with set fishing gear due to their morphology, behaviours and spatial distribution. As the population of Humpback whales on the East Coast of Australia has risen, the potential for interactions between whales and commercial fishing operations is increasing, with most entanglements occurring since 2006.

Over the 25-year period between 1994 and 2019 there have been 259 whale entanglements recorded in NSW waters.

Image 1: Entangled whale (NSW NPWS)

Information regarding the estimated population of Humpback whales and the number of reported whale entanglements over time is provided in Figure 1.

[5] NSW DPI Fisheries Scoping workshop presentation

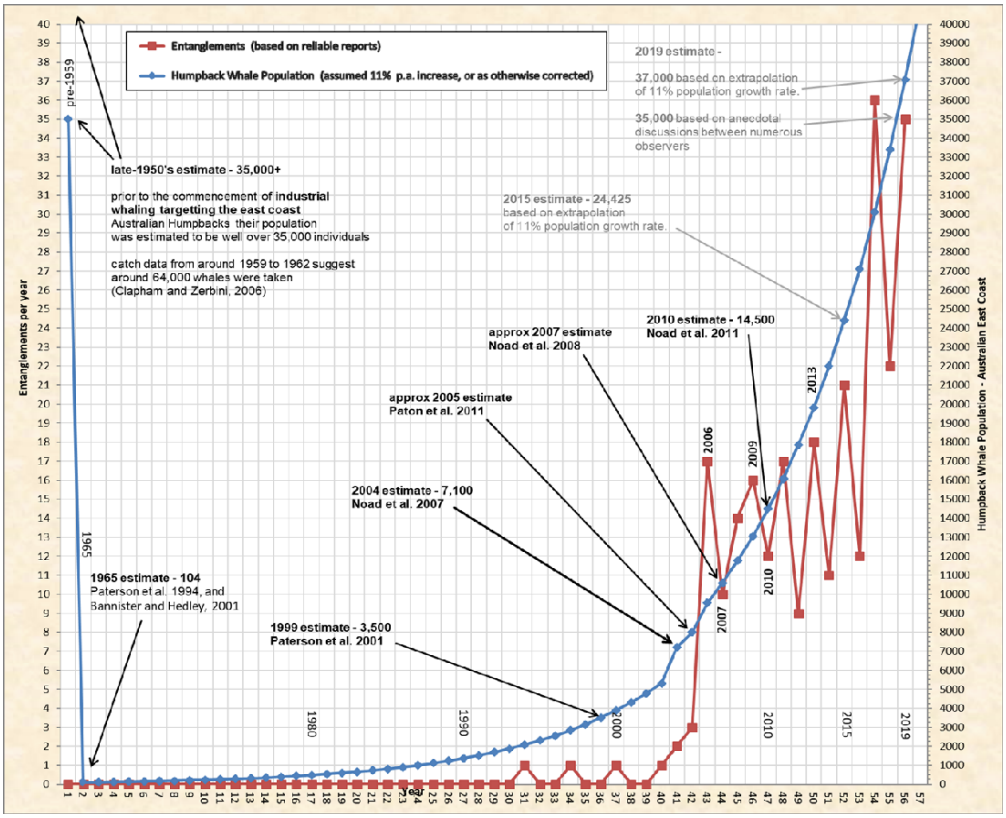

Figure 1: Statistics on NSW large whale entanglements (NSW NPWS)

Humpback whales comprise 255 (98%) of these entanglement incidents. To date, 46 whales have been successfully disentangled[6].

A preliminary assessment by NSW DPI Fisheries researchers of 73 of these entanglement incidents confirmed a variety of sources, including:

- NSW set fishing gear,
- set fishing gear of unknown origin, e.g. rope and floats, or rope only,
- set fishing gear not consistent with NSW,
- rope only, not consistent with NSW fishing gear,
- NSW and QLD shark mitigation gears,
- interstate set fishing gear,
- longline gear of unknown origin, and
- gear associated with aquaculture.

Entanglements associated with NSW set fishing gear include configurations used in the DFT, SC, NSW OTL Demersal Setline fisheries, and NSW Lobster (NSW Lob) fisheries, with higher incidents in the DFT sector and lower incidents in the other sectors[7].

[6] NSW NPWS Scoping workshop presentation.

It is likely that a proportion of these entanglements are attributable to inadvertent contact of whales with ropes and floats associated with some NSW OTL set fishing gears, resulting in rope and attached fishing gear becoming lodged or wrapped around the tail, body, fins or jaw of the whale.

Initial Mitigation Efforts

A number of NSW OTL fishers have made initial efforts to mitigate risks associated with whales becoming entangled in set fishing gear, including:

- trialling sections of rope of reduced breaking strength close to surface head gear,
- trialling lead core rope within the trotline of Spanner Crab fishing gear, and
- modifying fishing effort within the whale migration season.

Additionally, many NSW Lobster fishers have trialled, and in some cases adopted, acoustic release devices, galvanic time release devices and various grappling configurations to minimise ropes and floats in the water column. The main drivers for these gear modifications are trap loss and theft, with a secondary benefit of a mitigation of whale entanglement risk. A number of these NSW Lobster fishers also have entitlements to fish in the NSW OTL fishery.

[7] NSW DPI FISHERIES Scoping workshop presentation.

3. WEM Scoping Workshop

OWA partnered with the PFA to host a scoping workshop as the first stage of the project, held at the Sydney Fish Market Conference Room on Friday 13th September 2019.

Open workshop discussion encouraged fishers to consider solutions within and outside current fishing practices and management regulations. There was strong agreement among workshop participants for the following four actions:

1. Trial alternative gear and/or techniques that may reduce entanglements.
2. Develop a NSW OTL Code of Practice for whale entanglements.
3. Develop and complete a gear survey throughout the NSW OTL.
4. Investigate options for funding of further research.

The final report on the conduct and outcomes of the scoping workshop is attached to this report as Appendix 1.

4. NSW OTL Fishery Whale Code of Practice

The NSW OTL Whale Code of Practice (Whale CoP) assists NSW OTL DFT and SC fishers to reduce the incidence of, and risks associated with, whale entanglements.

The Whale CoP was developed utilising:

- direct engagement through telephone conversations with numerous NSW fishers, including all NSW OTL fishers who participated in the scoping workshop,
- information and feedback from NSW DPI Fisheries as the NSW OTL fishery regulator,
- information and feedback from NSW NPWS as the agency responsible for whale entanglement response, and
- a desk top review of a number of Codes of Practice (CoP) developed for Australian fishing jurisdictions utilising similar fishing methods to the NSW OTL fishery.

The Whale CoP is supplementary to the existing NSW OTL Fishery Code of Practice (NSW OTL CoP) developed by OWA and adopted by NSW OTL fishers through the OceanWatch Master Fishermen (MFP) training and assessment program.

The Whale CoP has four key elements.

1. Documenting whale - specific best practice fishing operations for NSW OTL fishers:

- including gear modifications that minimise the potential for whale entanglements,
- including conservation measures to assist in protecting whales from entanglement,
- to minimise damage to or loss of fishing gear and catch due to whale entanglements, and
- to demonstrate fisher's capacity to be proactive in response to emerging environmental issues.

2. Providing information on the appropriate course of action when encountering an entangled whale, including:

- appropriate and safe work practices for NSW OTL crews in the event of a whale entanglement,
- rapid reporting of incidents to enable the disentanglement process to begin, and
- assisting NSW NPWS whale disentanglement response teams.

3. Highlighting reporting requirements for interactions with Threatened, Endangered and Protected (TEP) species, relevant to the Commonwealth EPBC Act and NSW Biodiversity Conservation Act.

4. Highlighting opportunities for NSW OTL fishers to add to the knowledge base concerning whale migrations in NSW waters.

The Whale CoP was adopted by the PFA on behalf of NSW OTL fishers at their Annual General Meeting held on 29th November 2019, and is available for viewing and download from the OceanWatch website.

http://www.oceanwatch.org.au/wp-content/uploads/2020/04/NSW-OTL-whale-CoP-3-12-19.pdf

PFA has raised awareness of the Whale CoP through industry newsletters and face to face interactions with members. As part of the coordination of efforts and good will, the PFA also has protocols in place to send texts to all members when advised of a whale entanglement to help assist in the disentanglement operations led by NSW NPWS.

Each fisher undertaking modified gear field trials has had a face-to-face briefing regarding the Whale CoP.

A total of 938 wheelhouse stickers providing information on the course of action when encountering an entangled whale have been developed by the NSW NPWS, and distributed to 450 fishing business owners and nominated fishers operating licensed vessels in ocean waters by NSW DPI Fisheries.

Prime 7 News North Coast produced a story on August 18, 2020. The story was subtitled “The fishing industry is trialling new methods to protect whales” and ran for 1:28.

A copy of the Whale CoP is attached to this report as Appendix 2.

A copy of the Whale CoP wheelhouse sticker and associated cover letter is attached to this report as Appendix 3.

5. OceanWatch Master Fisherman Content Review

The OceanWatch Master Fisherman Program (MFP) encourages individual fishers to understand and adopt sustainable and responsible fishing practices through increased awareness and implementation of industry relevant codes of practice (CoP). It includes fisher participation in formal training and assessment workshops aligned to a Vocational Education and Training (VET) Certificate 2 competency. The MFP comprises 11 training and assessment modules.

The MFP content was reviewed and updated to incorporate best practice actions identified through the development of the Whale CoP. The updated MFP training and assessment materials have subsequently been delivered to 10 professional fishers through training workshops. Through the updated program delivery, fishers demonstrate an improved awareness of whale migratory patterns, known whale entanglement sources, and knowledge of how to accurately report interactions with threatened species.

A copy of the MFP TEP species training and assessment module is attached as Appendix 4.

6. Modified Gear Field Trials

6.1 Objectives

Modified fishing gear field trials were initiated during the 2020 East Coast whale migration, as a proactive response by fishers, industry representatives and key stakeholders to information gathered from preliminary assessments of whale entanglements recorded in NSW waters.

A central theme of the field trials was to trial modified gears and techniques which minimise the amount of rope (particularly slack rope) in the water column, consistent with best practice fishing advice for DFT and SC fishers identified within the Whale CoP (see Appendix 2).

Field trials consequently focused on the NSW OTL Demersal Fish Trap (DFT) and Spanner Crab (SC) fishing endorsements, which utilise buoy lines and surface floats attached to set demersal fishing gear, as an integral component of the fishing operation.

The project embraced the principle "*a high level of end-user participation in the research and development phase is likely to result in higher levels of acceptance and adoption of the project results and associated products.*" [8] Accordingly, concerted effort has been made to utilise NSW OTL fishers' experience and expertise as an essential component of the modified gear field trials.

Importance was placed on understanding individual fishers' unique circumstances in relation to the fishing gear modifications being trialled. Fishers provided a subjective assessment of:

- the practical utility and safety aspects of fishing gear modifications that may potentially minimise whale entanglement, incorporating common spatial and temporal variables encountered in the NSW OTL fishery,
- potential impacts on crew and vessel safety, and
- the potential for future uptake of specific gear modifications and techniques.

The field trials aimed to inform on the above, and to provide focus for further trials of fishing gears, techniques and technologies designed to reduce the risk of whale entanglement with NSW OTL fishing gears.

6.2 Materials

Participating fishers were provided with:

- Negatively Buoyant Rope (NBR); for use in DFT head rope and SC head rope and trot lines.

In total, 64 coils (18000 metres) of NBR were sourced from an Australian rope importer via Vietnam. The NBR was sourced in 6, 7 and 8 mm sizes, and was stored at the Ballina Fishermen's Co-op prior to distribution to nine DFT fishers and four SC fishers.

[8] Understanding Extension & Adoption in the Fishing Industry, FRDC 2011. Rufus Jennings and Roberts Evaluation. p35

Image 2: Negative Buoyant Rope (WEM)

- Galvanic Time Releases; for use with DFT head gear.

In total, 8300 GTRs were sourced from an Australian supplier via USA and distributed to eight DFT fishers.

Image3: Galvanic Time Release (GTR)

- Deep Sea Floats; for use with GTR controlled head gear.

In total 70 x 200 mm and 30 x 250 mm deep sea floats with the capacity to withstand water pressure to 250 m depth were distributed to eight DFT fishers.

- Oyster Mesh; for use with GTR controlled head gear.

Eight rolls of 20 x 20 oyster mesh were distributed to eight DFT fishers to manufacture rope and float bags.

- Shark Clips; for use with GTR controlled head gear.

A total of 100 x 100 mm stainless steel shark clips with swivels were distributed to eight DFT fishers to attach GTR rope and float bags directly to traps or via stub ropes.

- Lead Core Rope; for use in SC trot lines.

250 m of 8 mm lead core rope (LCR) was sourced from an Australian supplier and distributed to one SC fisher.

Image 4: Lead Core Rope

- Phosphor Bronze Hauler Plates; for use with SC trot lines in conjunction with LCR and NBR trials.

Three sets of phosphor bronze line hauler plates were sourced from a manufacturer on Flinders Island Tasmania, and distributed to three SC fishers.

6.3 NSW DPI Fisheries Section 37 Research Permits

Some field trials undertaken by DFT fishers included gear modifications not currently permitted under NSW OTL fishery management regulations.

Trialling modifications or alternatives to existing lawful commercial fishing gears is a complex and extensive exercise, requiring formal NSW DPI Fisheries assessment to determine whether the modification may assist in the long term sustainability and viability of commercial fishing. Complexity is increased when field trials may potentially interact with TEP species.

Subject to those considerations, some modified fishing gear field trials have proceeded through an agreed NSW DPIF Section 37 research permit process.

Clear guidelines are used for managing and granting permits issued under Section 37 of the Fisheries Management Act 1994. Assessing proposals and trialling modifications to fishing gear in NSW's commercial fisheries (Policy 0-040) involves a proposal stage, preliminary trial stage, assessment stage and assessment analysis and consultation stage. The issuing of a Section 37 research permit for modified gear field trials requires the design of scientifically rigorous field trials to support the assessment of the permit gear. The design of the field trials must be considered robust and reliable following intensive NSW DPI Fisheries review.

In the case of the WEM, designing field trials at a scientifically robust level is limited due, in part, to the statistically low level of whale interactions with NSW OTL set fishing gear.

As a result NSW DPI Fisheries supported the modified gear trials through:

- providing a less formal and detailed Section 37 research permit application process,
- providing advice and feedback throughout the Section 37 research permit application process,
- expediting assessment and issue of Section 37 research permits, and
- providing flexibility within the conditions of the Section 37 research permits to enable fishers to adapt gears and problem solve as the modified gear trials progressed.

Section 37 research permits associated with the modified fishing gear field trials are attached as Appendix 5.

6.4 Data Collection

The data collection methodology was developed through close collaboration with the OceanWatch Fisheries Program Manager, NSW DPI Fisheries research staff and the OTL Fishery Manager, to ensure the data had sufficient detail and rigour to meet the objectives of the field trials and the Section 37 research permit process, described in Section 6.3.

With consideration for the operating environment of the participating fishers, standardised questionnaires were developed to encourage fishers to respond with nuanced information at the completion of the field trials, rather than attempt to take objective measurements during their daily fishing operations.

Participating fishers received a face-to-face briefing explaining the objectives, methodology and reporting requirements of the field trials when the materials to construct the modified gears were delivered in March 2020.

Follow up telephone conversations were initiated in late April, early June and late July 2020 to discuss the performance of modified gears during the field trials. Fishers exchanged information through the project officer as the field trials progressed, resulting in improvements to grapple techniques and the practical use of NBR.

In November 2020 fishers reported through the questionnaire and telephone interviews on details of typical gears and gear modifications trialled. A copy of the reporting questionnaire is attached as Appendix 6.

Note: To provide consistency within the reporting framework; where fishers have reported depth or length in fathoms, the depth or length has been converted to metres using the formula:

2 metres = 1 fathom.

6.5 Method

6.5.i Overview

Rankings of risk mitigation strategies developed through the scoping workshop, fishers' expressed interest in testing specific mitigation measures on their own vessel, WEM timeframe, budget, and reporting considerations, and COVID-19 social and travel restrictions, were used to guide and prioritise the field trials.

Measures of the extent to which NSW OTL fishers were engaged in the field trials include the:

- willingness to travel and forgo income to attend the initial workshop,
- application of their knowledge and experience in prioritising gear modifications to trial,
- contribution of their time and expertise to fabricate gear modifications,
- participation in field trials utilising their own vessels, equipment and labour,
- support of other fishers through information exchange, and
- reporting of findings through the questionnaire and interviews process.

A number of other fishers showed interest in being involved in the field trials but were unable to due to the limited resources and timeframe available to the project.

Known variables in the spatial and temporal use of NSW OTL fishing gears were incorporated into the field trials, including:

- gear types,
- geographical area,
- substrates,
- water depth,
- current strength,
- gear soak times,
- target species,
- vessel size, construction and hauling equipment, and
- crewing arrangements.

Modified gear field trials were undertaken by 14 NSW OTL fishers, including nine fishers from the DFT and five fishers from the SC. Each fisher constructed and trialled modified gears under their own unique circumstances, with maximum flexibility in the use of the trial gears an inherent part of the methodology.

The field trials commenced in March 2020 and are ongoing (Dec 2020).

Fishers trialled modified gears and techniques concurrently with gear types typically used within the NSW OTL fishery, including typical DFT head gear (described Section 6.5.ii), and typical SC head gear and trot lines (described Section 6.5.iii).

Subjective comparisons between typical and trial gears were reported by fishers through the data collection process described in Section 6.4.

Field trials were undertaken between Bermagui and Tweed Heads, a geographical range of over 900km, and included all substrates from rocky reef to sand and mud.

Water depths varied between 20 and 140 m, with current strength encountered estimated to be between 0 and 4 knots.

Gear soak times varied between one and seven days for DFTs and multiple sets per day for SC trot lines. SC fishers returned to port with all fishing gear at the conclusion of their fishing activity.

Snapper, Yellowfin Bream and Ocean Jackets were the major target species for DFT fishers, with Spanner Crabs being targeted by SC fishers.

Fishers operated licensed vessels ranging between 5.8 and 16 m in length, of fibreglass or aluminium construction, with inboard diesel or outboard motors. Crew numbers were between one to three persons, varying with vessel size and crew workload.

Hauling equipment on board the vessels varied between small stationary petrol motors with steel capstan winches, to more sophisticated hydraulic driven alloy haulers. Trial hauler plates constructed from higher phosphor bronze alloy content were incorporated within the SC field trials.

6.5.ii Demersal Fish Trap

Although the extent of the risk of whale entanglement in DFT head gear is unknown, slack rope in the water column has been identified within the Whale CoP as an area where risk can be mitigated.

Modified gears were trialled concurrently with gear types typically used within the NSW OTL fishery.

Trials were conducted by nine DFT fishers between Bermagui and North Solitary Islands, a geographical range of approximately 785 km. The number of fishers, traps and trap lifts completed during the trials are provided in Table 1, for each of the trial types.

Table 1: Summary of DFT field trials

	Total	Typical Head Gear	NBR Modified Head Rope	GTR Modified Head Gear	Subsurface Rope
No. Fishers	9	9	9	7	2
No. Traps	239	130	61	40	8
No. of Trap Lifts	14086	7891	3830	2095	270

Typical Head Gear

Within this report, typical DFT head gear is defined as the rope, floats and other equipment connected to the DFT to facilitate identification and retrieval.

Typical DFT head gear, described by fishers undertaking field trials and identified in Figure 2 below;

1. Floats. Most floats were described as styrene between 150 and 250 mm diameter, with some hard plastic deep sea floats of between 200 and 250 mm diameter also in use. The number of floats per DFT is influenced by water depth and current, from a single 150 mm float on DFTs set in shallow waters with limited current, up to six 250 mm floats for DFTs set in deep water and strong current

areas. Fishers also reported clipping a single 20 litre plastic drum onto their head gear to keep floats on the surface while fishing in deep water with strong current.

2. Rope. Fishers used varying head rope diameters and composition, influenced by water depth, trap weight, hauling equipment, rope cost and personal preference. In general, rope types were either polypropylene (PP) or polyester (PE) rope, with a diameter between 7 and 10 mm. The head rope length to water depth ratios varied between 1:1.5 and 1:2.5. The rope length to depth ratio is greater in areas where stronger currents are encountered, to ensure DFT floats remain on the surface to facilitate trap identification and retrieval. As current strength is an unpredictable variable, PE and PP ropes have the potential to float to the surface when current is minimal.

3. Weights. Some fishers reported using weights or chain to ensure PE and PP rope does not rise to the surface when current is minimal. Weights were reported to be either clipped onto the head rope with a shark clip, or attached through a short branch line spliced on to the head rope.

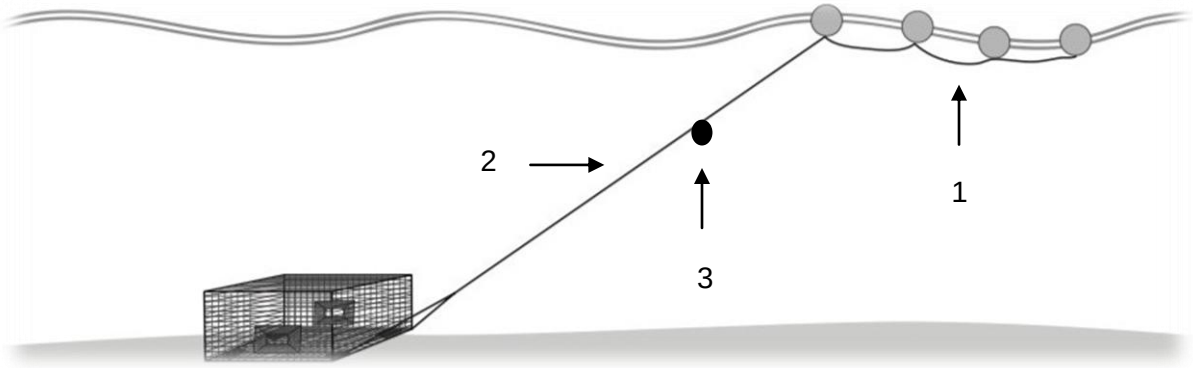

Figure 2: Typical DFT head gear (NSW DPI Fisheries). Note: numbers refer to paragraphs above.

While float types and configurations and added weights have potential to influence the risk of whale entanglement, field trials in these areas have not been undertaken through this project.

6.5.iii Spanner Crab

Although the extent of the risk of whale entanglement in SC head gear and trot lines is unknown, slack rope in the water column has been identified within the Whale CoP as an area where risk can be mitigated.

Modified gears were trialled concurrently with gear types typically used within the NSW OTL fishery.

Trials were conducted by five SC fishers between Ballina and Tweed Heads, a geographical range of approximately 76 km, in water depths between 30 and 64 m. The number of fishers, lines and hauls completed during the trials are provided in Table 2, for each of the trial types.

Table 2: Summary of SC field trials

SC	Total	Typical Gear	NBR modified head rope and/or trot line	LCR modified trot line	Bronze Hauler
No. Fishers	5	4	4	1	3
No. Lines	19	10	7	2	11
No. of Hauls	2390	1000	880	510	1740

Typical Head Gear and Trot Line

Within this report, typical SC fishing gear is separated into two components, head gear and trot line.

The head gear is defined as the rope, floats and other equipment connected to the trot line to facilitate identification and retrieval.

The trot line is defined as the long line (rope) which attaches multiple dillies (traps) together in one string on the sea bed.

Typical SC head gear, described by fishers undertaking field trials and identified in Figure 3 below;

1. Floats. Various configurations of floats and flags were attached at the top of the head rope. Most floats were described as styrene between 200 and 300 mm in diameter. The number used varied between 2 and 7 depending on float size, flag arrangement, current and fisher preference. Some fishers reported using silver rope up to 14 mm in diameter to join the floats and flag together.

2. Head Rope. Rope types were either PP or PE rope, with a diameter between 7 and 8 mm. The length of the head rope varied between 130 and 140 m.

Typical SC trot line gear, used by fishers undertaking field trials (see Figure3);

3. Trot Lines. Rope types were either PP or PE rope, with a diameter between 6 and 8mm. Fishers staggered the rope diameter using 8 mm at the start of the trot line where hauling tension is greatest, moving to 7 mm or even 6 mm towards the end of the trot line. The length of the trot line varied between 560 and 720 m, dependant on the number of dillies attached.

4. Dillies. The distance between dillies was between 60 and 70 m, with the number of dillies on a trot line varying between 10 and 13.

5. Weights. Some fishers used a weight of approximately 20 kg, attached on a 12 mm diameter branch line at the bottom of the head rope approximately 3 m before the first dilly, to anchor the trot line to the sea bed.

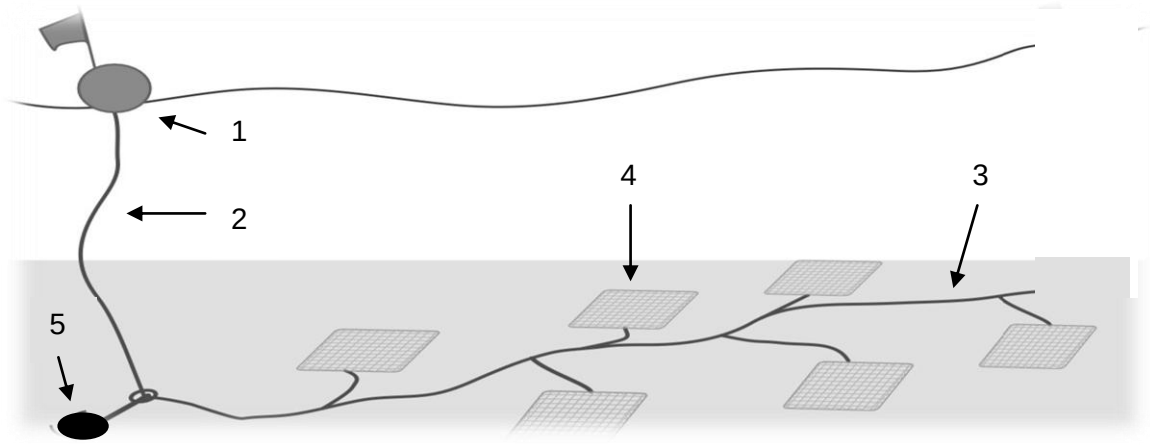

Figure 3: Typical SC head gear and trot line (NSW DPI Fisheries) Note: numbers refer to paragraphs above.

While float types and configurations are a potential influence on the risk of whale entanglement, field trials in this area have not been undertaken through this project.

6.6 Results and Discussion - Demersal Fish Trap

6.6.i Negative Buoyant Rope Modified Head Rope

The intent of this field trial was to reduce the potential for slack rope in the water column by using NBR for the top portion of the head rope (see Figure 4).

A total of 32 coils of NBR between 7and 8 mm diameter were distributed to nine fishers to trial NBR head rope modifications.

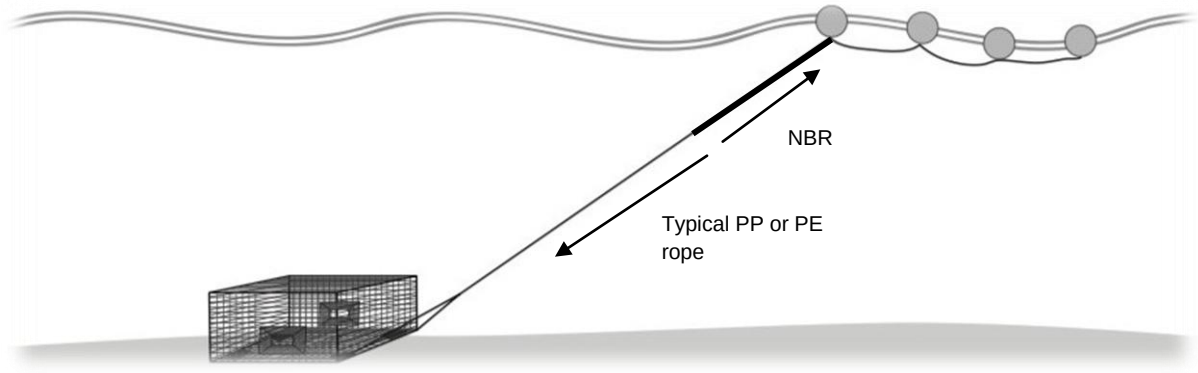

Figure 4: Modified NBR head gear (NSW DPI Fisheries)

The trials were conducted in water depths varying between 40 and 140 m, commenced late March 2020, and are ongoing (Dec 2020).

A total of 61 DFTs were deployed with NBR modified head gear by fishers operating from vessels between 5.8 and 16 m in length, solo or with crew. The number of days actively fished was 485, with the approximate number of DFT lifts being reported as 3830.

Utility

NBR was commonly used for the top 30% of the length of the head rope.

Six fishers described the gear modification as easy to undertake, with three fishers describing more difficulty. Some issues with splicing due to the softer lay of the NBR were reported.

Eight fishers reported similar efficiency of setting to typical gear, with one fisher describing setting to be easier. Some benefits associated with not needing to clip added weight onto, or splice a chain branch line into, the head rope were reported.

Six fishers reported similar efficiency with gear retrieval, with three fishers describing gear retrieval as being more difficult. The NBR head gear was described as *"feeling heavier"*, with the NBR *"hanging vertical in the water".*

These comments suggest the NBR was increasing tension and reducing the potential for slack in the head rope consistent with the intent of the trial.

Eight fishers reported no impact on catch, with one fisher reporting some negative impact. No impacts on crew arrangements or extra time at sea were reported associated with use of the modified gear.

Some fishers reported the softer lay of the NBR compared to PP and PE ropes potentially contributed to the NBR untwisting when floats were spinning as a result of strong current.

Fishers also reported that the NBR occasionally jammed between the hauler plates while being winched up, particularly in deep water and strong current. Some fishers were able to mitigate this problem through modifications to the profile and positioning of the rope peeler on the hauling gear.

Although some fishers reported concern about gear longevity, with some fraying and extra wear associated with the NBR, only one fisher reported the NBR breaking under strain during the field trials. This was attributed to a set of head gear utilising 100% NBR settling on the sea bed and becoming snagged.

Safety

No impacts on vessel stability were reported from the use of NBR in this application, with some implications for crew safety being identified.

One fisher, who hauls his gear on a capstan winch, described the NBR as having a tendency to grab, and raised concerns for less experienced operators experiencing rope jams. Nevertheless, this fisher is continuing to use the NBR and describes the NBR as *"harder to work in current and wind for a one out operator but not prohibitive".*

Other fishers noted positive benefits from not needing to add a weight or chain to weigh down the head rope. Adding weights can be a safety hazard as the weight or chain rapidly moves over the trap tipper and around the hauler or capstan on retrieval, as well as a potential risk vector for whale entanglement.

One fisher also saw some benefit in the NBR not being as slippery to stand on while it was lying on the deck, due to the differing composition from PP and PE rope.

Further comments suggested the NBR attracted more slime and growth than typical PP and PE ropes, once again potentially due to its composition. One fisher described a method where the top portion of head ropes were occasionally placed in a solution of bleach and water for a short period of time to kill the growth.

No fishers reported damage to their vessel, hauling gear or fishing gear. One fisher noted a decrease in recreational fishing gear entanglement.

Overall, the use of the NBR modified head rope was described as safe by all field trial participants.

Lost Gear

Seven fishers reported losing typical fishing gear during the trial, while six fishers reported losing modified fishing gear. Fishers attributed most lost gear to the sea conditions associated with the East Coast low in July and vessel or ship strike. One fisher couldn't attribute a lost trap with typical head gear to either scenario, as when he was able to retrieve the trap through grappling, the rope had a clean cut through it.

Overall, some fishers believed the NBR head gear had the potential to reduce gear loss, particularly due to the absence of floating rope when current strength is minimal. Other fishers reported no potential difference in lost gear.

Seven fishers reported being able to retrieve gear lost during the trial period; most fishers who lost DFTs reported being able to retrieve some or all by the use of a grapple. As surface head gear being cut off is an issue encountered by most DFT fishers at varying frequencies, it appears through the reports of retrievals of lost gear that most fishers who operate DFTs are somewhat experienced in the grappling technique. Further discussion concerning intentionally setting DFTs without surface head gear to be retrieved by grappling a subsurface horizontal rope is within Section 6.6.iii.

Future Uptake

The gear modification was reported to have the potential to reduce the risks of whale entanglement by eight fishers. Most fishers commented on the positive aspects of the NBR remaining under tension in the water column and not floating to the surface when the current reduces.

Four fishers are still using the modified gear, with eight fishers reporting the use of NBR as potentially useful for other DFT fishers during the whale migration season. While one fisher commented *"weights or NBR should be mandatory during whale season. If using weights, management regulations should stipulate the % of length of rope where the weight is attached, relevant to water depth"*; another fisher made the observation that adding weights or chain to the head rope, while having benefits for whale entanglement risk mitigation through adding tension to the head gear and reducing the incidence of floating rope, could also potentially add to entanglement risks similar to having extra knots on the head rope.

Making a comparison between NBR and adding weights, it would seem that using NBR may be a better option as the NBR is able to be spliced directly into typical PP or PE rope without knots, leaving a smooth head rope. This is assumed to reduce the risk of entanglement should a whale come into contact with the head rope.

Although the gear modification is reported as cost effective by seven fishers, it was identified that the differing qualities between the composition of the NBR supplied for the field trials in comparison to typical harder lay PP or PE rope could potentially be an impediment to its ongoing use. Overall, most negative comments regarding the NBR were associated with the rope composition and quality.

Safety considerations

- Potential to jam in hauler or on capstan winch

Potential benefits

- Simple modification, minimal extra cost.
- Adds tension to the head rope without adding weights.
- Can be spliced directly into the head rope removing potential risks associated with adding weights.
- Counteracts, to some extent, buoyancy effect of subsurface head gear.

Potential challenges to uptake

- Composition and quality of the trial NBR resulted in uncertainty of durability.

Indicative Cost

- 8mm NBR $0.45/m

6.6.ii Galvanic Time Release Controlled Head Gear

Galvanic Time Release (GTR) field trials were conducted under the NSW DPI Fisheries Section 37 research permit process described in Section 6.3. The intent of this field trial was to remove the head rope and associated floats from the water column for the majority of the soak time to be released by GTRs at a predetermined time.

A GTR consists of a galvanic couple arranged in a linked configuration. The anode and the cathode sections are composed of metals widely separated on the electromotive scale. When immersed in sea water the anode section (the centre) is corroded through and the linkage breaks releasing the float to the surface[9].

A total of 8300 GTRs were sourced from an Australian supplier via USA and were distributed to seven fishers to trial DFT head gear modifications.

Fishers trialled various models of GTRs including A2, A4, B5 and G8 in modified DFT head gear, including one fisher trialling GTRs as back up within the grappling trials, and one fisher trialling GTRs as back up to NBR modified head gear. The times displayed below in Table 3 are indicative corrosion times when GTRs are submerged in salt water[10].

[9] http://oceanappliances.com.au/index.php/products

[10] http://oceanappliances.com.au/index.php/prices

Table 3: Galvanic Time Release; indicative release times (Ocean Appliances)

GTR Model	Water Temperature		
	16℃	20℃	24℃
A2	16hrs	11hrs	9hrs
A4	21hrs	17hrs	15hrs
A5	26hrs	21.5hrs	18hrs
B5	50hrs	39hrs	32hrs
G8	9days	7days	6days

The field trials were conducted between Bermagui and North Solitary Islands, a geographical range of approximately 785 km. They commenced in March 2020, are ongoing (Dec 2020), and were conducted in water depths varying between 20 and 140 m.

A total of 40 DFTs were deployed with GTR controlled head gear (see Figure 5) by fishers operating from vessels between 5.8 and 16 m in length, solo or with crew. The number of days actively fished was 394, with the approximate number of modified gear trap lifts being reported as 2095.

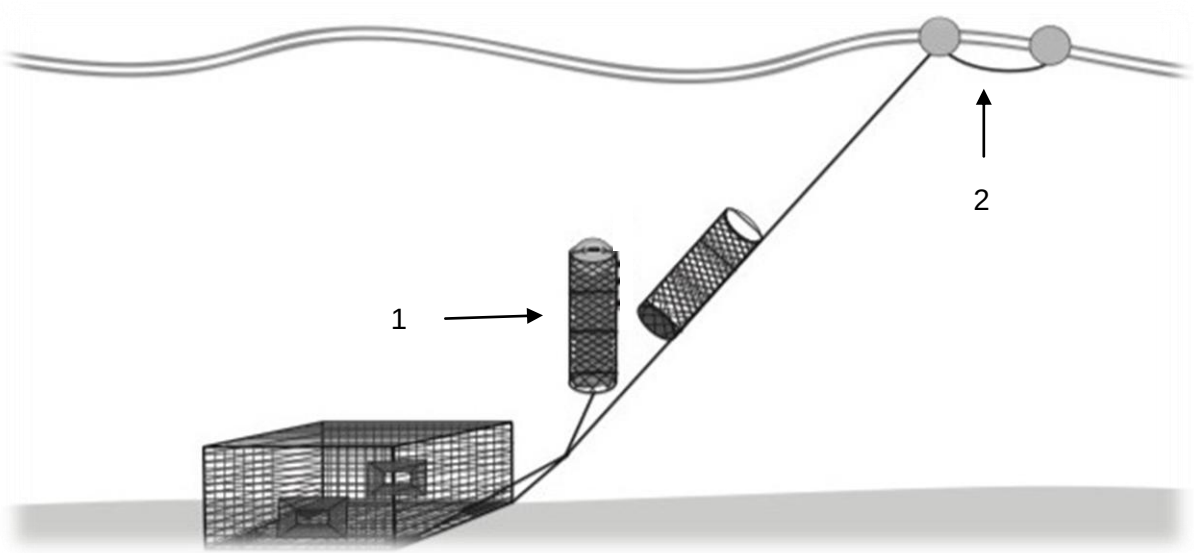

Figure 5: Modified GTR controlled head gear (NSW DPI Fisheries)

1. The DFT head rope was coiled and placed in a bag manufactured from oyster mesh. Some or all of the floats were also contained within the bag (see Image 5). The GTR rope bag was connected to the DFT by means of a short stub rope, or in some cases, directly to the top of the trap. The top of the rope bag was closed using a GTR which corroded over a specified time frame.

Image 5: Modified Galvanic Time Release rope bag (C Zarrella)

2. When the GTR corroded, the floats and head rope were released from the bag, with the buoyancy of the floats bringing the head gear to the surface. The DFT was then able to be retrieved and hauled using the typical method.

Utility

Three fishers described the gear modification as easy to undertake, with four fishers describing more difficulty related to the time needed to construct rope bags and closure mechanisms associated with the modification.

Of the seven fishers undertaking the GTR controlled head gear field trials,

- four fishers reported similar efficiency of setting to typical gear,
- two fishers reporting more difficulty, and
- one fisher describing setting gear as too difficult.

Most fishers commented on the extra time and effort to coil ropes into the GTR rope bag and the need to hold the GTR rope bag while setting the DFT to ensure it did not get tangled with the stub rope. Fishers trialling the modification in shallower water noted less time required to pack the rope and floats into the GTR bag than in deeper water.

For sole operators, the time spent packing the GTR rope bags was added to the turnaround time between DFT retrieval and resetting. To reduce turnaround time, it was identified that GTR bags could be prepacked before leaving port and changed over each time the DFT is worked. This approach would have its drawbacks though; *"To be viable in deep water you would need to take pre packed rope bags to swap over onto traps. Space storing bags would be a problem".*

For operators with crew, bags can be repacked while steaming to the next DFT allowing for a rotation of bags and maintained efficiency of the operation at sea.

One fisher who attached the GTR rope bag directly to the top of DFTs being set in deep water (90 m) described using GTRs as too difficult for this application. For GTRs to be more appropriate for deeper water applications, a method to facilitate rapid coiling of ropes would need to be employed. For fishers using similar methods in the NSW Lob fishery, crew members repack the rope bags after each use, often using a dedicated snood hauler to coil the rope into the rope bag.

A further negative aspect reported is the added buoyancy of the GTR controlled head gear making the DFT more likely to move along the bottom in strong current or rough seas. One fisher trialling GTR controlled head gear attached directly to DFTs in shallow water commented *"(I) put 3 extra bricks on the side where the rope bag is, to counteract one x 6" float"*.

This buoyancy effect is particularly exacerbated for DFTs being set in areas of strong current, as the number of floats required to ensure the head gear is available on the surface to facilitate retrieval has a marked effect on the weight of the trap in the water. One fisher working in deep water commented *"very difficult in deep water with strong current. Coiling the ropes is an issue. Traps need be a lot heavier to counteract the weight of the sunken headgear".*

Further concerns associated with this effect on DFT buoyancy include greater difficulty in being able to accurately set gear in deep water, particularly in times of strong current, as the buoyancy of the GTR controlled head gear increases the time for the DFT to sink to the sea bed. In deeper water applications, some fishers reported a reduction in catch associated with modified head gear being held under water by strong currents making DFT retrieval impossible. The buoyancy effect could potentially be mitigated by using heavier DFTs with resulting trade-offs in efficiency of working with heavier gear and the initial increased manufacturing costs. The added weight associated with using NBR in GTR controlled head gear may in some way counteract the buoyancy effect of the floats.

A number of fishers involved in the field trials fish in deep water during winter targeting ocean jackets. These fishers haul and reset multiple DFTs multiple times each day. The use of GTR controlled head gear in this application would be restricted to the last trap set of the day, and would rely heavily on mitigating the rope coiling and buoyancy issues described above.

Four fishers reported similar efficiency of gear retrieval, with three reporting more difficulty. *"Less floats in current makes it more difficult to hook head gear up, need to take care going through the fair lead (GTR bag)."* In practice, GTRs were found to have unreliable release times, potentially associated with varying water temperatures and float buoyancy.

In shallow water applications, GTR controlled head gear was reported to have a positive impact on catches due to a reduction in lost gear. In deeper water, GTR controlled head gear was reported to have a negative impact on catches due to reduced productivity associated with a longer turnaround time and added difficulty with gear setting accuracy*; "a lot of time spent packing bags"*.

One fisher commented *"a good idea but not very practical for fish trapping in deep water".*

<u>Safety</u>

There were no reported impacts on vessel stability, damage to vessels, hauling gear or fishing gear from the use of the modification.

Two fishers described potential safety hazards. For GTR controlled head gear attached to a DFT via a short stub rope, there are potential interactions between the fisher or crew and stub rope due to the need to hold on to the rope bag as the DFT is being set to ensure the bag does not become entangled in the stub rope. For DFTs with the GTR controlled head gear attached directly to the trap, the head rope and floats need to be packed into the bag while the DFT is sitting on the trap tipper. One fisher commented *"more interactions between deckie and ropes, more opportunity for something to go wrong".*

Overall the use of GTR controlled head gear was reported to be safe by five fishers, with two fishers unsure because of the increased interactions between crew and ropes.

Lost Gear

Six fishers reported losing typical fishing gear during the trial, with three fishers reporting losing modified gear. Comments regarding gear loss included *"due to weather 19th July lost all gear, massive seas- East Coast low", "cut off with a knife", "possibly picked up on trawler stabiliser arm"* and *"one trap 7mm broke away (whale)".* One fisher reported losing two trial DFTs on one day, commenting *"no, was hoping it would (reduce gear loss). Lose traps in that area anyway –trawlers and yachts travel through that area".*

One fisher described a potential for the GTR controlled head gear to increase gear loss due to *"potential for gear to drag"*, consistent with the discussion regarding increased buoyancy of subsurface head gear above. Most fishers reported GTR controlled head gear as likely to reduce the incidence of gear loss, with one fisher on the South Coast commenting *"headgear was close to the bottom when the whales came back through"*.

Five fishers were able to retrieve gear lost during the trial. Methods reported being used to recover lost gear include grappling and intentional entanglement with other DFTs set on the same mark.

Future Uptake

The general consensus regarding the application of this gear modification during whale migration season was positive. The gear modification was reported to have the potential to reduce the risks of whale entanglement by five fishers, with one fisher disagreeing and one fisher unsure.

One fisher was unsure about the potential to reduce risk considering *"(whales are) known to dive deep into the water column"*, and in whale season he was *"usually wanting to keep gear up on top of water with current".*

Fishers who reported that GTR controlled head gear has the potential to reduce the risks of whale entanglement commented that the modification *"removes the rope from the water column"*, albeit with reservations around the practicality for deep water and strong currents. Further comments included *"better than not working", "even out wide with heavier steel gear", "particularly in shallow water"* and *"timers or bags are a must during these months".*

For GTR controlled head gear to be most effective in reducing risk however, it would need to be either connected directly to the DFT, or attached with a very short stub rope.

All fishers reported barriers to uptake, *"management regulations don't allow it"*. A number of fishers made comments regarding the current regulation requiring DFTs to be marked on the surface with a

float; *"should be allowed to grapple traps and /or use GTRs all the time", "should have numbered tags on traps that have no headgear".*

Safety considerations

- Extra interactions between crew, ropes and rope bags

Potential benefits

- Removes most of the head gear from the water column for the majority of the soak time.
- Increases security of fishing gear.

Potential challenges to uptake

- Subsurface head gear adds buoyancy to the DFT.
- Head gear must be packed in GTR rope bags leading to impacts on productivity; exacerbated in deeper water.
- Unreliable release times associated with varying water temperatures and float buoyancy.
- Cost and availability of GTRs.
- Currently incompatible with NSW OTL regulations.

Indicative Cost

- GTR $2.00/3.00 per trap/day
- Hard floats and mesh bag $50/trap

GTRs as Backup

GTR controlled head gear was also used by one fisher as a backup bag during grappling trials, with a number of other fishers reporting using backup GTR controlled head gear on DFTs with typical or NBR head gear, both during and prior to the field trials.

For fishers using GTR controlled head gear as back up for when surface head gear is cut off, the efficiency impacts associated with coiling ropes and packing bags are negated as the backup GTR is replaced before the backup head gear is released. Further, when backup head gear is released after the main head gear is cut off, lost DFTs that would otherwise not be able to be retrieved through grappling may be recovered even if they have been dragged to a different location. One fisher commented *"(its) good to know that if you lose a trap the secondary bubble will be up in a few days".*

In the case of lost traps, although the backup GTR controlled head gear can become entangled with the remaining portion of head rope creating some difficulty with retrieval, using GTRs in this way has the potential to increase the number of lost DFTs being recovered, with positive benefits for fisher viability "*navigation safety, whales, gear security and ghost fishing".*

One fisher reported the use of light gauge steel tie wire as a substitute for GTRs in back up bags, taking advantage of the benefits of a backup bag system without the costs associated with the purchase of GTRs.

6.6.iii Grappling a Subsurface Rope

Grappling a subsurface rope field trials were conducted under the NSW DPI Fisheries Section 37 research permit process described in Section 6.3.

The intent of this field trial was to remove the surface head gear from the water column by retrieving DFTs through the use of a subsurface rope (see Figure 6). Previous research permits have enabled use of this technique on DFTs in Sydney Harbour and the Hawkesbury River in areas of high boating traffic.

1. A subsurface rope is weighted to lie horizontally near the sea bed.

2. A grapple is then towed across the subsurface rope. The subsurface rope is hooked between the body of the grapple and a grapple pin, and is then hauled to recover the DFT.

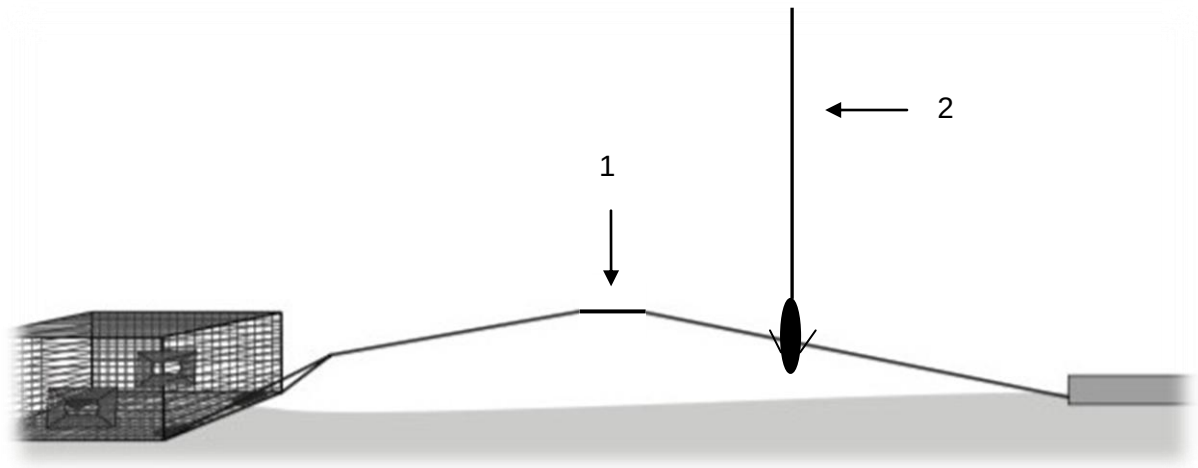

Figure 6: Grappling a subsurface rope (NSW DPI Fisheries)

The field trials were conducted by two DFT fishers between Jervis Bay and Sydney, a geographical range of approximately 141 km, in water depths between 40 and 90 m, commenced in April 2020 and are ongoing (Dec 2020).

One fisher used 100 m polypropylene 7 mm PP rope as the subsurface rope. The other fisher used 100 m of 7 mm PE rope and incorporated GTR back up into the grappling trials. Both fishers used bricks to weigh down the subsurface rope.

The specifications of an effective stainless steel grapple used by a fisher in the field trials (see Image 6);

The main body of the grapple was constructed of 60 mm solid round bar, 600 mm in length. The grapple pins were constructed of 12 mm round bar welded at an acute angle to the grapple body, to facilitate the subsurface rope becoming jammed between the grapple body and pins. The grapple pins were attached towards the centre of the grapple body to allow the grapple to be used on hard reef without hooking up on the bottom. Between 250 and 300 m of 8 mm PP rope was attached to the end of the grapple body.

Image 6: Grapple used in field trials (P. Sullivan)

A total of 8 DFTs were deployed with subsurface ropes. One fisher operated from a vessel of over 14 m in length with a crew member, while one fisher operated from a vessel of 5.8 m in length with no crew.

The number of days actively fished was 74, with the approximate number of trap lifts being reported as 270.

Utility

Both trial participants reported relative ease of gear modification; "*just replacing floats with a couple of bricks".*

Both fishers described similar minor impacts on efficiency associated with gear setting; *"need to steam away from trap and tighten rope",* which may be exacerbated if working solo from a small vessel.

Both fishers reported extra difficulty with gear retrieval; "*takes time to grapple", "grapple back 1st go each time- but it takes longer".* Grappling requires `knowledge and experience to successfully implement. Information regarding appropriate grapple specifications and correct setting of the hauling rope was exchanged between participants with resultant improvements in technique leading to successful implementation reported by both fishers; *"improved technique, now easier".*

An indication of the value that experience plays in the success of the technique is that both trial participants were actively involved in grappling the subsurface rope, whether they had crew on board or were working solo; *"efficiency improves with experience".* One fisher suggested that grappling is "*unlikely to be successful in areas where traps are set alongside reef ledges due to the likelihood of the grapple fouling on the bottom".*

Gear loss attributed to accidental vessel and ship strike or intentional interference with set fishing gear is seen by many DFT fishers as a more common occurrence than gear loss by whale strike or entanglement. Both trial participants reported improved catch rates associated with a reduction in lost gear; *"didn't affect catch rates but because I didn't lose traps the gear was available each time I went fishing- meaning more catch"* and *"not losing traps any more, to whales, amateurs or boat strikes".*

Extra time at sea associated with retrieval of gear was reported by one fisher, "*takes a bit longer to do gear- about extra 10 minutes per trap",* while less time at sea was reported by the other "*working less because I'm no longer concerned about the security of my traps".*

Safety

There were no impacts on vessel survey or stability, with no crew safety hazards identified. There was no damage to the vessel, hauling gear or fishing gear reported.

One of the participants, operating in a high traffic area for recreational fishers, also described a marked difference in the incidence of recreational fishing gear entanglement in his DFT grapple gear compared to typical surface floats and ropes; *"absolutely. No hooks, sinkers and lures in your head gear".* This is a positive outcome; the removal of a known safety hazard for professional fishers hauling their gear, accompanied with a reduction in lost recreational fishing gear.

Overall, the gear modification was described as safe; *"no floating rope even in times of no current. No rec gear on ropes".*

Lost Gear

One fisher reported losing all traps, both typical and modified, due to sea conditions associated with an East Coast low on 19th July. Only one trap was able to be recovered. The other fisher did not lose any traps during the trial period.

The gear modification was described as likely to reduce the incidence of gear loss; *"headgear close to the bottom when the whales came back through"* and*, "no headgear to be cut off".*

Future Uptake

The gear modification was reported to have the potential to reduce the risks of whale entanglement, is still being used by both fishers who described it as potentially useful for other DFT fishers during the whale migration season and is cost effective. Some trial participants, who also participate in the NSW Lobster fishery, have reported using this technique on deep water lobster gear for a number of years. DFT fishers have also reported grappling as the primary technique for recovering traps when the headgear is cut off through vessel and ship strike, whale strike, or intentional interference with set fishing gear by recreational fishers.

The gear modification was reported as cost effective; *"don't lose traps balanced with a bit of extra work, time and labour. Better than not working at all".*

The current DPI F regulation requiring the marking of DFTs with surface floats is seen by both fishers as the major barrier to the uptake of this technique. While one trial participant commented that grappling of subsurface head gear "*should be an option if DPI F is serious about mitigating the risk to whales",* It was suggested that some extension or '*education process"* would be valuable to demonstrate the technique to other fishers if management arrangements were to allow this technique in the future.

While the current field trials have focussed on fishers working in the NSW OTL fishery, whale interactions with set fishing gear are also experienced by a small number of NSW Estuary General Trap (EGT) fishers who have entitlements to fish in Jervis Bay.

Although outside the scope of the current project, one of the fishers participating in the modified gear field trials made the following comments; *"Solved the whale entanglement, poaching and running over the gear issue with grappling. In a high recreational boating area which has implications for surface head gear. Win /win for everybody. Jervis Bay is a half way point of whale migration on the East coast. It is also a rest point for both north and south bound whales, with whales coming right into the bay. There would be minimal compliance issues seeing that my fishery (EGT region 6) has hardly any participants. It is a very popular whale watching area which has negative implications for my EGT business. The whale season seems to be lengthening to include April to December. I haven't been able to use this entitlement (EGT) effectively but this grappling system would work well for me in the bay. Local compliance officers are very aware of the issues".*

Safety considerations

- Potential to reduce recreational gear interactions with commercial fishing ropes/gear.

Potential benefits

- Simple modification, minimal extra cost.
- Keeps the head gear low in the water column for the entire soak time.
- Increases security of fishing gear.
- Can be supported by back up GTR controlled head gear.

Potential challenges to uptake

- Impacts on productivity associated with added DFT retrieval time.
- Currently incompatible with NSW OTL regulations.
- NSW DPI Fisheries concern regarding the enforceability of trap restrictions and management arrangements if surface floats are not used to identify traps.

Indicative Cost

- Reduced trap cost due to no floats. May be offset by extra time at sea.

6.6.iv DFT Management Regulations

DFT fishers involved in GTR and subsurface rope modified gear trials commented that current DPI F regulations requiring the marking of DFTs with surface floats likely increases the risk of whale entanglement. While these gear modifications are not practical in all applications, regulations are seen by fishers as the major barrier to the uptake of GTR controlled head gear and subsurface ropes in some areas which would likely mitigate entanglement risk.

While there was recognition that marked surface floats are a method used by DPI F officers to ensure compliance with NSW OTL regulations, a system of identifying traps by attaching DPI F specific numbered tags was suggested by some of fishers as a suitable mechanism for marking DFTs in the absence of surface floats, resulting in a similar compliance outcome.

6.7 Results and Discussion - Spanner Crab

6.7.i Negative Buoyant Rope Head Gear and Trot Line

Typical SC trot lines constructed of PP or PE rope contact the bottom adjacent to each dilly, with the buoyancy characteristics of the PP and PE ropes allowing the trot line to rise into the water column in loops between each dilly. The intent of this field trial was to use NBR to reduce the amount of slack rope in the water column by increasing tension on the SC head gear, and to ensure the SC trot line remained in contact with the sea bed for its entire length Figure7).

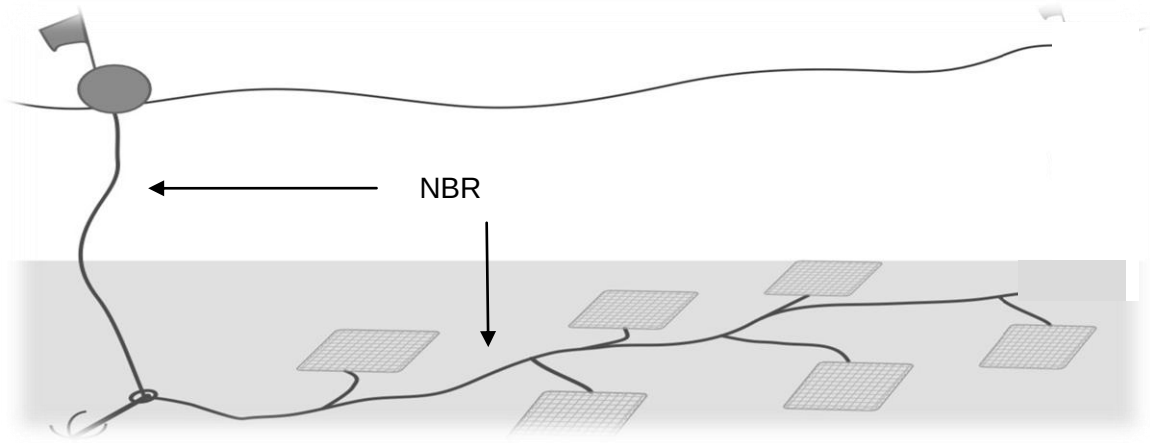

Figure 7: NBR modified SC head gear and trot line (NSW DPI Fisheries)

A total of 32 coils of NBR were distributed to four SC fishers. The fishers used varying combinations of 6, 7 and 8 mm NBR to construct modified head gear and trot lines.

The trials were conducted between Ballina and Tweed Heads, a geographical range of approximately 76 km, commenced in March 2020 and are ongoing (Dec 2020).

Trials were conducted in depths varying between 30 and 64m, from small vessels between 5.2 and 7.5 m in length, solo or with 1 crew member.

A total of 7 trial SC gears were deployed. The number of days actively fished was 165, with the approximate number of sets being reported as 970.

Utility

Three fishers described the gear modification as easy to undertake, with one fisher describing more difficulty splicing due to the *"looser yarn of the NBR".*

Although the efficiency of setting the NBR modified gear was reported as similar to typical SC gear, some fishers noted that NBR used in the trials did not coil well creating the potential for rope snarls while shooting away *"does not coil well and catches and knots easier than PE"*. One fisher noted that although there was not as much current encountered this fishing season as in typical years, the NBR settled more quickly and *"laid down in the water better".*

Fishers encountered two main issues making the retrieval of their gear more difficult.

The first issue concerned the potential for the NBR to compress more than the typical PP and PE rope, resulting in the NBR pulling more tightly into the hauler. This created potential for the NBR to jam between the hauler plates, with the rope peeler becoming unable to separate the rope from the hauler; *"had problems with peeler, rope wants to grab a bit more"*. This characteristic of the NBR used within the field trials resulted in a number of tangles and rope jams in the hauling gear. Some fishers were able to mitigate this issue through modifications to the profile and positioning of the rope peeler.

The second issue common for most fishers was the amount of "passion flower" and other benthic debris attached to NBR trot lines when they were being hauled. This is believed to be due to the NBR used in the trials having a "*fluffy*" quality and "*looser yarn*" in comparison with the harder lay of the PP and PE ropes typically used in SC trot lines. Fishers dealt with this issue in varying ways, from incorporating brushes into the fair lead in an attempt to remove the "passion flower" mechanically as the NBR trot line was being hauled, to shovelling the debris overboard at the completion of each haul. Either way, this issue was seen to be a major inconvenience to most fishers, with fishers commenting they were *"continually cleaning up passion flower"* and *"I would have liked to have had a deck hand to help shovel flower over the side each shot".*

No impact on catch was reported by fishers, with one fisher reporting extra time at sea associated with rope tangles and jams.

Safety

Two fishers reported potential impacts on vessel stability from the use of NBR, with the NBR being reported as *"at least twice as heavy as PP rope, especially when wet".* As rope bins are often situated on one side of the vessel, some fishers needed to compensate for the resulting impacts on their vessel trim and stability brought about by this extra weight through moving their rope bins around during the day.

Potential crew hazards were identified by two fishers. One fisher also noted the NBR *"grabbed the hand very easily"* if being held while shooting away, with another fisher raising concerns that is was "*more difficult to cut with a safety knife".*

Two fishers reported damage to their vessel, with all fishers reporting damage to the hauling gear, due to the amount of sand and other abrasive debris held within the rope. Fishers described increased wear on the side of the vessel, the fair lead and the hauler plates associated with this extra grit; "m*ore wear on the gunwale as the rope collects sand and other abrasive debris"* and *"more wear on the line hauler as the rope picks up lots of debris and sand".* This was identified as a potential issue at the initial scoping workshop and resulted in concurrent trials of phosphor bronze hauling plates on three vessels (Section 6.7.iii).

Although some fishers reported concern about gear longevity, with some fraying and extra wear of the NBR in comparison to typical PP and PE ropes, no fishers reported the NBR breaking under strain during the field trials.

Overall, the gear modification was described as safe.

Lost Gear

While there was no typical or modified fishing gear lost during the trial, the gear modification was described as likely to reduce the incidence of gear loss. Fishers reported the NBR as working very well within the SC head gear, with the modified gear appearing to sit with increased tension in the

water column. One fisher described an incident where *"Whales were coming through, two other fishers had normal gear with float rope cut off. My gear in the same area using NBR was not cut off. I want to change all my headgear to sink rope, it works beautifully".*

Future Uptake

The gear modification was reported to have the potential to reduce the risks of whale entanglement by three fishers, *"head gear sitting with more tension in the water column. Trot line is sitting on the bottom"* and *"I really believe it will make a difference to entanglements".*

Three fishers are still using the modified gear, with all fishers reporting the potential for other SC fishers to use NBR during the whale migration season, with some reservations. While most fishers are continuing to use the NBR at this time, it was identified that the composition of the NBR supplied for the field trials in comparison to the typical harder lay of PP or PE rope could potentially be an impediment to its future use. One fisher summed up the general consensus by saying *"we need the qualities of PE rope but negative buoyant".*

In conclusion, one fisher made the following general comments about his SC operation. *"More aware about the whale issue since the workshop, now modifying how I fish. Not shooting away if I see whales, moving to other grounds".*

Image 7*: Passion Flower* attached to SC NBR trot line- G Bordin

Safety considerations

- Potential to jam in hauler.

Potential benefits -head gear

- Simple modification, minimal extra cost.
- Adds tension to the head rope without adding weights.

Potential challenges to uptake – head gear

- Composition and quality of the trial NBR resulted in questionable durability.

Potential benefits - trot line

- Simple modification, minimal extra cost.

- Adds weight to the trot line ensuring constant contact with the sea bed.

Potential challenges to uptake – trot line

- Composition of the trial NBR resulted in excess benthic debris.
- Vessel stability can be compromised by the extra weight of the NBR trot line.
- Extra wear on hauling equipment.

Indicative Cost

- 6 mm NBR $0.26/m
- 7 mm NBR $0.40/m
- 8 mm NBR $0.45/m

6.7.ii Lead Core Rope Trot Line

The intent of this field trial was to reduce the potential for slack rope in the water column through the use of LCR in the trot line (Figure 8).

A total of 250 m of 8 mm Lead Core Rope (LCR) was distributed to one SC fisher for use on SC trot lines.

The trials were conducted between Ballina and Byron Bay, a geographical range of approximately 25 km, commenced mid March 2020 and are ongoing (Dec 2020).

The two trot lines were constructed as follows; typical 8 and 7 mm PP rope with 4 x 4 m lengths of 8 mm LCR spliced into the trot line at regular intervals between each dilly. The number of dillies was 10, with the distance between dillies being 70 m. One piece of 8 mm LCR of 300 mm length was also spliced into the branch line (snood) between the trot line and each dilly.

A 20 kg weight was attached on a 12 mm PP branch line 6 m before the first dilly to anchor the trot line.

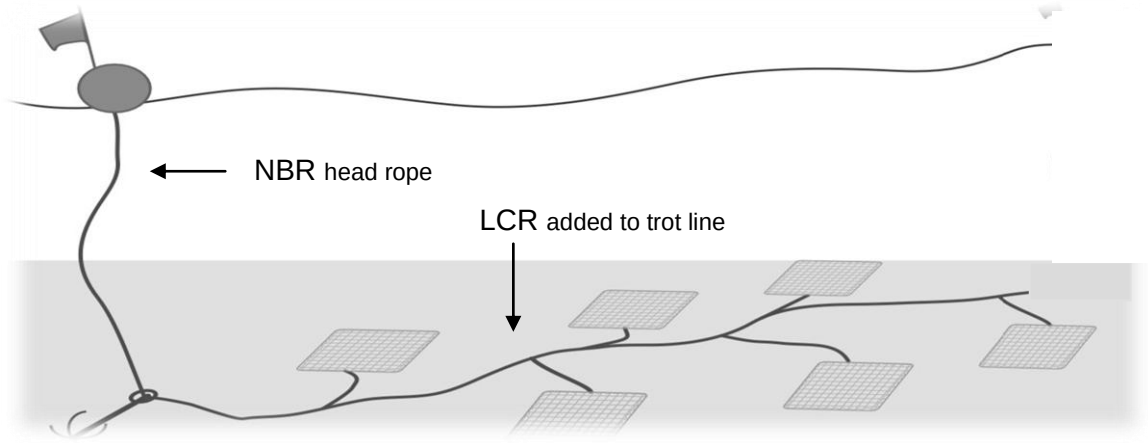

Figure 8: Modified LCR trot line with Modified NBR head gear (NSW DPI Fisheries)

The trials were conducted from a vessel 7.5 m in length, with 1 crew member.

The number of days actively fished with the LCR modified trot line was 85, with the approximate number of sets being reported as 255.

Utility

The LCR was found to be similar to splice as typical PP rope. A major consideration associated with the manufacture of SC trot lines incorporating LCR is the time taken to integrate rope splices into each gear set. The fisher described the gear modification as difficult to undertake, with *"a lot of splicing required"*. The LCR was described as *"ok to splice".*

The fisher reported similar efficiency of setting and retrieval to typical gear. The fisher also noted the lack of "passion flower" attached to the LCR trot line as opposed to two sets of NBR trot lines he was operating in the same area, likely due to the LCR being of similar composition to typical PP rope.

No impact on catch, impact on crew arrangements or extra time at sea associated with use of the modified gear was reported.

Safety

Although the use of LCR was reported to be safe, some important considerations should be highlighted.

The fisher undertaking the LCR trials operated from a vessel of 7.5 m in length, which is at the upper range of vessel size for SC fishers. The modified gear incorporating LCR in the trot line was significantly heavier than typical PP or PE gear. For efficiency purposes, the fisher typically stored the rope bins containing the fishing gear on the starboard side of the boat, directly underneath the rope hauler. As SC gear was deployed for fishing and then removed from the water and transported back to port at the end of each fishing day, vessel stability was impacted by the extra weight associated with the LCR gear being on one side of the vessel during transportation. The fisher trialling LCR reported that he would not be able to use four sets of LCR gear as a result of this impact on his vessel stability; *"extra weight couldn't run four lead core".*

As most SC vessel sizes used during the field trials were reported to be in the 5.2 to 6 m range, these stability concerns would likely be exacerbated for other operators.

There was also potential for cuts to hands if the LCR trot line is being held while being shot away, as small sharp pieces of the lead protruded from the trot line where the LCR was spliced into the PP rope; "*harder on your hands when shooting away".*

Damage to the vessel as well as damage to the hauling gear was also reported*; "wear marks on wear plates from running over the side, much more abrasive."* and *"wears into hauler, creates a groove. Hauler has been machined twice".*

Lost Gear

One set of modified fishing gear was lost during the trial, and subsequently recovered. The gear modification was described as likely to reduce the incidence of gear loss.

During the trials, the headgear associated with one set of LCR gear was cut off near the top (PP rope) by a whale. While the head gear and LCR trot line were able to be recovered, the grapple used to recover the LCR trot line; "*needed to be modified to increase the weight, particularly at the front end, to allow the grapple to dig into the sandy bottom to hook the lead core rope"*. Although it was more

difficult to recover the LCR trot line in comparison to a typical trot line cut off in similar circumstances, this scenario was also an indication of the LCR trot line being in direct contact with the sea bed.

Future Uptake

The gear modification was reported to have the potential to reduce the risks of whale entanglement.

The fisher is still using the modified gear, reporting the use of LCR as potentially useful for other SC fishers during the whale migration season; *"would prefer LCR over NBR"*, and *"doesn't collect passion flower like NBR"*.

The gear modification is reported as cost effective, with no operational barriers to its uptake noted.

Safety considerations

- Vessel stability can be compromised by the extra weight of the LCR trot line.

Potential benefits

- LCR adds weight to the trot line ensuring constant contact with the sea bed.
- LCR did not collect benthic debris similar to the NBR used in the trials.

Potential challenges to uptake

- Time consuming modification.
- Extra wear on hauling equipment.

Indicative Costs

- 8 mm LCR $1.55/m

6.7.iii Phosphor Bronze Hauler Plates

Typical alloy hauler plates are known to be prone to wear from hauling PP or PE ropes used within the NSW OTL fishery, even in applications where ropes rarely come in contact with the sea bed. The gear modifications being trialled using NBR and LCR were designed to keep the SC trot line in direct contact with the sea bed, and were expected to significantly increase the amount of grit and benthic debris grinding into the hauler plates as the trot line was hauled. The expected additional wear to typical aluminium alloy hauling gear had the potential to make the use of NBR and LCR impractical for application within SC trot lines and prematurely curtail the trialling of these gear modifications.

The intent of this field trial was to evaluate the performance of phosphor bronze hauler plates while hauling NBR and LCR modified SC trot lines (Image 12).

A total of three sets of phosphor bronze hauler plates were sourced from a foundry on Flinders Island Tasmania, and distributed to three SC fishers.

The field trials were conducted between Ballina and Byron Bay, a geographical range of approximately 25 km, commencing late March 2020 and are ongoing (Dec 2020).

Fishers used the phosphor bronze hauling plates to haul typical SC fishing gear and SC fishing gear modified with NBR or LCR.

A total of six typical and five modified SC gears were deployed. The number of days actively fished was 75 for typical gears and 115 for modified gears, with the approximate number of hauls being reported as 720 for typical gears and 1110 for modified gears.

Trials were conducted in depths varying between 30 and 64 m. Fishers operated from small vessels between 5.2 and 7.5 m in length, solo or with one crew member.

Utility

Fishers reported difficulty in making the modification as some engineering work was required to fit the modified hauler plates to existing hauling gear. There was some concern noted by one fisher that the larger size and heavier weight of the modified hauler plates may result in increased wear to bearings associated with the hauler motor. All fishers described the hauler modification as requiring some downtime and expense to carry out; *"needed engineering to install because of extra weight",* and *"just had to make brackets for rope peeler and cut my rope bin down a bit".* One fisher commented *"size of plates too big. Had to re-engineer to suit".*

Two fishers commented that the larger than typical diameter of the hauling plates hauled the fishing gear faster, one reporting efficiency gains from less time at sea to haul the same number of sets; *"larger diameter hauled faster".* No impact on catch or on crew arrangements was reported. One fisher reported less time at sea associated with use of the modified hauler.

Safety

There were no potential impacts on vessel stability and no potential crew hazards reported by fishers.

One fisher reported concerns regarding potential future damage to hauler motor bearings. There was no reported damage to fishing gear associated with the modification.

Overall, the hauler modification was described as safe.

Future Uptake

Two fishers are still using the modified hauler. The hauler modification is reported as cost effective, with no operational barriers to its uptake noted.

The phosphor bronze alloy hauler plates used in this field trial are significantly harder than typical aluminium alloy hauling plates and were predicted to be less prone to "grooving" from grit embedded in NBR and LCR trot lines.

One fisher, who reported the largest amount of fishing activity amongst the three trial participants, reported some wear from grit associated with concurrent LCR and NBR modified trot line trials. Although some wear was apparent, this fisher commented *"Less wear on bronze hauler reducing need to reface hauler when using LCR or NBR. A step in the right direction".*

Image 8: Modified Phosphor Bronze Hauler Plates (G. Bordin)

Potential benefits

- Added durability when using LCR or NBR trot line.
- Improved productivity related to hauler diameter.

Potential challenges to uptake

- Expensive modification requiring engineering work.

Indicative Cost

- Supply and freight $1200
- Engineering

6.8 Summary

An indicative cost, and a summary of the utility, safety, implications for lost gear and potential for future uptake is summarised in Table 4 for each DFT trial type. A scoring system (Table 4 key) was used to summarise the potential benefits, challenges and barriers of DFT trial modifications.

Table 4: Summary of DFT field trial findings

DFT summary	NBR head rope	GTR	Grapple
Cost	$0.45/m	$3/trap/day	$0 direct cost
Utility	Simple modification	Takes time to pack rope bags Buoyancy of head gear	Added retrieval time
Safety	Potential rope jams	Added interactions between crew and ropes	Less recreational gear on ropes
Implications for Lost Gear	Reduces slack rope	Removes most of the head gear from the water column	Head rope low in the water column
Future Uptake	Rope quality	NSW OTL Regulations	NSW OTL Regulations

Table 4 Key	benefits	challenges to overcome	barrier to proceed

An indicative cost, and a summary of the utility, safety, implications for lost gear and potential for future uptake is summarised in Table 5 for each SC trial type. A scoring system (Table 5 key) was used to summarise the potential benefits, challenges and barriers of SC trial modifications.

Table 5: Summary of SC field trial findings

SC summary	NBR head rope	NBR trot line	LCR trot line
Cost	$0.45/m	> $0.45/m	$1.55/m
Utility	Simple modification	Simple modification Added grit and excess benthic debris	Complex modification
Safety	Potential rope jams	Added weight may affect vessel stability	Added weight may affect vessel stability
Implications for Lost Gear	Reduces slack rope	Trot line remains in contact with sea bed	Trot line remains in contact with sea bed
Future Uptake	Questionable rope quality	Added wear on hauling equipment	Added wear on hauling equipment

Table 5 Key	benefits	challenges to overcome	barrier to proceed

7. Recommendations

1. Follow up Workshop.

Workshop agenda items to include:

- the initial Whale CoP,
- the results of the field trials,
- issues identified as challenges to overcome, (see Table 4 and 5),
- current NSW OTL management arrangements,
- whale entanglements 2020 East Coast migration, and
- further research topics and funding sources.

2. Extension of Whale CoP and Field Trial Results.

Review and extend the initial Whale CoP and field trial results to NSW OTL fishers and wider marine stakeholders.

3. Conduct a Gear Survey.

With the great diversity of fishers and gear applications within the NSW OTL fishery, an initial survey of the gear used within the fishery was given a high priority at the scoping workshop by NSW DPI Fisheries as important baseline knowledge.

While field trial participants have provided some information regarding the types of gear they currently use within the NSW OTL fishery through their reporting questionnaires, limited information is known about gear types (particularly ropes and floats) in use by the majority of NSW OTL participants.

A fishery wide gear survey would:

- assist in determining the source of observed entanglements,
- allow the impact of gear changes on rates of entanglement to be estimated or assigned a likely risk reduction rating,
- allow realistic costing to be developed to understand cost of fleet-wide adoption of modified gears, and
- allow cross referencing for all future entanglements to quantify risk vectors.

4. Investigate further strategies to minimise the number of floats and length of head rope.

- Extend the findings of field trials to fishery managers to evaluate the efficacy of current management arrangements, particularly those related to surface head gear.
- While floats are a factor involved in many entanglements, investigations and field trials related to float types and configurations have not been undertaken through this project.

5. Assess the requirements and specifications for a compliance arrangement to meet the needs of NSW OTL fishers, and NSW DPI Fisheries managers and compliance officers.

Identify solutions that address management and compliance concerns while reducing entanglements and loss. Examples could include gear location apps and supporting trap tagging systems.

6. Conduct expanded field trials of alternative negative buoyant rope with characteristics similar to the PE and PP ropes in typical use within the fishery.

The use of NBR has been identified as an area where some risk can be mitigated relatively easily and cost effectively. The NBR used in the field trials had characteristics, potentially due to its composition, which created challenges for trial participants. These challenges included the attachment of excess benthic debris and added hauler wear for SC fishers and questions of durability for both DFT and SC fishers. Further trials of NBR with similar handling and wear characteristics to typical PE and PP ropes, using expanded variables of fishing gears and operations, may influence many NSW OTL fishers to adopt this risk mitigation measure.

7. Conduct an evaluation of the utility of acoustic technology for use in the DFT, including field trials of Fiobuoy acoustic release technology.

Fiobuoy is an Australian made, at call, acoustic release system which has been used for a number of years in the marine research and defence industries. The Fiobuoy system uses a bobbin like design which enables the rope to be rapidly wound onto the device. This design feature may contribute to overcoming a major hurdle in the practical use and uptake of acoustic release systems in the NSW OTL fishery.

Field trials were planned for the Fiobuoy system to commence in early May 2020. Travel restrictions associated with the COVID-19 health emergency precluded travel from Tasmania to NSW to deliver equipment and training to the DFT fisher who was to undertake the trials, consequently the field trials were postponed.

OCEANWATCH AUSTRALIA

WetFEET Project

Activity 1.1 Report: East Coast Whale Entanglement Mitigation Program

November 2019

Sydney

Australian Government | National Landcare Program

This project is funded through the Australian Government's National Landcare Program.

OceanWatch Australia would like to thank the presenters, professional fishermen, industry representatives and government scientists and management representatives who attended the workshop at the Sydney Fish Market on the 13th September 2019 – and in particular, for the generous spirit of collaboration and innovation shown.

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EXECUTIVE SUMMARY

As Humpback whale populations in the southern hemisphere recover from past commercial whaling, the potential for interactions between whales and commercial fishing operations is increasing, with most entanglements occurring since 2006. Most entanglement incidents involve Humpback whales, a species listed as a Vulnerable within the Commonwealth EPBC Act and NSW Biodiversity Conservation Act 2016.

In the past few years, there has been an increase in media reports relating to whale entanglement in fishing gear. Preliminary assessment of reported whale entanglements in New South Wales has confirmed a variety of sources. These comprise of set fishing gear of unknown origin, e.g. rope and floats, or rope only, set fishing gear not consistent with NSW, rope only not consistent with NSW fishing gear, NSW and QLD shark mitigation gear, interstate set fishing gear, longline gear of unknown origin and gear associated with aquaculture.

Entanglements associated with NSW set fishing gear include configurations used in the demersal fish trap, spanner crab, demersal setline and lobster trap fisheries, with higher incidents in demersal fish trap sector and lower incidents in the other sectors.

The East Coast Whale Entanglement Mitigation Program has been initiated in NSW to respond to the issue of entanglement with NSW set fishing gear. OceanWatch Australia (OceanWatch) partnered with the Professional Fishermen's Association (PFA) to host a workshop as the first stage of the East Coast Whale Entanglement Mitigation Program.

The workshop objectives identified a range of fishing gears and techniques suitable for the mitigation of whale entanglements to be tested by commercial fishers, and considered modification of existing NSW OTL Fishery Codes of Practice to include specific practices to mitigate whale entanglement.

There was strong agreement among attendees for the following four actions to be progressed:

1. Trial gear and techniques to reduce whale entanglements.
2. Develop a NSW OTL Code of Practice for whale entanglements.
3. Develop and complete a gear survey throughout the NSW OTL.
4. Investigate options for funding of further research.

A list of 12 modified gear type and techniques most likely to be useful in whale mitigation in NSW Demersal fish trap, Spanner crab and Lobster fisheries were established. Fishers demonstrated interest in trialling most of the proposed modifications, however the priorities were identified as:

1. Time release devices with approximate or exact time of activation to remove surface head gear
2. Techniques that involved grappling a subsurface horizontal rope
3. Use of negatively buoyant rope

Allowing for limitations in budget and timeframe, the report recommends that initial gear trials should introduce industry to a range of mitigation measures, including modifications not currently permitted under current NSW OTL fisheries management arrangements through an agreed permit process.

Gear trials should be undertaken to determine the practical utility and safety aspects of gear modifications that may potentially minimise whale entanglement. Trials will determine potential uptake by endorsed fishers and provide focus for further scientific trials to determine whale entanglement mitigation.

East Coast Whale Entanglement Mitigation Program

1. Introduction

As Humpback whale populations in the southern hemisphere recover from past commercial whaling, the potential for interactions between whales and commercial fishing operations is increasing, with most entanglements occurring since 2006. Most entanglement incidents involve Humpback whales, a species listed as a Vulnerable within the Commonwealth EPBC Act and NSW Biodiversity Conservation Act 2016.

In the past few years, there has been an increase in media reports relating to whale entanglement in fishing gear. There has also been an increase in community awareness and concern for animal welfare and bycatch issues.

Whale entanglements are complex and often dangerous incidents to respond to. Due to the size of whales, disentanglement operations require staff to have specialist training and skills. To date, 46 whales have been successfully disentangled. While disentanglement provides a means for dealing with incidents as they arise, the optimum solution to the problem involves reducing the risk of the entanglement.

The East Coast Whale Entanglement Mitigation Program has been initiated in NSW. Two individual projects funded by the Australian Government's National Landcare Program and the Australian Government Marine Park Fisheries Assistance Extension Program are currently active to assist fishers to reduce the incidence of, and risks associated with, whale entanglement in NSW OTL fishing gear.

2. Background

Humpback whales migrate through NSW waters between March and November, with a high percentage of the population found between 1nm and 5nm offshore.

They are vulnerable to entanglement with fishing gear due to their body shape, habitat use, distribution and behaviours. Unique to Humpback whales are wart like round protuberances (bumps or tubercles) that occur on the head forward of the blowhole and on the edges of the flippers, increasing the potential for entanglement with set fishing gear.

The population of Humpback whales has risen from an estimated 2,000 individuals to 35,000 over the 25-year period from 1994 to the present. This recent recovery of the population of Humpback whales has led to increasing community interest and economic activity associated with observing whale migrations. Over the same 25-year period there have been 259 whale entanglements recorded in NSW waters. Humpback whales comprise 255 of these entanglement incidents, with two entanglements attributed to Southern Right whales.

Southern Right Whales generally have a shorter season in NSW waters than Humpback whales, typically between June and September. Their migration may extend north to Forster or Port Macquarie, but generally most records of sightings occur south of Sydney. They spend approximately 90% of their time in waters less than 10m depth (Crocetti, workshop presentation).

Southern Right Whales are of conservation interest due to the low population level, estimated at less than 300 individuals in the South Eastern Australia population. They are listed as an Endangered species within the Commonwealth EPBC Act and NSW Biodiversity Conservation Act 2016.

Preliminary assessment of recorded whale entanglements in New South Wales confirmed a variety of sources contributing to whale entanglements recorded in NSW. These sources include: set fishing gear of unknown origin, e.g. rope and floats, or rope only; set fishing gear not consistent with NSW; rope only (not consistent with NSW fishing gear); NSW and QLD shark mitigation gears; interstate set fishing gear; longline gear of unknown origin and gear associated with aquaculture. Entanglements associated with NSW set fishing gear include configurations used in the demersal fish trap, spanner crab, demersal setline and lobster trap fisheries, with higher incidents in demersal fish trap sector and lower incidents in the other sectors.

It is likely that a proportion of these interactions are attributable to the inadvertent contact of whales with rope associated with some set fishing gears used in New South Wales coastal waters. Contact with buoy lines may result in rope and attached fishing gear becoming lodged or wrapped around the tail, body, fins or jaw of the whale. This can compromise a whale's ability to swim, feed and breathe and result in mortality.

Fishers have already made concerted efforts to minimise interaction and decrease likelihood of entanglement in fishing gear. For example, Lobster fishers have made efforts to trial acoustic release devices, galvanic time release devices and various grappling configurations to minimise ropes and floats in the water column. Demersal fish trap fishers have trialled sections of rope of reduced breaking strength. Spanner crab fishers have also trialled neutral or negatively buoyant rope within the trotline of spanner crab fishing gear, but have identified challenges including damage to line haulers resulting from the use of soft lay leaded rope.

3. Management of the NSW OTL Fishery

A comprehensive Fishery Management Strategy (FMS) has been prepared for the NSW OTL Fishery and was approved by the Minister for Primary Industries in November 2006.

Prior to finalisation, the FMS was subjected to a comprehensive Environmental Impact Assessment process under the NSW Environmental Planning and Assessment Act 1979.

There are six types of Ocean Trap and Line endorsements in NSW waters. The East Coast Whale Entanglement Mitigation Program is focussed on Demersal fish trap (3.1) and Spanner crab and (3.2) endorsement types which utilise buoy lines attached to set fishing gear as an integral component of the fishing operation.

Current fishery management regulations require set fishing gear to be marked with a buoy of minimum 100 mm diameter at the surface.

3.1 Demersal Fish Trap

A demersal fish trap endorsement authorises the holder to take fish from ocean waters by means of a fish trap set on the sea bed.

Demersal fish traps are permitted in all NSW waters excluding Marine Parks. The demersal fish trap endorsement within the NSW OTL fishery is managed by input controls which limit the fishing capacity of fishers, and thereby indirectly controlling the amount of fish caught. These controls include restrictions on the number of endorsements, number of traps, design and dimensions and the waters that may be worked.

There are strong regional differences in catch and effort. Effort reported in the fishery has been steadily declining, with 75% of current effort reported by 24 fishers. On average approximately 40% of the total value of the fishery is landed between July and September (Daniel Johnson, workshop presentation).

3.2 Spanner Crab - Northern Zone and Southern Zone

A Spanner Crab Northern Zone or Southern Zone endorsement authorises the holder to use a spanner crab net, commonly referred to as a dilly, to take spanner crabs from ocean waters.

The fishery operates from Hat Head to the NSW/Queensland border. The fishery is managed through a Total Allowable Catch and input restrictions. Fishers are restricted to operating a maximum of 40 dillies, with generally 10 dillies attached to each trot line.

Seasonal closures are in place to protect spawning females between 21st October and 20th January the following year, and males between 21st November and 20th December.

Recently there has been a large decline in fishing effort, measured by both days fished and net lifts. Currently, there are less than 650 days fishing reported from less than 20 fishing businesses. On average, over 40% of the total value of the fishery is landed between July and September (Daniel Johnson, workshop presentation).

3.3 Permits for gear trials

The process whereby industry-initiated proposals for trialling modifications or alternatives to existing lawful commercial fishing gears, requires formal assessment to determine whether or not they may assist in the long-term sustainability and viability of commercial fishing. Clear guidelines are used for managing and granting permits issued under section 37 of the Fisheries Management Act 1994. The process involves a proposal stage, preliminary trial stage, assessment stage and assessment analysis and consultation stage.

Trialling modified fishing gear configurations that are not permitted under the current FMA is a complex and extensive exercise. Complexity is increased when a project may potentially interact with Threatened, Endangered and Protected (TEP) species.

The issuing of a research permit for modified gear trials generally requires the design of scientifically rigorous field trials to support the assessment of the permit gear. The design must be considered robust and reliable following intensive departmental review. In this case, designing gear trials at a scientifically robust level will be limited due to the low level of whale interactions with NSW OTL set fishing gear.

NSW DPIE have informed support for the project, and will assist by expediting assessment and issue of permits where appropriate. This agreement will provide a less formal and detailed process.

4. Stakeholder Workshop

OceanWatch partnered with the Professional Fishermen's Association (PFA) to host a workshop as the first stage of the East Coast Whale Entanglement Mitigation Program. The workshop was held at the Sydney Fish Market Conference Room on Friday 13th September 2019 and was funded through OceanWatch's WetFEET Project (Activity 1.1) under the Marine NRM Grant awarded by the Australian Government Department of Agriculture National Landcare Program.

4.1 Workshop Objectives

The workshop objectives were:

1. Evaluate fisher's awareness of whale entanglement and inform behaviour/practice change
2. Identify a range of fishing gears and techniques, suitable for the mitigation of whale entanglements, to be tested by commercial fishers.
3. Consider modification of existing NSW OTL Fishery Codes of Practice to include specific practices to mitigate whale entanglement.

4.2 Workshop Method

Key industry stakeholders were identified from around Australia through accessing the latest industry shareholder data available on the NSW DPIE website and through PFA, OceanWatch and NSW DPIE contact lists. Invitations were developed to encourage stakeholder involvement and participation in a facilitated workshop.

The workshop was attended by 34 participants, including NSW fishers and scientists as well as representatives from Western Australia, Victoria, Tasmania, Queensland and the Commonwealth. A list of workshop attendees is shown in the Appendix.

A short attitudinal survey was conducted the morning of the workshop to establish fishers' awareness of various aspects of whale entanglements in fishing gear.

A series of expert presentations (section 4.3) were delivered on a range of topics including:

- East Coast Whale populations, Susan Crocetti OEH
- Source of entanglements in NSW, Daniel Johnson NSW DPIE
- NSW Lobster Fishery, why is interaction so low?, Geoff Liggins NSW DPIE
- Western Rock Lobster Fishery maintaining social licence, Jason How WA Fisheries and,
- An overview of potential mitigation measures for NSW demersal trap and spanner crab fisheries, Daniel Johnson NSW DPIE.

Fishers were then tasked with identifying issues associated with whale entanglements. Open workshop discussions encouraged workshop participants to consider currently available solutions, both within and outside current fishery practices and management regulations.

Fishers also ranked the importance of trialling individual modifications at a fishery practice level and volunteered for involvement in the proposed trialling and evaluation of gear types and techniques.

An attitudinal survey was completed in the afternoon to establish changes in fishers' concerns and awareness of mitigation opportunities, as well as changes to their perception of risk to their businesses as a result of the workshop.

4.3 Workshop Results

4.3a Presentations

A series of presentations were delivered by key industry stakeholders and government to outline the issues and questions to be resolved.

Presentations are briefly summarised (boxed) with details listed in point form.

Setting the Scene for Industry

The PFA presented to attendees on three main points:

Community perception and social licence,

International implications of whale entanglement with fishing gear, and

Encouraging industry to workshop suggestions of potential entanglement mitigation solutions.

Tricia Beatty, CEO Professional Fishermen's Association (PFA)

The industry is under pressure as a result of news media reporting of activism by environmental groups and community concerns.

While commercial fishers themselves have no wish to see whales entangled, they come under fire following the reporting of any entanglement, the implication being that fishing gear is responsible.

The industry needs to do more to address this concern.

As an example, the Dungeness crab fishery, on the west coast of USA, was closed in 2017 based on interactions with TEP species. Some Australian NGOs look at this as precedent.

In addition to the funding received from the Commonwealth for this project, funding may also be available from the NSW Marine Estate Management Authority (MEMA) and the Fisheries R&D Corporation (FRDC).

There are gear mitigation trials currently occurring domestically and internationally. This workshop aims to encourage fishers to make their own suggestions about improvements that could be made in the East Coast fishery

Understanding the Problem to be Solved

The National Parks and Wildlife Service presented on data relating to:

Whale population surveys,

Reported whale entanglements in NSW,

NPWS whale disentanglement response teams.

Susan Crocetti Marine Wildlife Team Leader, NSW National Parks and Wildlife Service

Group E (east coast) Humpback whale population is the primary population being entangled. Southern Right Whales are of greatest conservation concern.

Whale media in NSW in 2018/19 had a public reach of 223 million. Public concern is as much about welfare as it is about conserving the species.

Tacking Point off the NSW coast is the best location for estimating whale populations. Aerial surveys are also used.

NPWS presentation continued

The most common species involved in entanglements due to body shape, habitat use, distribution & behaviour:

- Humpback whale
    - Population is approx. 35,000 and increasing about 11% a year
    - Transiting through NSW waters, heading to QLD
    - Vulnerable status
- Southern right whale
    - population is approx. 300 and is not increasing
    - Remain in VIC, NSW, TAS waters for extended periods for breeding
    - Endangered status
- Other possibilities for entanglements:
    - Brydes whales
    - Minke whales
    - Sperm whales
    - Blue whales
    - Fin whales

Historically 259 recorded entanglement events; mostly humpback whales.

Based on photos that have been analysed by scientific staff, the causes of entanglement have been:

- 85% ropes
- 6 % nets/mesh
- 2% longline
- 7% heavy ropes, FADs, anchors, others
- Data is available on rope colour and float type

There are 3 trained whale entanglement response teams employed by NSW NPWS.

NPWS presentation continued

Experience with Humpback whales

In 1965, the population was only 104 (due to commercial whaling). Rapid population recovery since then. Ultimate population size unknown. Scientific estimates of future krill populations, the primary food source, means the status of *vulnerable* for humpbacks will not be reduced.

60 reports of entanglements to 13 September this year in NSW over 35 individual whales.

- Most entanglements result in death, if entangled for more than 7-10 days.
- Better survival chance with rapid response.
- June / July / Aug – peak times for entanglements
- Humpback peak migration north June / July, peak migration south Sept / Oct
    - window widening February-December
    - 1-5nm offshore

Southern Right Whale

- Shorter season in NSW waters – June /Sept

Understanding Entanglement in NSW

NSW DPI Fisheries presented on data relating to 73 cases of whale entanglement in NSW, including determining the contribution of NSW set fishing gear to those entanglements.

Daniel Johnson, NSW DPIE

Reviewed 73 cases from photographs and discussions with fishers and department staff.

Preliminary results indicate that the level of interaction between the NSW demersal fish trap sector and whales, is greater than the combined interactions from the NSW spanner crab, demersal setline and lobster fisheries. Other sources of interaction included: shark mitigation gear (NSW and QLD), set fishing gear interstate and surface longline gear.

Following the collection of entanglement data over the current whale migration season (May-October), more detailed analyses will be completed to determine the source of observed interactions, i.e. percentage entanglement by source.

NSW Lobster Fishery

Geoff Liggins, NSW DPI Fisheries

NSW DPI Fisheries presented data relating to NSW Lobster Fishery whale entanglement.

Investigation of the reasons why interactions between the NSW Lobster fishery and whales are so low.

Annually the fishery conducts 90,000 trap lifts over 523,565 days total soak time.

Reasons for so few entanglements:

- Less than 10m depth – almost no risk of entanglement
- Very little fishing effort along the south coast between 10-30m depth
- At depths greater than 30m along the South coast there is very little overlap between whale season and fishing effort

Gear used to minimise entanglements includes:

- Opportunity to use Galvanic Time Release (GTR) for last 25 years. Different GTR release time depends on salinity & temperature.
- Acoustic releases to submerge head-gear
- Short, anchored ropes to submerge head gear – use grapple to retrieve
- Horizontal line with depth-float and anchor (eliminates head gear) – grapple to retrieve.

These 4 gear methods achieve two important outcomes

- Reduced amount of rope in column (length & time)
- Reduced amount of slack and surface rope

The cost of these gear types are:

- Acoustic releases are expensive. $13k for the surface station and each release costs $3,250. If 20 units used, and usually many more needed, cost would be around $80k.
- GTR moderate (~$1.50/$4.00 ea.)
- Rope solutions inexpensive

Cost vs. benefit better for lobster than OTL

- Long soak,
- Big catches & value per trap.
- Minimal spatial overlap between fishers

Details of the major 6 motivations for use of submerged gear can be found in the presentation.

NSW DPIE Lobster continued

Details of the major 6 motivations for use of submerged gear can be found in the presentation.

Future implementation of a Code of Practice for reducing risk of entanglements is encouraged. The format could be based on similar codes developed in NZ and WA.

The Western Australia Experience of Mitigating Whale Entanglement

WA Department of Fisheries presented on the history of whale entanglement issues in WA, Code of Practice development and discussion of potential solutions identified at an industry workshop.

Jason How, WA Fisheries

The main emphasis is on the Western Rock Lobster fishery, valued at over $400million per annum.

Concerns are twofold:

- Social, humaneness and conservation
- Possible loss or modification of Marine Stewardship Council certification of the fishery.

Main time of year is May – Nov when whales are migrating close to coast. Problem became worse when the fishery was restructured, resulting in a longer fishing season, following the introduction of quotas.

Code of Practice developed in 2006 to decrease entanglements in rock lobster fishery.

2013 – Federal government stepped in with threat to remove export approval and state government pressed industry for action.

A workshop to reduce whale entanglement in Western Australia resulted in the following options.

- 7 gear modifications:
- Acoustic releases
- Biodegradable rope
- Negatively buoyant rope
- Neg. buoy single large float
- Future ocean whale pinger
- Banana whale pinger

- Regulations – mainly deeper water (+20m).
- No surface rope, so tight all the time
- Negatively buoyant top 1/3
- Active fishing – pull every 7 days.

The key message is to get ropes out of the water column.

Gear modifications started 2014 and resulted in a significant reduction in entanglements (~60%). But entanglements are creeping up again.

Considerable detail can be found in the presentation about correlations between different colours and strengths of rope. The use of pingers were highlighted as not successful and biodegradable rope was considered as a potential safety hazard and additionally may result in lost gear and ghost fishing issues.

Snap Shot of the NSW Fish Trap and Spanner Crab Fisheries

Daniel Johnson, NSW DPIE

NSW DPIE presented a snapshot of fishing effort and input NSW Demersal Fish Trap and Spanner Crab Fisheries and potential gear types for use in mitigation.

Demersal Fish Trap

Timing of OTL peak productivity and peak whale migration coincides.

Demersal fish traps are an input controlled fishing method limiting the number of traps that may be used by individually endorsed licence holders. There are 140 licence endorsements, with 75% of effort is reported by 24 fishers.

Spanner Crab Fishery

A quota managed fishery with periods of high value & effort from July to September overlapping with peak whale migration.

Less than 650 days effort reported from < 20 fishing businesses. There has been a reduction in effort days & net lifts in the fishery.

- Most effort north of Yamba

NSW DPIE Continued

Potential Gear Types for Use in Mitigation

- Reduced breaking strength rope
- Negatively buoyant rope
    - Issue with hauler wearing out more quickly with leaded rope
- Biodegradable rope
- Weak links (legislated in many US fisheries)
    - Atlantic Large Whale Take Reduction Plan.
    - Didn't fit in WA fishery – dismissed.
- Time tension line cutter (industrial razor in unit)
    - Results inconclusive
- Acoustic deterrent devices (ADDs) – pingers
    - WA tested pingers, massive variation, results inconclusive
- Galvanic Time Release
    - available from 1 day release ($2), up to 30 days ($4)
- Acoustic release technology
- Grappling a subsurface vertical or horizontal rope
- Ropeless fishing app for use with submerged floats
    - Fisher can determine distance, regulators see all.
    - Android only.
- Horizontal line – but can only pull half the number of traps in a day

What Might a Code of Practice Look Like

OceanWatch discussed the potential for an industry wide Code of Practice to provide guidance and document best practice for current fishers and new entrants.

Michael Wooden, OceanWatch Australia

The OTL fishery has a current Code of Practice (CoP).

- OceanWatch Master Fishermen are currently trained through the OTL CoP
- Specific, whale focussed actions can be developed as an appendix to the current OTL CoP

An OTL CoP for whale entanglements would be recognised as a positive step forward

- Document best practice for current fishers and new entrants

During discussions the range of operational actions suggested for possible inclusion in the CoP included:

- Be vigilant of increased numbers of whales during migratory period
- Minimise length of rope in the water
- Check pots regularly and minimise soak time
- Avoid setting in clusters
- Alert other fishers if whales migrate close to fishing grounds
- Report entanglements
- Collect and report on lost and found fishing gear

4.3b Stakeholder Discussions at Workshop

Open workshop discussion encouraged fishers to consider solutions, both within and outside current fishery practices and management regulations. Comments and questions from the audience are recorded below in note form.

The OTL has unnecessary restrictions applied by regulations. For example, not allowed to use short ropes and grapple retrieves. Does this contribute to the industry's slow response to making change? Fishers should be able to obtain conditional permits in the NSW OTL as part of this study.

Need government commitment to enable fishers to change. Why aren't people from compliance or management here today?

Acoustic options are expensive but can still be profitable.

- Fisher 1 and Fisher 2 have spent $800k on acoustic release devices over 6 years as they consider it the best way to do business, to overcome pot losses due to theft and interaction with boats as well as whales.

- NSW Government needs to consider loans/funds for fishers to invest in this technology. Perhaps a Seafood Innovation Fund?

Lots of head gear thought to be lost through shipping.

WA has currently purchased satellite tags exclusively for tracking entangled whales.

Acoustic technology considered too expensive for fish traps.

Geoff Liggins - Perhaps a northern and southern project for fish traps.

- Submerged gear out of the question in the north due to strong currents.
- North uses heavier head gear, perhaps a solution is horizontal lines for grappling.

Queensland gets around some of this in net fisheries due to shorter periods of set time due to attendance rules.

Fisher 3- Sink rope for the spanner crab

- Using trot lines
- Trialled different ropes
- Sink rope damaging hauler

Fisher 4 – sees as management/compliance issue, can grapple up to 50 fathoms

Comments on 1 day GTR for the Northern Trap Fishery.

- Experiences strong currents,
- Retrieval takes longer with strong current,
- Extra fuel use,
- Rope tension a big problem.

Fisher 5 Could we use compressed air, like in a life jacket in a trap? Acoustic remote activated, air filled bag canister release (like diving, salvage lift bag).

Questions regarding satellite tracking gear

- Find out if entanglement occurs when gear is attached to rope, or if shipping cuts rope and then entanglement occurs.
- Most entanglements associated with fishing gear in Hunter region which has a high concentration of shipping.

Disentanglement response has cost NSW government $500,000 year-to-date

Some fish traps pulled twice a day at the moment, so complex systems are not feasible.

Grappling horizontal gear fine

- But don't have permission from DPIE.
- Acoustic devices fine with lobster, fish traps don't have funds.

Northern trappers – horizontal rope possible solution

- Short rope would only work if tide not running

Spanner crab – sink rope could work but need to solve the hauler issue.

North coast issues because current runs too quick with the AEC.

Whales migrate close to the coast on their northern migration.

Fisher 6 – Thicker rope at bottom, then thinner rope at top, but need to understand where the entanglement occurs (top, bottom or middle). I run 30 fathoms of 7 mm rope thickness at the surface, and then goes to 10mm. My trap won't break off near the bridle, it will break 70 fathoms off the bottom so I can give myself a chance of grappling my trap back. It all depends where the whale might pick up the gear. If the majority are entangled at the surface, you could use 5 fathoms of 7mm and then normal (10mm) to the trap.

Fisher 7- We currently have restrictions on the thickness of trap ropes near the cable zones in Sydney (submarine cables), if we hook up the rope breaks (max 8mm rope).

Biodegradable rope

- Fisher 8 concerned ghost fishing issue.
- Expensive option that doesn't offer much.
- Trialled in WA – negatively buoyant, but don't know when it's going to snap leading to safety concerns.
- No understanding of strength rating or how long it lasts or reduced strength overtime.

Daniel Johnson – a detailed gear survey would assist in determining the suite of gear configurations (temporal and spatial variations) and operational aspects and utility of solutions. It may be that operational aspects are just as important as the gear. This could involve:

- Documenting the difference between north & south and season of the year.
- Ask what fishers already do to mitigate whale entanglements.
- WA have already completed 2 fleet wide detailed gear surveys as a start.

Geoff Liggins - Knowledge of the configurations can assist the debate on management of mitigation strategies.

- Pre-trial work, gear surveys could be funded by FRDC or others
- Smart drum lines use weak links at the top.

- Potential to construct an experiment to withstand weather conditions but break nearer the trap (in the event a whale is hooked in heavier rope).
- Fisher 9 and Fisher 10 concerned that traps may break off in heavy sea conditions.

Investigate the use of cardinal marks to designate fishing areas on shipping navigation systems.

4.3c Recommendations from Stakeholders

Following the discussion there was strong agreement among workshop attendees for the following four actions:

1. Trial gear and techniques to reduce entanglements
    a. Described in detail in Section 4.6
2. Develop a NSW OTL Code of Practice for whale entanglements.
    a. OceanWatch in consultation with fishers and government
3. Develop and complete a gear survey throughout the NSW OTL.
    a. A project leader and funding will be sought for this work, which was given high priority be all workshop attendees.
4. Investigate options for funding of further research, including:
    a. Development of a more durable hauler for use with lead-line.
    b. Documenting commercial vessel operations to determine if they are a cause of broken gear.
    c. Obtaining access to the rope loss fishing app, for use by fishers using submerged floats and horizontal lines.
    d. Tracking cut-off gear.
    e. Accurate and timely whale tracking on the NSW East Coast.

4.3d Evaluation of Gear Types by Fishers

The workshop identified the following list of gear types and techniques (Table 1).

Table 1. List of Gear Types and Techniques

Minimising ropes and floats in the water column
Acoustic time release programmable (exact)
GTR time release (approximate)
Grappling a subsurface short vertical rope
Grappling a subsurface horizontal rope
Compressed air canister release
Rope alternatives
Negatively buoyant rope
Reduced breaking strength rope
Biodegradable rope
Other
Time tension line cutter
Weak links
Acoustic deterrent device (Pingers)

The system used by attendees (Table 2) ranked the importance of gear types and techniques for trial.

Table 2. Rating System Used by Workshop Attendees

4	Very Important
3	Fairly important
2	Not very important
1	Not important

Fishers ranked importance of modifications to gear types and techniques for the demersal fish trap, spanner crab and lobster fisheries (Table 3).

The number of industry participants that ranked the listed gear types or techniques were; Demersal Fish Trap (10), Spanner Crab (2) and Lobster Trap (8). Using the scoring system in Table 2, the maximum score for each sector was 40, 8 and 32 respectively. A percentage score is also displayed.

Table 3. Ranking of Importance of Testing Gear Types and Techniques

Gear type or technique	DFT	DFT%	SPC	SPC%	L	L %
Minimising ropes and floats in the water column						
Acoustic release	17	43	2	25	15	47
Time release programmable (exact)	19	48	2	25	24	75
GTR time release (approximate)	24	60	2	25	19	59
Grappling with a subsurface horizontal rope	30	75	2	25	21	66
Compressed air canister release	16	40	2	25	11	34
Grappling of a subsurface short vertical rope	12	30	2	25	13	41
Rope alternatives						
Negatively buoyant rope	20	50	5	63	16	50
Reduced breaking strength rope	29	73	6	75	19	59
Biodegradable rope	10	25	2	25	8	25
Other						
Weak links	14	35	4	50	14	43
Time tension line cutter	10	25	2	25	10	31
Acoustic deterrent device	20	50	5	63	14	44
Maximum score	40	100	8	100	32	100

The highest ranking modification for demersal fish trap comprised techniques or gear that minimises rope and floats in the water column including grappling and use of time releases. Rope alternatives and acoustic deterrent devices were also ranked with potential.

Fishers ranked the importance of the gear types for NSW OTL Demersal Fish Trap (Table 4).

Table 4. Ranking of Importance of Testing Gear Types or Techniques for Demersal Fish Trap

Gear Type or technique	Score
Grappling with a subsurface horizontal rope	30
Reduced breaking strength rope	29*
GTR time release (approximate)	24
Negatively buoyant rope	20
Acoustic deterrent devices	20*

*Although use of head rope with reduced breaking strength was identified as a potential mitigation measure worth trialling (ranking score 29), the learned experience from the room identified this technique would most likely be unsuccessful and potentially lead to concomitant problems in any disentanglement opportunity. The safety of the use of biodegradable rope was questioned with

supplementary concerns regarding the potential to lose fishing gear resulting in ghost fishing. Additionally, although the use of acoustic deterrent devices (Pingers) received interest (ranking score 20), however comments were raised regarding their suitability and effectiveness.

Fishers ranked the importance of the gear types for NSW OTL Spanner Crab (Table 5).

Gear Type	Score
Reduced breaking strength head rope	6
Negatively buoyant rope	5
Acoustic deterrent device (Pingers)	5*
Weak links	4

In contrast to demersal fish trap, highest ranking gear modifications for the Spanner Crab fishery included reduced breaking strength and negatively buoyant rope.

Although discussion was had on the effectiveness of acoustic deterrent devices, spanner crab fishers ranked acoustic deterrents as potentially logistically and operationally appropriate. Weak links were ranked by fishers as having some potential merit.

Fishers ranked the importance of the identified gear types for the NSW Lobster Fishery (Table 6).

Gear Type	Score
Time release programmable (exact)	24
Grappling with a subsurface rope -horizontal rope	21
GTR time release (approximate)	19
Rope thickness (reduced breaking strength) head rope	19*
Acoustic release	17

Some Lobster fishers have already made efforts to trial acoustic release devices. Additional or optional measures were discussed and ranked with gear configurations comprising programmable time release devices, GTRs and acoustic release as highest importance for further testing. There was also interest in the trialling of reduced breaking strength rope, although as previously described there is concern for concomitant impacts.

4.3e Code of Practice

Fishers participating in the workshop communicated full support for the development of a NSW whale entanglement code of practice. The development of a code was viewed as an initial positive step to reduce the incidence of, and risk associated with, whale entanglement in NSW fishing gear.

4.3f Call for Volunteers to Test Gear Types

Fishers expressed interest in testing gear on their own boats. Table 7 indicates the numbers of fishers interested in the trialling the modified gear types.

Table 7. Summary of Gear Types and Fishers Interest in Testing

Gear Type	Votes	Names of interested Fishers
Acoustic time release	9	6 fisher
Time release - programmable (exact)	6	4 fishers
Grappling with a subsurface horizontal rope	15	2 fishers
Negatively buoyant rope	9	3 fishers
Reduced breaking strength rope	8	3 fishers
Acoustic deterrent device (Pingers)	5	3 fishers
GTR time release (approximate)	4	1 fisher
Grappling with a subsurface short vertical rope -short rope	1	1 fisher
Weak links	1	1 fisher
Compressed air canister release	1	1 fisher
Biodegradable rope	0	No interest
Time tension line cutter	0	No interest

Table 7 results contrast with those indicated in Tables 3, 4, 5 and 6. In part this was because some fishers voted for gear they thought might be supplied by the project at reduced cost. For example, fishers would welcome the chance to test devices that minimise rope and floats from the water column, if the costs were supported by the program.

5. Recommendations

5.1 Code of Practice

The NSW OTL Whale Code of Practice (WCoP) should be developed through a collaborative approach between PFA, OceanWatch, NSW fishers and NSW DPIE.

The WCoP should:

1. Document whale specific best practice fishing operations for NSW fishers
2. Provide information on the appropriate course of action when encountering an entangled whale
3. Highlight reporting requirements for interactions with TEP species
4. Highlight opportunities for NSW fishers to add to the knowledge base concerning whale migrations in NSW waters

The WCoP should supplement existing guidelines outlined in the NSW Ocean Trap and Line Fishery Code of Practice (NSW OTL CoP) previously developed by OceanWatch and adopted by NSW OTL fishers through the OceanWatch Master Fishermen training and assessment program.

5.2 Gear Trials

Gear trials should be undertaken to determine the practical utility and safety aspects of gear modifications that may potentially minimise whale entanglement. Trials will determine potential uptake by endorsed fishers and provide focus for further scientific trials to determine whale entanglement mitigation.

Workshop rankings and fishers' expressed interest in testing gear on their own boats, should be used to guide and prioritise proposed field trials. Gear trials should introduce fishers to a range of mitigation measures focussed primarily on the demersal fish trap and spanner crab fisheries. Gear trials will provide fishermen with the gear to trial (within program budget and scope) and instruction on recording information to assess operational performance. Data collected will provide sufficient detail and rigour to meet the proposed aims of the trials, and inform recommendations for progression to further trials.

Gear trials may include potential modifications not currently permitted under current fisheries management arrangements, proceeding only through an agreed permit process.

Trials that require removal of surface head gear should also incorporate trials of a rope-less fishing App. The App should be used to identify the location of set fishing gears, both for compliance outcomes and to reduce conflict between fishers and gear types.

5.3 Gear Survey

There are known variations in the spatial and temporal use of fishing gears within NSW OTL endorsement types, i.e. gear configurations are modified periodically to respond to sea conditions, seasons, area, depth, current etc.

A detailed survey design would need to measure across the various spatial and temporal conditions to be able to provide data that can describe a typical gear configuration. A fishery wide gear survey is considered a major body of work and is outside the current scope of this project.

Appendix 1. Workshop Attendees

Name	**Sector**	Area
Len Stephens	Facilitator	NA

Industry representatives

Name	**Relevant Fishery**	**Area**
Gary Bordin	OTL Spanner crab	Ballina
Paul Porter	OTL Spanner crab	Yamba
Troy Billin	OTL - Line	Yamba
Danny Stewart	OTL – Line, DFT and Lobster	Coffs Harbour
Mitchell Sanders	OTL – Line, DFT and Lobster	Newcastle
Danny Green	OTL – Line, DFT	Coffs Harbour
Mark Cranstone	Lobster and COMMFISH	Newcastle
Scott Westley	Lobster	South coast
Dan Gogerly	OTL – Line, DFT and Lobster	Wallis
Noel Gogerly	Lobster	Wallis
Steve Rosskelly	OTL – Line, DFT and Lobster	Wallis
Chris Judd	OTL - DFT	Central Coast
Paul Sullivan	OTL – Line, DFT	Sydney
Tricia Beatty	PFA - CEO	Coffs Harbour
Glen Foxton	WA Octopus	WA
Glen Fisk	SIV fisher	Victoria
Leah Powell	SIV fisher	Victoria
Darryl Grey	TSIC rep	Launceston
Emma Woodcock	TSIC rep	Hobart
Margaret Stevenson	QSIA rep	Bundaberg
Graham Stevenson	QSIA rep	Bundaberg

Government

Name	Sector	Area
Susan Crocetti	NSW NPWS	NSW
Simon Walsh	DPIE	NSW
Daniel Johnson	DPIE	NSW
Jason How	WA Fisheries	WA
Geoff Liggins	NSW DPIE	NSW
John Pritchard	A/G Department of Environment	Canberra

OceanWatch Australia

Name	Sector	Area
Lowri Pryce	OceanWatch - CEO	Sydney
Michael Wooden	Program Manager	Sydney
Simon Rowe	Program Manager	Sydney
Brad Warren	Project Extension	Newcastle
Andy Myers	Program Manager	Newcastle

NSW Ocean Trap and Line Fishery
Code of Practice for Reducing Whale Entanglements

PROFESSIONAL FISHERMEN'S ASSOCIATION

OCEANWATCH AUSTRALIA

1. Best Practice Operations for NSW OTL Fishers

NSW OTL fishers are encouraged to adopt the following measures to reduce the risk of whale entanglement:

Be aware of increased whale numbers between May and October.

Alert other fishers in the area if whales are observed near fishing grounds.

Remove traps from the water when not actively fishing.

Trial the practicality of gear and techniques that have the potential to reduce whale entanglements.

Provide assistance to further refine this Code of Practice.

Fishing Gear

Trials of the practicality of modified fishing gears that have the potential to reduce whale entanglements are scheduled to commence in early 2020[11]. Knowledge gained from gear trials will be used to further inform future best practice advice.

Current NSW OTL management regulations require fish traps and spanner crab trot lines to be marked with a buoy of minimum 100 mm diameter at the surface. The following advice identifies best practice fishing gear which complies with current management arrangements for the NSW OTL Fishery.

Demersal Trap

1. Limit slack rope in the water column.
2. Avoid excessive knots on ropes.

Spanner Crab

1. Limit slack rope in the water column.
2. Avoid excessive knots on ropes.
3. Minimise the number of buoy lines during whale season.
4. Minimise distance between dillies during whale season.

[11] *Trials of the practicality of modified fishing gears that have the potential to reduce whale entanglements are scheduled to commence in early 2020. NSW DPIE have informed support for gear trials, and will assist by expediting assessment and issue of permits where appropriate.*

Line West, Line East, School and Gummy Shark

1. Limit slack rope in the water column.
2. Avoid excessive knots on ropes.
3. Minimise the number of buoy lines during whale season.
4. Minimise distance between hooks during whale season.

2. Course of Action when Encountering an Entangled Whale

The safety of fishing vessels and crew is the highest priority. Do not attempt to disentangle whales.

Immediately report entangled whales to NPWS on 1300072757.

Rapid reporting ensures the NSW Government Large Whale Disentanglement Team has the best opportunity to successfully disentangle whales.

Provide details including:

- Location.
- Type of entanglement.
- Location of entanglement on the whale.
- Speed and direction of travel.

Stand by and monitor an entangled whale from a minimum 100m for an adult or 300m if a calf is present.

Assist the disentanglement team to rapidly locate an entangled whale.

Provide assistance to disentanglement teams when requested.

3. Reporting Requirements for Interactions with Threatened, Endangered and Protected (TEP) Species

All whales In Australian waters are protected under the Environment Protection and Biodiversity Conservation Act 1999.

All interactions with protected species must be reported via Fisher Mobile reporting app or DPI logbook. An interaction with a protected species means any physical contact between the protected species, and a fisher, their vessel or fishing gear.

It is not an offence to interact with a protected species if fishers are working in accordance with management regulations.

4. Adding to the Knowledge Base Concerning Whale Migrations in NSW Waters

Real-time reporting of whale sightings supports researchers in better understanding the paths of migrating whales and contributes important information to long-term monitoring. NSW OTL fishers can assist through reporting whale sightings via the Wild about Whales app.

The NSW OTL Whale CoP has been developed with funding support from the Australian Government Department of Agriculture and Water Resources and the Australian Government Department of Environment and Energy.

About this Code of Practice

Background

The Professional Fisherman's Association (PFA) has developed the NSW Ocean Trap and Line Fishery Code of Practice for Reducing Whale Entanglements (NSW OTL Whale CoP) in association with OceanWatch Australia. The NSW OTL Whale CoP provides detailed information specific to the entanglement of whales in NSW Ocean Trap and Line (NSW OTL) fishing gear, and is a supplement to the existing NSW Ocean Trap and Line Fishery Code of Practice (NSW OTL CoP), previously developed by OceanWatch Australia and adopted by NSW OTL fishers through the OceanWatch Master Fishermen training and assessment program.

The NSW OTL Whale CoP is designed to assist NSW OTL fishers to reduce the incidence of, and risks associated with, whale entanglements in fishing gear.

Trials of the practicality of modified fishing gears that have the potential to reduce whale entanglements are scheduled to commence in early 2020.The Code will be regularly reviewed as further knowledge regarding whale specific best practice fishing operations for NSW OTL fishers becomes available.

The NSW OTL Whale CoP has four key elements.

1. Documenting whale specific best practice fishing operations for NSW OTL fishers:

1. including gear modifications that minimise the potential for whale interactions[12].
2. including conservation measures to assist in protecting whales from entanglement.
3. to minimise damage to or loss of fishing gear and catch due to whale entanglements.
4. to demonstrate fisher's capacity to be proactive in response to emerging environmental issues.

2. Providing information on the appropriate course of action when encountering an entangled whale, including:

1. appropriate and safe work practices for NSW OTL crews in the event of a whale entanglement.
2. rapid reporting of incidents to enable the disentanglement process to begin.
3. assisting whale disentanglement response teams.

3. Highlighting reporting requirements for interactions with Threatened, Endangered and Protected (TEP) species.

Relevant to the Commonwealth EPBC Act and NSW Biodiversity Conservation Act.

4. Highlighting opportunities for NSW OTL fishers to add to the knowledge base concerning whale migrations in NSW waters.

Scope of the Entanglement Issue

As whale populations in the southern hemisphere recover from past commercial whaling, the potential for interactions between whales and commercial fishing operations is increasing, with most

[12] *Trials of the practicality of modified fishing gears that have the potential to reduce whale entanglements are scheduled to commence in early 2020. NSW DPIE have informed support for gear trials, and will assist by expediting assessment and issue of permits where appropriate.*

entanglements occurring since 2006. Most entanglement incidents involve Humpback whales, a species listed as a Vulnerable within the Commonwealth EPBC Act and NSW Biodiversity Conservation Act 2016.

Humpback whales migrate through NSW waters between March and November, with a high percentage of the population found between 1nm and 5nm offshore. They are vulnerable to entanglement with fishing gear due to their body shape, habitat use, distribution and behaviours. Unique to Humpback whales are wart like round protuberances (bumps or tubercles) that occur on the head forward of the blowhole and on the edges of the flippers, increasing the potential for entanglement with set fishing gear.

The population of Humpback whales has risen from an estimated 2,000 individuals to 35,000 over the 25-year period from 1994 to the present. This recent recovery of the population of Humpback whales has led to increasing community interest and economic activity associated with observing whale migrations.

Over the same 25-year period there have been 259 whale entanglements recorded in NSW waters. Humpback whales comprise 255 of these entanglement incidents, with two entanglements attributed to Southern Right whales.

Southern Right Whales generally have a shorter season in NSW waters than Humpback whales, typically between June and September. Their migration may extend north to Forster or Port Macquarie, but generally most records of sightings occur south of Sydney. They spend approximately 90% of their time in waters less than 10m depth.

Southern Right Whales are of conservation interest due to the low population level, estimated at less than 300 individuals in the South Eastern Australia population. They are listed as an Endangered species within the Commonwealth EPBC Act and NSW Biodiversity Conservation Act 2016.

In the past few years, there has been an increase in media reports relating to whale entanglements in fishing gear. There has also been an increase in community awareness and concern for animal welfare and bycatch issues.

Preliminary assessment of recorded whale entanglements in New South Wales confirmed a variety of sources contributing to whale entanglements recorded in NSW. These sources include: set fishing gear of unknown origin, e.g. rope and floats, or rope only; set fishing gear not consistent with NSW; rope only (not consistent with NSW fishing gear); NSW and QLD shark mitigation gears; interstate set fishing gear; longline gear of unknown origin and gear associated with aquaculture.

Entanglements associated with NSW commercial set fishing gear include configurations used in the demersal fish trap, spanner crab, demersal setline and lobster trap fisheries, with a higher incidence of interaction with the demersal fish trap sector and low incidence in other sectors. It is likely that a proportion of these entanglements are attributable to the inadvertent contact of whales with ropes associated with some NSW OTL set fishing gears. In the NSW OTL Fishery, potential exists for entanglements to occur when whales inadvertently make contact with buoy lines that extend from set demersal fish traps to identifying head gear. Potential also exists within the Spanner Crab and line fishing components of the fishery for whales to become entangled in trot lines to which multiple crab "dillies" or baited hooks are attached. Entanglements can compromise a whale's ability to swim, feed and breathe and result in mortality.

Whale entanglements are complex and often dangerous incidents to respond to. Due to the size of whales, disentanglement operations require staff to have specialist training and skills. To date, 46 whales have been successfully disentangled. While disentanglement provides a means for dealing with incidents as they arise, the optimum solution to the problem involves reducing the risk of the entanglement.

Gear trials, commencing early 2020, will be undertaken by NSW OTL fishers to determine the practical utility and safety aspects of gear modifications that may potentially minimise whale entanglement. These trials will determine potential uptake of gear modifications by endorsed fishers, and provide focus for further scientific trials to determine whale entanglement mitigation.

The NSW OTL Fishery

A comprehensive Fishery Management Strategy (FMS) has been prepared for the NSW OTL Fishery and was approved by the Minister for Primary Industries in November 2006.

Prior to finalisation, the FMS was subjected to a comprehensive Environmental Impact Assessment process under the NSW Environmental Planning and Assessment Act 1979.

There are six types of Ocean Trap and Line endorsements in NSW waters. The East Coast Whale Entanglement Mitigation Program is focussed on Demersal Fish Trap, Spanner Crab North and South, Line West, Line East, and School and Gummy Shark fishers who may utilise buoy lines attached to set fishing gear as an integral component of their fishing operation.

Current NSW OTL fishery management regulations require fish traps and spanner crab trot lines to be marked with a buoy of minimum 100 mm diameter at the surface.

Demersal Fish Trap

A demersal fish trap endorsement authorises the holder to take fish from ocean waters by means of a fish trap set on the sea bed.

Demersal fish traps are permitted in all NSW ocean waters excluding Marine Parks.

The demersal fish trap endorsement within the NSW OTL fishery is managed by input controls which limit the fishing capacity of fishers, and thereby indirectly controlling the amount of fish caught. These controls include restrictions on the number of endorsements, number of traps, design and dimensions and the waters that may be worked.

Spanner Crab - Northern Zone and Southern Zone

A Spanner Crab Northern Zone or Southern Zone endorsement authorises the holder to use a spanner crab net, commonly referred to as a dilly, to take spanner crabs from ocean waters.

The fishery operates from Hat Head to the NSW/Queensland border.

The Spanner Crab Northern Zone or Southern Zone endorsement within the NSW OTL fishery is managed through a Total Allowable Catch and input restrictions. Fishers are restricted to operating a maximum of 40 dillies, with generally 10 dillies attached to each trot line. Seasonal closures are also in place to protect spawning females between 21st October and 20th January the following year, and males between 21st November and 20th December.

Line fishing western zone endorsement

A line fishing western zone endorsement authorises the holder to use a line to take fish from ocean waters that are west of the 183 metre (100 fathoms) depth contour.

Line fishing eastern zone endorsement

A line fishing eastern zone endorsement authorises the holder to use a line to take fish from ocean waters that are east of the 183 metre (100 fathoms) depth contour.

School and gummy shark endorsement

A school and gummy shark endorsement authorises the holder to take school and gummy sharks using a line from ocean waters south of a line drawn due east from the northern point of the entrance to Moruya River.

East Coast Whale Entanglement Mitigation Program

Dear NSW fisher,

Enclosed with this letter is a sticker with information for all NSW fishers operating in ocean waters on the course of action when sighting an entangled whale.

Please attach this sticker to your vessel.

Preliminary assessments of reported whale entanglements in New South Wales have confirmed a variety of sources including, but not limited to, NSW set fishing gear.

An initial workshop was held at SFM in mid September to set an overall direction for the East Coast Whale Entanglement Mitigation Program. There was strong agreement among participants (which included 15 NSW fishers) for the following four actions:

- Trial gear and techniques to reduce entanglements.
- Develop a NSW OTL Code of Practice for whale entanglements.
- Develop and complete a gear survey throughout the NSW OTL.
- Investigate options for funding of further research.

Following the workshop, a NSW OTL Whale Code of Practice has been developed to assist NSW OTL fishers to reduce the incidence of, and risks associated with, whale entanglements.

A copy of the full NSW OTL Whale Code of Practice can be viewed at http://www.oceanwatch.org.au/east-coast-whale-entanglement-mitigation-program/

14 NSW OTL fishers are currently taking part in gear trials to determine the practical utility and safety aspects of gear modifications that may potentially minimise whale entanglement. Gears being trialed include galvanic time releases, negatively buoyant rope and lead core rope.

The safety of fishing vessels and crew is the highest priority.

Do not attempt to disentangle whales.

Supported by the NSW GOVERNMENT

https://www.marine.nsw.gov.au/strategy-implementation/reducing-impacts-on-threatened-and-protected-species

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https://www.marine.nsw.gov.au/strategy-implementation/reducing-impacts-on-threatened-and-protected-species

Supported by the NSW GOVERNMENT

Appendix 4.OceanWatch Australia Master Fisherman content update

Professional fishers are often the first to find solutions to reduce impacts on TEP species.

It is important to promote these improvements throughout industry and to the community.

OCEANWATCH AUSTRALIA

OceanWatch Master Fisherman Training: Threatened, Endangered and Protected

TEP species you may encounter in NSW W6

CHECK THE THREATENED SPECIES AND SPECIES CODES HANDOUT

- Marine Mammals
- Seabirds
- Fish Species
- Reptiles


Australian Fur Seal


Common Dolphin


Whale species


Shy Albatross


Little Pied Cormorant


Australian Pelican


Green Sea Turtle


Scalloped Hammerhead Shark

OCEANWATCH AUSTRALIA

OceanWatch Master Fisherman Training: Threatened, Endangered and Protected

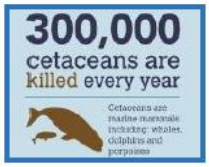
TEP species interaction W5

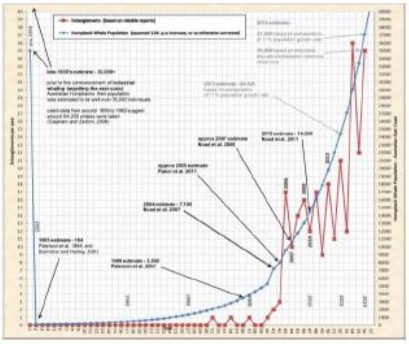
*An interaction is '**an incident where the animal (a species of conservation interest – protected or threatened) comes into contact, is entangled or captured during a fishing operation**'*

OCEANWATCH AUSTRALIA

Increasing whale entanglement issue

- The graph below illustrates a recovering Humpback whale population (blue line).
- Reported whale interactions increasing with a recovering Humpback population (red line).

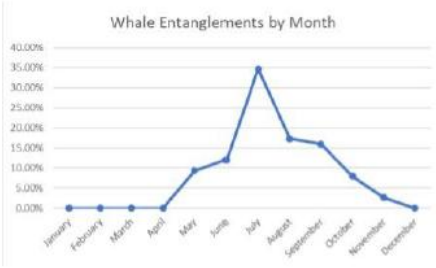




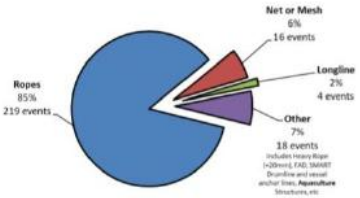
- In total, 259 entanglements have been reported in NSW, with the majority occurring post 2005.
- 255 of these entanglements are reported with Humpback whale.

OCEANWATCH AUSTRALIA

Whale entanglement by month



- Whale entanglements have been reported between May and November.
- The majority of interactions coincide with northern migration (June – July), and southern migration (August – September).



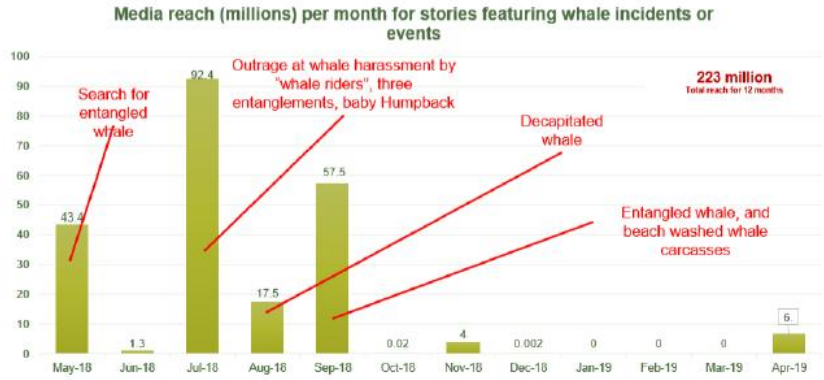
Percentage entanglement by source

* Ropes = 85% of reported entanglement

OCEANWATCH AUSTRALIA

OceanWatch Master Fisherman Training: Threatened, Endangered and Protected

Community concern of Whale entanglement



- There is great community concern relating to whale entanglement, > 43 million in May 2018 alone relating to search for entangled whale.

OCEANWATCH AUSTRALIA

OceanWatch Master Fisherman Training: Threatened, Endangered and Protected

What is being done to minimise the risk of entanglement?

NSW OTL fishers are encouraged to adopt the following measures to reduce the risk of whale entanglement:
Be aware of increased whale numbers between May and October.

Alert other fishers in the area if whales are observed near fishing grounds.

Remove traps from the water when not actively fishing.

Trial the practicality of gear and techniques that have the potential to reduce whale entanglements.

Provide assistance to further refine this Code of Practice.

Trials of modified fishing gears with potential to reduce whale entanglements are scheduled to commence early 2020. Information collected will help to inform future best practice advice.

OCEANWATCH AUSTRALIA

OceanWatch Master Fisherman Training: Threatened, Endangered and Protected

What is being done to minimise the risk of entanglement?

- A code of practice for reducing whale entanglement has been developed for NSW Ocean Trap and Line fishery endorsements.

Demersal Trap

* Limit slack rope in the water column.
* Avoid excessive knots on ropes.

Spanner Crab, Line West, Line East, School and Gummy Shark

* Limit slack rope in the water column.
* Avoid excessive knots on ropes.
* Minimise the number of buoy lines during whale season.
* Minimise distance between dillies/ hooks during whale season.

OCEANWATCH AUSTRALIA

OceanWatch Master Fisherman Training: Threatened, Endangered and Protected

Course of Action when Encountering an Entangled Whale

The safety of fishing vessels and crew is the highest priority. Do not attempt to disentangle whales.
Immediately report entangled whales to NPWS on 1300072757.
Rapid reporting ensures the NSW Government Large Whale Disentanglement Team has the best opportunity to successfully disentangle whales.
Provide details including:
Location.
Type of entanglement.
Location of entanglement on the whale.
Speed and direction of travel.
Stand by and monitor an entangled whale from a minimum 100m for an adult or 300m if a calf is present.
Assist the disentanglement team to rapidly locate an entangled whale.
Provide assistance to disentanglement teams when requested.

OCEANWATCH AUSTRALIA

OceanWatch Master Fisherman Training: Threatened, Endangered and Protected

Reducing interactions with TEP species

Fisheries Management Strategies (FMS) use two main measures to obtain data on fishers' TEP interactions during fishing operations.

1. *Observer based surveys* ***(costly to industry)***
2. Mandatory reporting of TEP interactions.

Fisheries Management Strategies highlight management responses that aim to minimise impacts on threatened species.

These include:

- Educating fishers in the identification of threatened species,
- Educating fishers in avoidance measures, such as:
  - Fishing closures,
  - Gear modifications
  - Implementing threatened species recovery plans
  - Threat abatement plans.

OCEANWATCH AUSTRALIA

OceanWatch Master Fisherman Training: Threatened, Endangered and Protected

You have a legal obligation to report all TEP interactions

Environmental Protection of Biodiversity Conservation Act (1999)
Sections 18, 19 and 20

T2

A person must not take an action that:

(a) has or will have a significant impact on a listed TEP; or

(b) is likely to have a significant impact on a listed TEP species.

Certain actions relating to listed threatened species and listed threatened ecological communities not prohibited.

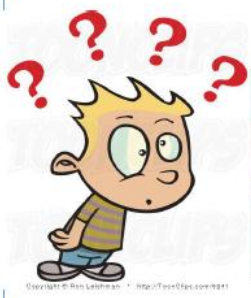
EPBC Act 1999 Section 255

- it is **not** an offence to kill a protected species provided it occurred, *"as a result of an unavoidable accident, other than an accident caused by negligent or reckless behaviour".*
- Reckless or negligent behaviour may be defined as any behaviour outside normal industry practices.

OCEANWATCH AUSTRALIA

OceanWatch Master Fisherman Training: Threatened, Endangered and Protected

Accurate and timely reporting



WWF Bycatch Campaign

−

Neil Perry - Sustainable Seafood Opportunities

+

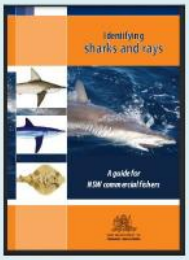
WWF Warning on Global Fish Stocks

WWF Smart Fishing Gear Competition

OCEANWATCH AUSTRALIA

OceanWatch Master Fisherman Training: Threatened, Endangered and Protected

Handling and identifying TEP species W1 P2



Sharks and rays identification guide

TEP species handling guide

Catch reporting arrangements for NSW commercial fishers require that any sharks and rays landed are correctly identified and recorded to the species or genus level

OceanWatch Threatened Species Handling Guide

Be aware of best practice techniques to handle TEP species.

Scan the QR code illustrated, or click on the link below.

OceanWatch Protected Species Handling Manual
www.oceanwatch.org.au/wp-content/uploads/2010/01/PSHMII.pdf

OCEANWATCH AUSTRALIA

OceanWatch Master Fisherman Training:
Threatened, Endangered and Protected

Key points – Threatened, Endangered and Protected

- An interaction is *'an incident where an protected or threatened animal comes into contact, is entangled or captured during a fishing operation'*
- There may be social and biological implications of TEP species interactions.
- It is a legal requirement to report all TEP interactions in NSW DPI Catch and Effort logbooks;
- There a identification guides available to ensure accurate reporting;
- Accurate reporting helps shape fisheries management decisions;
- Without accurate information, improved industry response and progress cannot be proven.

OCEANWATCH AUSTRALIA

OceanWatch Master Fisherman Training:
Threatened, Endangered and Protected

Appendix 5. NSW DPI Fisheries Section 37 Permits

NSW GOVERNMENT | Department of Primary Industries

OUT20/2307

PERMIT UNDER SECTION 37
FISHERIES MANAGEMENT ACT 1994

In accordance with the provisions of Section 37(1)(f) of the *Fisheries Management Act 1994* (the Act), [redacted], is authorised to take fish for sale in accordance with the conditions specified in this permit.

Conditions

1. The permit holder is authorised to use a maximum of 10 of the permitted number of fish traps modified in accordance with the following methods and waters, despite the fish trap marking requirements prescribed under Clause 7A(1)(a) of the Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006 (the OTL Plan):

   Methods

   (a) Galvanic time release

   A Galvanic Time Release device may be used to hold the buoy (and any additional buoys) below the surface of the water on deployment of the trap. The buoy must measure not less than 100 mm in all dimensions and display the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with that of the buoy.

   (b) Sub-surface horizontal rope

   A sub-surface horizontal rope may be attached to the trap to facilitate retrieval. The trap must have a tag or similar device attached in lieu of a buoy, with the tag or similar device displaying the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with the tag or device.

   In addition to the sub-surface horizontal rope, the following may be attached separately to the trap to facilitate retrieval:

   a) a surface buoy meeting requirements of Clause 7A(1)(a) of the OTL Plan, or
   b) a backup buoy meeting requirements of the Galvanic time release method.

   Waters

   Waters generally adjacent to and between Terrigal and Long Reef in water depths between 12 and 35m.

2. Other than where expressly stated, this Permit does not authorise fishing activities in contravention of the Act or the regulations under the Act.
3. This permit only permits the permit holder to use the Methods whilst the permit holder is the holder of a current commercial fishing licence and demersal fish trap

Department of Primary Industries – Coffs Harbour
PO BOX 4291, COFFS HARBOUR NSW 2450
www.dpi.nsw.gov.au ABN: 72 189 919 072

Department of Primary Industries

endorsement in the Ocean trap and line fishery under Fishing Business [redacted] whilst operating on LFB [redacted].

4. The permit holder must report relevant details of fishing activity and observations conducted under the authority of this permit using the *NSW OTL Modified Gear Trials Report* as required to meet project requirements and objectives, and in any case within 4 weeks of expiry of this permit.
5. The permit holder must abide by any instruction relating to the operation of this permit, given by an Officer of the New South Wales Department of Primary Industries (NSW DPI).
6. The permit holder must notify the relevant District Fisheries Officer/s:
    a. before initial deployment of modified fish traps to inform them of modifications, areas of operation and duration of intended trials, and
    b. on cessation of trials.
7. A copy of this permit shall be carried at all times during fishing operations authorised by this permit.
8. Unless sooner suspended or cancelled, this permit shall remain in force until the first of cessation of the project trial period or 31 December 2020.

Notes

- This permit is not transferable.
- Other than where expressly stated, this permit does not authorise fishing activities in contravention of the Act, the *Marine Estate Management Act 2014* or the associated Regulations.
- Failure to comply with any of the conditions of this permit may result in the modification or cancellation of this permit and prosecution or other sanction under the Act.
- This permit may be varied, suspended or cancelled at any time by a duly delegated officer of NSW DPI.
- The issue of this permit in no way implies or guarantees future rights in the Ocean trap and line fishery beyond the date of expiry of this permit.

Darren Reynolds
A/Group Director Commercial Fisheries & Aquaculture

24 March 2020

Department of Primary Industries – Coffs Harbour
PO BOX 4291, COFFS HARBOUR NSW 2450
www.dpi.nsw.gov.au ABN: 72 189 919 072

Department of Primary Industries

OUT20/2308

PERMIT UNDER SECTION 37
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   Methods

   (a) Galvanic time release

   A Galvanic Time Release device may be used to hold the buoy (and any additional buoys) below the surface of the water on deployment of the trap. The buoy must measure not less than 100 mm in all dimensions and display the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with that of the buoy.

   (b) Sub-surface horizontal rope

   A sub-surface horizontal rope may be attached to the trap to facilitate retrieval. The trap must have a tag or similar device attached in lieu of a buoy, with the tag or similar device displaying the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with the tag or device.

   In addition to the sub-surface horizontal rope, the following may be attached separately to the trap to facilitate retrieval:

   a) a surface buoy meeting requirements of Clause 7A(1)(a) of the OTL Plan, or
   b) a backup buoy meeting requirements of the Galvanic time release method.

   Waters

   Waters generally adjacent to and between Culburra and Sussex Inlet in water depths between 20 and 110m.

2. Other than where expressly stated, this Permit does not authorise fishing activities in contravention of the Act or the regulations under the Act.
3. This permit only permits the permit holder to use the Methods whilst the permit holder is the holder of a current commercial fishing licence and demersal fish trap

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endorsement in the Ocean trap and line fishery for Fishing Business [redacted]5 whilst operating on LFB [redacted]2.

4. The permit holder must report relevant details of fishing activity and observations conducted under the authority of this permit using the *NSW OTL Modified Gear Trials Report* as required to meet project requirements and objectives, and in any case within 4 weeks of expiry of this permit.
5. The permit holder must abide by any instruction relating to the operation of this permit, given by an Officer of the New South Wales Department of Primary Industries (NSW DPI).
6. The permit holder must notify the relevant District Fisheries Officer/s:
    a. before initial deployment of modified fish traps to inform them of modifications, areas of operation and duration of intended trials, and
    b. on cessation of trials.
7. A copy of this permit shall be carried at all times during fishing operations authorised by this permit.
8. Unless sooner suspended or cancelled, this permit shall remain in force until the first of cessation of the project trial period or 31 December 2020.

Notes

- This permit is not transferable.
- Other than where expressly stated, this permit does not authorise fishing activities in contravention of the Act, the *Marine Estate Management Act 2014* or the associated Regulations.
- Failure to comply with any of the conditions of this permit may result in the modification or cancellation of this permit and prosecution or other sanction under the Act.
- This permit may be varied, suspended or cancelled at any time by a duly delegated officer of NSW DPI.
- The issue of this permit in no way implies or guarantees future rights in the Ocean trap and line fishery beyond the date of expiry of this permit.

Darren Reynolds
A/Group Director Commercial Fisheries & Aquaculture

24 March 2020

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OUT20/2309

PERMIT UNDER SECTION 37
FISHERIES MANAGEMENT ACT 1994

In accordance with the provisions of Section 37(1)(f) of the *Fisheries Management Act 1994* (the Act), [redacted], is authorised to take fish for sale in accordance with the conditions specified in this permit.

Conditions

1. The permit holder is authorised to use a maximum of 10 of the permitted number of fish traps modified in accordance with the following methods and waters, despite the fish trap marking requirements prescribed under Clause 7A(1)(a) of the Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006 (the OTL Plan):

   Methods

   (a) Galvanic time release

   A Galvanic Time Release device may be used to hold the buoy (and any additional buoys) below the surface of the water on deployment of the trap. The buoy must measure not less than 100 mm in all dimensions and display the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with that of the buoy.

   (b) Programmable Time Release

   A Programmable Time Release device may be used to hold the buoy (and any additional buoys) below the surface of the water on deployment of the trap. The buoy must measure not less than 100 mm in all dimensions and display the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with that of the buoy.

   Waters

   Waters generally adjacent to and between Old Bar and Seal Rocks in water depths between 20 and 90m.

2. Other than where expressly stated, this Permit does not authorise fishing activities in contravention of the Act or the regulations under the Act.
3. This permit only permits the permit holder to use the Methods whilst the permit holder is the holder of a current commercial fishing licence and demersal fish trap endorsement in the Ocean trap and line fishery for Fishing Business [redacted] whilst operating on LFB [redacted]
4. The permit holder must report relevant details of fishing activity and observations conducted under the authority of this permit using the *NSW OTL Modified Gear Trials Report* as required to meet project requirements and objectives, and in any case within 4 weeks of expiry of this permit.

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5. The permit holder must abide by any instruction relating to the operation of this permit, given by an Officer of the New South Wales Department of Primary Industries (NSW DPI).
6. The permit holder must notify the relevant District Fisheries Officer/s:
    a. before initial deployment of modified fish traps to inform them of modifications, areas of operation and duration of intended trials, and
    b. on cessation of trials.
7. A copy of this permit shall be carried at all times during fishing operations authorised by this permit.
8. Unless sooner suspended or cancelled, this permit shall remain in force until the first of cessation of the project trial period or 31 December 2020.

Notes

- This permit is not transferable.
- Other than where expressly stated, this permit does not authorise fishing activities in contravention of the Act, the *Marine Estate Management Act 2014* or the associated Regulations.
- Failure to comply with any of the conditions of this permit may result in the modification or cancellation of this permit and prosecution or other sanction under the Act.
- This permit may be varied, suspended or cancelled at any time by a duly delegated officer of NSW DPI.
- The issue of this permit in no way implies or guarantees future rights in the Ocean trap and line fishery beyond the date of expiry of this permit.

Darren Reynolds
A/Group Director Commercial Fisheries & Aquaculture

24 March 2020

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Department of Primary Industries

OUT20/2310

PERMIT UNDER SECTION 37
FISHERIES MANAGEMENT ACT 1994

In accordance with the provisions of Section 37(1)(f) of the *Fisheries Management Act 1994* (the Act), [redacted], is authorised to take fish for sale in accordance with the conditions specified in this permit.

Conditions

1. The permit holder is authorised to use a maximum of 10 of the permitted number of fish traps modified in accordance with the following methods and waters, despite the fish trap marking requirements prescribed under Clause 7A(1)(a) of the Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006 (the OTL Plan):

   Methods

   (a) Galvanic time release

   A Galvanic Time Release device may be used to hold the buoy (and any additional buoys) below the surface of the water on deployment of the trap. The buoy must measure not less than 100 mm in all dimensions and display the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with that of the buoy.

   (b) Programmable Time Release

   A Programmable Time Release device may be used to hold the buoy (and any additional buoys) below the surface of the water on deployment of the trap. The buoy must measure not less than 100 mm in all dimensions and display the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with that of the buoy.

   Waters

   Waters generally adjacent to and between Red Rock and Grassy Head in water depths between 10 and 150m.

2. Other than where expressly stated, this Permit does not authorise fishing activities in contravention of the Act or the regulations under the Act.
3. This permit only permits the permit holder to use the Methods whilst the permit holder is the holder of a current commercial fishing licence and demersal fish trap endorsement in the Ocean trap and line fishery under Fishing Business [redacted] whilst operating on LFB [redacted].
4. The permit holder must report relevant details of fishing activity and observations conducted under the authority of this permit using the *NSW OTL Modified Gear Trials Report* as required to meet project requirements and objectives, and in any case within 4 weeks of expiry of this permit.

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5. The permit holder must abide by any instruction relating to the operation of this permit, given by an Officer of the New South Wales Department of Primary Industries (NSW DPI).
6. The permit holder must notify the relevant District Fisheries Officer/s:
    a. before initial deployment of modified fish traps to inform them of modifications, areas of operation and duration of intended trials, and
    b. on cessation of trials.
7. A copy of this permit shall be carried at all times during fishing operations authorised by this permit.
8. Unless sooner suspended or cancelled, this permit shall remain in force until the first of cessation of the project trial period or 31 December 2020.

Notes

- This permit is not transferable.
- Other than where expressly stated, this permit does not authorise fishing activities in contravention of the Act, the *Marine Estate Management Act 2014* or the associated Regulations.
- Failure to comply with any of the conditions of this permit may result in the modification or cancellation of this permit and prosecution or other sanction under the Act.
- This permit may be varied, suspended or cancelled at any time by a duly delegated officer of NSW DPI.
- The issue of this permit in no way implies or guarantees future rights in the Ocean trap and line fishery beyond the date of expiry of this permit.

Darren Reynolds
A/Group Director Commercial Fisheries & Aquaculture

24 March 2020

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OUT20/2311

PERMIT UNDER SECTION 37
FISHERIES MANAGEMENT ACT 1994

In accordance with the provisions of Section 37(1)(f) of the *Fisheries Management Act 1994* (the Act), [redacted], is authorised to take fish for sale in accordance with the conditions specified in this permit.

Conditions

1. The permit holder is authorised to use a maximum of 10 of the permitted number of fish traps modified in accordance with the following methods and waters, despite the fish trap marking requirements prescribed under Clause 7A(1)(a) of the Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006 (the OTL Plan):

   Methods

   (a) Galvanic time release

   A Galvanic Time Release device may be used to hold the buoy (and any additional buoys) below the surface of the water on deployment of the trap. The buoy must measure not less than 100 mm in all dimensions and display the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with that of the buoy.

   (b) Acoustic Release

   An Acoustic Release device may be used to hold the buoy (and any additional buoys) below the surface of the water on deployment of the trap. The buoy must measure not less than 100 mm in all dimensions and display the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with that of the buoy.

   Waters

   Waters generally adjacent to and between North Solitary Island and Nambucca in water depths between 10 and 150m.

2. Other than where expressly stated, this Permit does not authorise fishing activities in contravention of the Act or the regulations under the Act.
3. This permit only permits the permit holder to use the Methods whilst the permit holder is the holder of a current commercial fishing licence and demersal fish trap endorsement in the Ocean trap and line fishery for Fishing Business [redacted] whilst operating on LFB [redacted] or LFB [redacted].
4. The permit holder must report relevant details of fishing activity and observations conducted under the authority of this permit using the *NSW OTL Modified Gear Trials Report* as required to meet project requirements and objectives, and in any case within 4 weeks of expiry of this permit.

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5. The permit holder must abide by any instruction relating to the operation of this permit, given by an Officer of the New South Wales Department of Primary Industries (NSW DPI).
6. The permit holder must notify the relevant District Fisheries Officer/s:
    a. before initial deployment of modified fish traps to inform them of modifications, areas of operation and duration of intended trials, and
    b. on cessation of trials.
7. A copy of this permit shall be carried at all times during fishing operations authorised by this permit.
8. Unless sooner suspended or cancelled, this permit shall remain in force until the first of cessation of the project trial period or 31 December 2020.

Notes

- This permit is not transferable.
- Other than where expressly stated, this permit does not authorise fishing activities in contravention of the Act, the *Marine Estate Management Act 2014* or the associated Regulations.
- Failure to comply with any of the conditions of this permit may result in the modification or cancellation of this permit and prosecution or other sanction under the Act.
- This permit may be varied, suspended or cancelled at any time by a duly delegated officer of NSW DPI.
- The issue of this permit in no way implies or guarantees future rights in the Ocean trap and line fishery beyond the date of expiry of this permit.

Darren Reynolds
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24 March 2020

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OUT20/2312

PERMIT UNDER SECTION 37
FISHERIES MANAGEMENT ACT 1994

In accordance with the provisions of Section 37(1)(f) of the *Fisheries Management Act 1994* (the Act), [redacted], is authorised to take fish for sale in accordance with the conditions specified in this permit.

Conditions

1. The permit holder is authorised to use a maximum of 10 of the permitted number of fish traps modified in accordance with the following methods and waters, despite the fish trap marking requirements prescribed under Clause 7A(1)(a) of the Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006 (the OTL Plan):

   Methods

   (a) Galvanic time release

   A Galvanic Time Release device may be used to hold the buoy (and any additional buoys) below the surface of the water on deployment of the trap. The buoy must measure not less than 100 mm in all dimensions and display the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with that of the buoy.

   (b) Programmable Time Release

   A Programmable Time Release device may be used to hold the buoy (and any additional buoys) below the surface of the water on deployment of the trap. The buoy must measure not less than 100 mm in all dimensions and display the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with that of the buoy.

   Waters

   Waters generally adjacent to Bermagui in water depths between 50 and 130m.

2. Other than where expressly stated, this Permit does not authorise fishing activities in contravention of the Act or the regulations under the Act.
3. This permit only permits the permit holder to use the Methods whilst the permit holder is the holder of a current commercial fishing licence and demersal fish trap endorsement in the Ocean trap and line fishery for Fishing Business [redacted] whilst operating on LFB [redacted].
4. The permit holder must report relevant details of fishing activity and observations conducted under the authority of this permit using the *NSW OTL Modified Gear Trials Report* as required to meet project requirements and objectives, and in any case within 4 weeks of expiry of this permit.

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5. The permit holder must abide by any instruction relating to the operation of this permit, given by an Officer of the New South Wales Department of Primary Industries (NSW DPI).
6. The permit holder must notify the relevant District Fisheries Officer/s:
    a. before initial deployment of modified fish traps to inform them of modifications, areas of operation and duration of intended trials, and
    b. on cessation of trials.
7. A copy of this permit shall be carried at all times during fishing operations authorised by this permit.
8. Unless sooner suspended or cancelled, this permit shall remain in force until the first of cessation of the project trial period or 31 December 2020.

Notes

- This permit is not transferable.
- Other than where expressly stated, this permit does not authorise fishing activities in contravention of the Act, the *Marine Estate Management Act 2014* or the associated Regulations.
- Failure to comply with any of the conditions of this permit may result in the modification or cancellation of this permit and prosecution or other sanction under the Act.
- This permit may be varied, suspended or cancelled at any time by a duly delegated officer of NSW DPI.
- The issue of this permit in no way implies or guarantees future rights in the Ocean trap and line fishery beyond the date of expiry of this permit.

Darren Reynolds
A/Group Director Commercial Fisheries & Aquaculture

24 March 2020

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OUT20/2313

PERMIT UNDER SECTION 37
FISHERIES MANAGEMENT ACT 1994

In accordance with the provisions of Section 37(1)(f) of the *Fisheries Management Act 1994* (the Act), [redacted], is authorised to take fish for sale in accordance with the conditions specified in this permit.

Conditions

1. The permit holder is authorised to use a maximum of 10 of the permitted number of fish traps modified in accordance with the following methods and waters, despite the fish trap marking requirements prescribed under Clause 7A(1)(a) of the Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006 (the OTL Plan):

   Methods

   (a) Galvanic time release

   A Galvanic Time Release device may be used to hold the buoy (and any additional buoys) below the surface of the water on deployment of the trap. The buoy must measure not less than 100 mm in all dimensions and display the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with that of the buoy.

   (b) Sub-surface horizontal rope

   A sub-surface horizontal rope may be attached to the trap to facilitate retrieval. The trap must have a tag or similar device attached in lieu of a buoy, with the tag or similar device displaying the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with the tag or device.

   In addition to the sub-surface horizontal rope, the following may be attached separately to the trap to facilitate retrieval:

   a) a surface buoy meeting requirements of Clause 7A(1)(a) of the OTL Plan, or
   b) a backup buoy meeting requirements of the Galvanic time release method.

   Waters

   Waters generally adjacent to and between Swansea and Sydney in water depths between 10 and 150m.

2. Other than where expressly stated, this Permit does not authorise fishing activities in contravention of the Act or the regulations under the Act.
3. This permit only permits the permit holder to use the Methods whilst the permit holder is the holder of a current commercial fishing licence and demersal fish trap

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endorsement in the Ocean trap and line fishery for Fishing Business [redacted] whilst operating on LFB 1[redacted]0, LFB 1[redacted]9 or LFB 1[redacted].

4. The permit holder must report relevant details of fishing activity and observations conducted under the authority of this permit using the *NSW OTL Modified Gear Trials Report* as required to meet project requirements and objectives, and in any case within 4 weeks of expiry of this permit.
5. The permit holder must abide by any instruction relating to the operation of this permit, given by an Officer of the New South Wales Department of Primary Industries (NSW DPI).
6. The permit holder must notify the relevant District Fisheries Officer/s:
    a. before initial deployment of modified fish traps to inform them of modifications, areas of operation and duration of intended trials, and
    b. on cessation of trials.
7. A copy of this permit shall be carried at all times during fishing operations authorised by this permit.
8. Unless sooner suspended or cancelled, this permit shall remain in force until the first of cessation of the project trial period or 31 December 2020.

Notes

- This permit is not transferable.
- Other than where expressly stated, this permit does not authorise fishing activities in contravention of the Act, the *Marine Estate Management Act 2014* or the associated Regulations.
- Failure to comply with any of the conditions of this permit may result in the modification or cancellation of this permit and prosecution or other sanction under the Act.
- This permit may be varied, suspended or cancelled at any time by a duly delegated officer of NSW DPI.
- The issue of this permit in no way implies or guarantees future rights in the Ocean trap and line fishery beyond the date of expiry of this permit.

Darren Reynolds
A/Group Director Commercial Fisheries & Aquaculture

24 March 2020

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OUT20/2314

PERMIT UNDER SECTION 37
FISHERIES MANAGEMENT ACT 1994

In accordance with the provisions of Section 37(1)(f) of the *Fisheries Management Act 1994* (the Act), [redacted], is authorised to take fish for sale in accordance with the conditions specified in this permit.

Conditions

1. The permit holder is authorised to use a maximum of 10 of the permitted number of fish traps modified in accordance with the following methods and waters, despite the fish trap marking requirements prescribed under Clause 7A(1)(a) of the Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006 (the OTL Plan):

   Methods

   (a) Galvanic time release

   A Galvanic Time Release device may be used to hold the buoy (and any additional buoys) below the surface of the water on deployment of the trap. The buoy must measure not less than 100 mm in all dimensions and display the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with that of the buoy.

   (b) Sub-surface horizontal rope

   A sub-surface horizontal rope may be attached to the trap to facilitate retrieval. The trap must have a tag or similar device attached in lieu of a buoy, with the tag or similar device displaying the relevant fishing business number followed by the letter "F" in clearly visible letters that are not less than 50 mm in height and are of a colour that contrasts with the tag or device.

   In addition to the sub-surface horizontal rope, the following may be attached separately to the trap to facilitate retrieval:

   a) a surface buoy meeting requirements of Clause 7A(1)(a) of the OTL Plan, or
   b) a backup buoy meeting requirements of the Galvanic time release method.

   Waters

   Waters generally adjacent to and between Broken Bay and Wattamolla in water depths between 10 and 140m.

2. Other than where expressly stated, this Permit does not authorise fishing activities in contravention of the Act or the regulations under the Act.
3. This permit only permits the permit holder to use the Methods whilst the permit holder is the holder of a current commercial fishing licence and demersal fish trap

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endorsement in the Ocean trap and line fishery for Fishing Business [redacted] whilst operating on LFB [redacted].

4. The permit holder must report relevant details of fishing activity and observations conducted under the authority of this permit using the *NSW OTL Modified Gear Trials Report* as required to meet project requirements and objectives, and in any case within 4 weeks of expiry of this permit.
5. The permit holder must abide by any instruction relating to the operation of this permit, given by an Officer of the New South Wales Department of Primary Industries (NSW DPI).
6. The permit holder must notify the relevant District Fisheries Officer/s:
    a. before initial deployment of modified fish traps to inform them of modifications, areas of operation and duration of intended trials, and
    b. on cessation of trials.
7. A copy of this permit shall be carried at all times during fishing operations authorised by this permit.
8. Unless sooner suspended or cancelled, this permit shall remain in force until the first of cessation of the project trial period or 31 December 2020.

Notes

- This permit is not transferable.
- Other than where expressly stated, this permit does not authorise fishing activities in contravention of the Act, the *Marine Estate Management Act 2014* or the associated Regulations.
- Failure to comply with any of the conditions of this permit may result in the modification or cancellation of this permit and prosecution or other sanction under the Act.
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Darren Reynolds
A/Group Director Commercial Fisheries & Aquaculture

24 March 2020

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Appendix 6. Fisher Reporting Questionnaire

NSW OTL Modified Head Gear Trials Report **Demersal Fish Trap - Galvanic Time Release** **Grappling a Sub Surface Horizontal Rope**	
Project leader contact details	Brad Warren brad.warren61@gmail.com 0412606959
Name mobile email Port	FB No LFB No Boat length OTL Endorsements
Trial start date	Trial end date
Details of typical gear configuration Number of floats/trap Type of floats Size of floats Diameter of rope Type of rope Depth to rope ratio *Sketch*	**Details of modified gear configuration** Number of floats/trap Type of floats Size of floats Diameter of rope Type of rope Depth to rope ratio GTR models/times Position of rope bag Length of sub surface rope *Sketch*

No more than 10 modified traps to be used per trial

Trial Summary	Typical Gear	Modified Gear
Number of Traps		
Number of Days fished		
Approx. Number of Lifts		
Depth Ranges		

Utility of the Gear Modification

1. How difficult was it to modify the gear?

1	2	3	4	5

Easy → Difficult

Please provide details

2. In comparison to your typical gear, how efficient was setting the modified gear?

1	2	3	4	5
Easier →	Similar →	More Difficult →	Very Difficult →	Too Difficult

Please provide details

3. In comparison to your typical gear, how efficient was retrieving the modified gear?

1	2	3	4	5
Easier →	Similar →	More Difficult →	Very Difficult →	Too Difficult

Please provide details

4. In your opinion, did using the modified gear have an impact on your catch? **Y/N**
Please provide details

5. Is there any impact on crew arrangements as a result of the gear modification? **Y/N**
Please provide details

6. Is there any impact on time at sea as a result of the gear modification? **Y/N**
Please provide details

Safety Aspects of the Modified Gear

7. Are there any impacts on vessel survey and operating requirements as a result of the gear modification? **Y/N**
Please provide details

8. Are there crew safety hazards as a result of the gear modification? **Y/N**
Please provide details

9. Was there any damage to the vessel as a result of the gear modification? **Y/N**
Please provide details

10. Was there any damage to the hauling gear as a result of the gear modification? **Y/N**
Please provide details

11. Was there any damage to fishing gear as a result of the gear modification? **Y/N**
Please provide details

12. Did you notice an increase/decrease in recreational fishing gear entangled in your modified gear? **Y/N**
Please provide details

13. In comparison to your typical gear, how would you rate the safety of this gear modification?

1.	2.	3.
Safe →	Unsure →	Unsafe

Please provide details

Lost Gear

14. Did you lose any typical fishing gear during the trial? **Y/N**
Please provide details

15. Did you lose any modified fishing gear during the trial? **Y/N**
Please provide details

16. In your opinion, did the gear modification increase gear loss? **Y/N**
Please provide details

17. In your opinion, did the gear modification decrease gear loss? **Y/N**
Please provide details

18. Were you able to retrieve any gear lost during the trial? **Y/N**
Please provide details

Future Uptake

19. In your opinion, does this gear modification have the potential to reduce the risks of whale entanglement? **Y/N**
Please provide details

20. Are you still using the modified gear? **Y/N**
Please provide details

21. Could you apply this gear modification across your NSW OTL operation during whale migration season (May/Oct)? **Y/N**
Please provide details

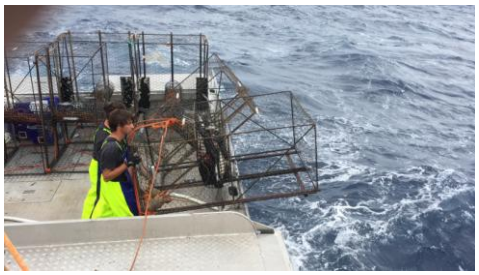
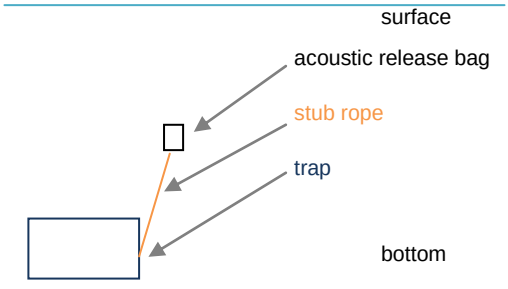
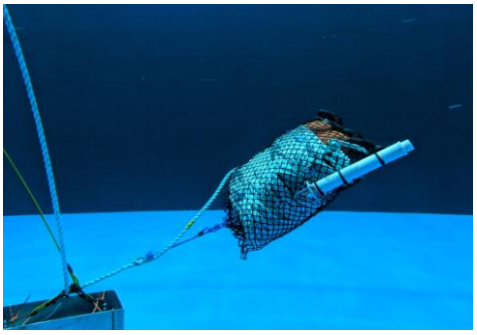
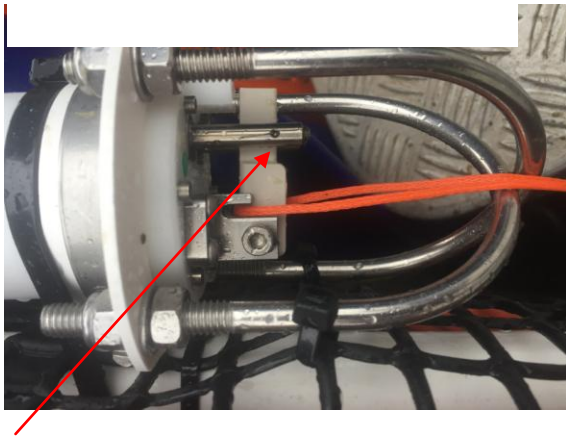
22. Is this gear modification cost effective for your business to implement over the whale migration season? (May/Oct)? **Y/N**
Please provide details

23. Are there operational barriers to future uptake of this gear modification? **Y/N**
Please provide details

24. In your opinion, could other NSW OTL fishers apply this gear modification during whale migration season (May/Oct)? **Y/N**
Please provide details

Further Comments

Appendix 7. Desert Star acoustic release evaluation

NSW OTL Modified Head Gear Trials Report **Desert Star Acoustic Release System evaluation trip** **[redacted] – NSW Lobster**	
Project leader contact details	Brad Warren brad.warren61@gmail.com 0412606959
[redacted] NSW Lobster Forster Report compiled by Brad Warren 10/2/20	Marco Flagg CEO Desert Star Monterey Bay Cal.
Trial start date 6/2/20	Trial end date 6/2/20
Details of gear configuration  Traps are similar to demersal fish traps. 1800x1500x900 steel frame, wrapped with galvanised 50mm chicken wire. Traps are set on the bottom with a 40m stub rope to the acoustic release bag.   Desert Star acoustic release systems. System used ARC-1XD	Number of floats/trap - 2 Type of floats - Hard plastic Size of floats - 8” Diameter of rope - 8mm &10mm Type of rope - PE Depth to rope ratio – 2.5:1 GTR models/times – n/a Position of rope bag – 40m from trap Acoustic model – Desert Star ARC-1XD Acoustic Release STM-3 Deck Box for Ranging Releases  A deployed Desert Star acoustic release system  Desert Star acoustic release mechanism close up. A Nickel chromium burn wire is seated between two titanium burn posts with lever arm.

Hinged stainless steel bag closer is attached under tension to the acoustic release mechanism.

Packed acoustic release bag ready for deployment. Desert Star acoustic transponder and release mechanism upper right of the bag.

Trial Summary	Typical Gear	Modified Gear
Number of Traps		13
Number of Days fished		6 weeks
Approx. Number of Lifts		13traps x 1 lift
Depth Ranges		100m

A current of over 3 knots was encountered during the day

Utility of the Gear Modification

1. How difficult was it to modify the gear?

1	2	3	**4**	5

Easy → Difficult

Please provide details
Ropes are packed in mesh bags with acoustic transponder attached.
Mesh bags are manufactured the correct size for rope length to reduce risk of fouling floats on release.
Hinge mechanism for top of rope bag is manufactured incorporating a tensioned release for attachment to the acoustic trigger.

2. In comparison to your typical gear, how efficient was setting the modified gear?

1	2	**3**	4	5

Easier → Similar → More Difficult → Very Difficult → Too Difficult

Please provide details
Floats, bags and trigger releases cleaned with high pressure hose after use.
Rope bags need to be repacked after each use, and acoustic release rearmed.
Significant time spent using snood hauler to shoot ropes into mesh bags.
Attention to detail required to reduce the risk of rope fouling on release.

3. In comparison to your typical gear, how efficient was retrieving the modified gear?

1	**2**	3	4	5

Easier → Similar → More Difficult → Very Difficult → Too Difficult

Please provide details
Slack current – some time delay between initialising the release process and the floats surfacing. ~ 1+min
Strong current – Floats released from the bag stay on the surface until the slack rope is taken up. This gives the fisher an opportunity to retrieve gear which would overwise be inaccessible when standard surface float configurations are being pulled under by strong current.

4. In your opinion, did using the modified gear have an impact on your catch? **Y/N**
Please provide details
Positive impact
Traps are accessible when standard surface float configurations may be inaccessible due to strong current pulling floats underwater.
Reduces the risk of lost catch due to ship strike and poaching.

5. Is there any impact on crew arrangements as a result of the gear modification? **Y/N**
Please provide details
One crew member (total 3 + skipper) required to clean acoustic release bags, floats and trigger mechanism, and to refill rope bags prior to resetting gear.

6. Is there any impact on time at sea as a result of the gear modification? **Y/N**
Please provide details
Some wait between initialising release and floats appearing on the surface.
Extra boat manoeuvring required– boat may not be in correct position when floats surface.
Crew required to maintain and reset acoustic release bags.

Safety Aspects of the Modified Gear

7. Are there any impacts on vessel survey and operating requirements as a result of the gear modification? **Y/N**
Please provide details

8. Are there crew safety hazards as a result of the gear modification? **Y/N**
Please provide details
Crew required to lean over rail to unclip acoustic release bag on trap retrieval.

9. Was there any damage to the vessel as a result of the gear modification? **Y/N**
Please provide details

10. Was there any damage to the hauling gear as a result of the gear modification? **Y/N**
Please provide details
Snood hauler installed to load rope into bag

11. Was there any damage to fishing gear as a result of the gear modification? **Y/N**
Please provide details

12. Did you notice an increase/decrease in recreational fishing gear entangled in your modified gear? **Y/N**
Please provide details
No recreational gear on ropes or traps.

13. In comparison to your typical gear, how would you rate the safety of this gear modification?

1.	2.	3.
Safe →	Unsure →	Unsafe

Please provide details
Increased risk - Crew required to lean over rail to unclip acoustic release bag on trap retrieval.
Reduced risk – less likely to encounter recreational gear tangled in ropes and floats

Lost Gear

14. Did you lose any typical fishing gear during the trial? Y/N
Please provide details

15. Did you lose any modified fishing gear during the trial? Y/N
Please provide details
13 traps were released, only 12 traps were recovered.
Acoustic release acknowledged signal but failed to surface – rope tangle or release bag fouling.
Potential for grappling lost trap when current reduces.

16. In your opinion, did the gear modification increase gear loss? Y/N
Please provide details

17. In your opinion, did the gear modification decrease gear loss? Y/N
Please provide details
Reduced risk of ship strike, whale entanglement and poaching

18. Were you able to retrieve any gear lost during the trial? Y/N
Please provide details
Have not attempted to grapple lost trap while current is strong.

Future Uptake

19. In your opinion, does this gear modification have the potential to reduce the risks of whale entanglement? Y/N
Please provide details
Reducing the amount of rope in the water column will reduce the risk of whale entanglements.

20. Are you still using the modified gear? Y/N
Please provide details
Has purchased ~ 150 release units and deck box.

21. Could you apply this gear modification across your NSW OTL operation during whale migration season (May/Oct)? Y/N
Please provide details
The gear is operated with acoustic release year round in the NSW Rock Lobster fishery. The characteristics of the NSW Lob fishery include deep water, high current, long soak times and high prices for product.
Efficiency may be questionable for short soak times and less valuable product; characteristic of demersal fish trapping in NSW.

22. Is this gear modification cost effective for your business to implement over the whale migration season? (May/Oct)? Y/N
Please provide details
Has invested some $400k in the technology for NSW Lobster fishery.
The economics of the NSW Lobster fishery are dissimilar to the demersal fish trapping sector due to short soak times and less valuable product.
Cost effectiveness of the Desert Star system for demersal fish traps in NSW OTL fishery is untested.

23. Are there operational barriers to future uptake of this gear modification? Y/N
Please provide details
Acoustic release technology is currently outside NSW OTL regulations. Current regulations do not allow for the use of sub surface head gear NSW OTL fishery.

24. In your opinion, could other NSW OTL fishers apply this gear modification during whale migration season (May/Oct)? Y/N
Please provide details
The technology has been shown to work well under conditions experienced in the NSW Lobster fishery, in particular the long soak times associated with deep water fishing.
There is scope for adoption within the NSW OTL sector which uses similar trap configurations as the NSW Lob sector.

Further Comments
Challenges to adoption of the Desert Star acoustic release technology within the demersal fish trap sector of the NSW OTL fishery will include:

The high initial cost of the equipment, which includes US$8,000 per deck box and US$1700 per acoustic release unit.
~15 mins to clean, repack and rearm acoustic release rope bags at each trap lift before resetting. A high pressure water washer and dedicated hydraulic snood hauler have been installed on the boat.
1 crew member needed to focus on acoustic release bags cleaning and repacking
Technical training for fishers and crew to ensure successful operation
A change of regulation to allow sub surface head gear.

Desert Star Acoustic Release System - Discussion

Acoustic signals were used to control the release of the head gear of lobster traps. The intent of this evaluation was to assess the removal of the head rope and associated floats from the water column for the entire soak time through having ropes and floats released by acoustic release devices from mesh bags attached to a short stub rope.

1. The floats and head rope were coiled and placed in a bag manufactured from plastic mesh. The bag was closed using an acoustic release device and connected to the DFT by a short stub rope.

2. When the acoustic release was triggered, the floats and head rope were released from the bag, with the buoyancy of the floats bringing the head gear to the surface. The DFT was then able to be retrieved and hauled using the typical method.

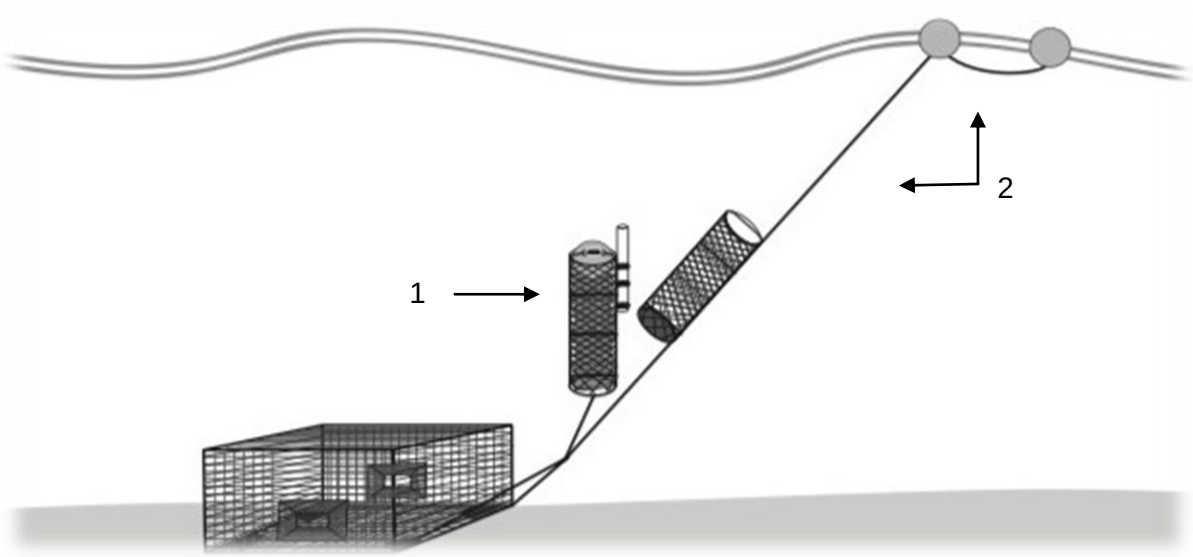


Figure: Desert Star acoustic release system

A number of vessels in the NSW Lob fishery have successfully used Desert Star acoustic release technology for a number of years to minimise ropes and floats in the water column.

The characteristics of the NSW Lob fishery include deep water, high current, long soak times and high prices for product.

Ropes were packed in mesh bags with an acoustic transponder attached. The bags were manufactured to the correct size for the rope length to reduce the risk of fouling the floats on release. The hinge mechanism for the top of the bag was manufactured incorporating a tensioned release for attachment to the acoustic trigger.

Image: Packed acoustic release bag ready for deployment. Desert Star acoustic transponder and release mechanism upper right of the bag. (WEM)

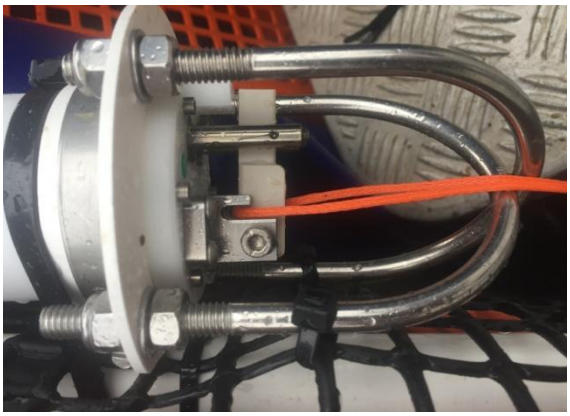


Image: Desert Star acoustic release mechanism close up. A Nickel chromium burn wire is seated between two titanium burn posts with lever arm. (WEM)

There was some wait time, dependent on water depth, between initialising the acoustic release signal and the floats appearing on the surface. Some extra manoeuvring was required as the vessel was unlikely to be in the correct position to haul the DFT when the floats surface.

When the current was strong, the floats released from the rope bag stayed on the surface until the slack rope was taken up. This gave the fisher an opportunity to retrieve gear which might otherwise be inaccessible when standard surface float configurations are being pulled under by a strong current.

The floats, rope bags and acoustic trigger releases were cleaned with a high pressure hose after each use to remove marine growth. The rope bags were repacked after each use, and the acoustic release rearmed. Significant time was spent using a dedicated snood hauler to coil the rope into the rope bag, with considerable attention to detail being required to reduce the risk of the rope fouling on release. Extra crew was required to clean the rope bags, floats and acoustic release trigger mechanism, and to repack the rope bags prior to resetting gear.

There was one identified safety risk as a crew member was required to lean over the rail to unclip the rope bag / acoustic release mechanism from the stub rope while retrieving the trap, however the crew are unlikely to encounter recreational fishing gear tangled in the ropes and floats which is a known hazard associated with surface head gear.

Reducing or removing rope in the water column through the use of acoustic release technology will likely eliminate the risk of whale entanglement and poaching, as well as the potential for gear to be lost through ship or boat strike of surface head gear. Reduction of lost gear also has positive implications for ghost fishing and fisher viability.

Acoustic technology has been shown to work well under conditions experienced in the NSW Lob fishery. Although there is scope for adoption within the NSW OTL fishery which uses similar trap configurations to the NSW Lob fishery, the suitability of this technology is uncertain for the short soak times and lesser value products characteristic of DFT fishing in NSW.

The cost effectiveness of the Desert Star system for DFT fishing in NSW is untested, with significant investment required to purchase acoustic release transponders and associated wheelhouse electronics and software.

Acoustic release technology is currently incompatible with NSW OTL regulations.

Safety Considerations

- Extra interactions between crew, ropes and rope bags.

Potential Benefits

- Removes most of the head gear from the water column for the entire soak time.
- Increases security of fishing gear.

Potential Challenges to Uptake

- High initial cost of the equipment.
- Subsurface head gear adds buoyancy to the DFT.
- Impacts on productivity, exacerbated in deeper water.
- Technical training required.
- Currently incompatible with NSW OTL regulations.

Indicative Cost

The initial cost of the equipment is approximately US$8,000 per deck box and US$1700 per acoustic release unit. Technical training is required to ensure successful operation of the acoustic release units and controlling software.