Occurrence of *Cephalorhynchus hectori* in coastal waters of Taranaki, New Zealand;

Second Deployment

Identifying temporal and spatial information for review of the 2012 Threat Management Plan

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Abstract

Cephalorhynchus hectori (Hectors dolphin) are an endangered species that are only found in New Zealand waters (ICUN, 2013). *Cephalorhynchus hectori maui* (Māui dolphin) are a subspecies of Hectors dolphin that inhabit the west coast of the North Island and are currently listed as critically endangered on the International Union for Conservation of Nature red list (ICUN, 2013). Much of their population decline has resulted from human impacts. To improve existing knowledge on the distribution of Māui and Hectors dolphin, spatial information was gathered using click detector devices called C-POD's deployed at various locations along the West Coast of the North Island. This report summaries data from the second deployment in the Taranaki coastal area. There were no detections made on Motunui C-POD 2718. A total of 11 detection positive minutes (DPM) were made on Tongaporutu C-POD 2720 during the month of April and July. All of these detections were made during night time hours. Further research is required to determine if there is evidence of diurnal movements and for better understanding of the distribution of this species.

Introduction

The coastal waters of New Zealand are home to many marine mammal species, including *Cephalorhynchus hectori* (Hectors dolphin) which inhabit the coastal waters around the South Island of New Zealand (Dawson et al., 2004: Slooten et al., 2004, 2005). A small population of this species have been isolated in the west coast region of the North Island and have evolved slightly different physiology and genetic makeup to the main southern population. This population is *Cephalorhynchus hectori maui* (Māui dolphin) and has been recognised as a subspecies of Hectors dolphin since 2002 (Baker et al., 2002, 2012). Māui dolphin are the smallest and rarest dolphin subspecies in the world and are listed as Nationally Critical under the NZ Threat Classification System and as Critically Endangered under the International Union for the Conservation of Nature Red List Categories and Criteria (ICUN, 2013; Baker et al. 2016; Reeves et al. 2013). Estimates have suggested that 95.5% of human-induced mortality in Māui dolphins is due to trawling and by-catch from gillnetting (Calderwood, 2014). Since the introduction of gill nets into New Zealand waters in the 1960's, there has been a significant population decline from an estimated 1500 to the current estimate of 63 (95% CI 57 – 75) individuals (Baker et al. 2016). Their home range used to be anywhere from Cook Strait to Ninety Mile Beach, but today they are only found from Maunganui bluff to New Plymouth (Slooten et al., 2005). Māui dolphins are slow breeders, with each female giving birth to one calf every 2-4 years, resulting in a low population growth of 2% per year (Department of Conservation, 2017a). Māui dolphin are in need of conservation intervention in order to avoid their expected extinction in the next 20-26 years (Burkhart and Slooten, 2003).

The first Threat Management Plan for Hector's and Māui dolphins was implemented in 2008 to ensure the long-term survival of their population by reducing impacts from human activity (Currey et al. 2012). The Māui dolphin portion of the Threat Management Plan was later reviewed in 2012 after four public sightings of these dolphins in the Taranaki coastal area. In the 2012 review, the updated Potential Biological Removal analysis estimated that Māui dolphin population could only sustain one human-induced mortality every 10 - 23 years without affecting the population's ability to rebuild to a sustainable level (Hamner et al. 2014). The current restrictions and prohibitions in the Taranaki coastal area is enforced under the Fisheries Act 1996 and the Marine Mammals Protection Act 1978. The Marine Mammal Sanctuary extends out to 12 nautical miles offshore from Maunganui Bluff to Oakura Beach (Parliamentary Counsel Office, 2018b; see *Appendix A*). This sanctuary includes restrictions on mining, with prohibition out to 2 nautical miles along the length of the Marine Mammal Sanctuary and out to 4 nautical miles from Manuka harbour to south of Raglan Harbour (New Zealand Gazette, 2012: Fisheries New Zealand, 2018: see *Appendix A*). Acoustic seismic surveying in this area is also restricted and must abide by the Code of conduct for minimising acoustic

disturbance to marine mammals (New Zealand Gazette, 2012: Department of Conservation, 2017b: see *Appendix A*). Along the west coast, there are also restrictions on set netting. From Maunganui Bluff to Waiwhakaiho River commercial and recreational set netting is prohibited out to 7 nautical miles (Parliamentary Counsel Office, 2018b; see *Appendix A* and *B*). From Waiwhakaiho River to Hawera commercial set netting is also prohibited out to 7 nautical miles unless an MPI observer is onboard (New Zealand Gazette, 2012: see *Appendix A* and *B)*.

In order to understand how we can best protect Māui dolphin, and increase their population to a sustainable level, more long-term and extensive information must be gathered. This helps maintain evidence for the current protection measures under the Threat Management Plan. Visual sightings of Māui are rare due to the fact that these dolphins themselves are rare and that there are fewer visitors to these remote and rough areas of coastline. Therefore, there is a need for a more reliable way of detecting them. Underwater acoustic devices called C-PODs detect the high frequency (120 – 125 kHz) echolocation clicks that Māui dolphins emit when foraging. These devices may be the way forward as they are able to log bioacoustic data through all hours of the day and night, and across long time periods. This gathers a much more extensive and informative data set as compared to aerial surveys which are limited to short term collection and are financially expensive and labour intensive. Information from this underwater acoustic technology can be used to determine the extent of Māui dolphin occurrence and about the temporal and spatial distribution of these mammals within their home range.

Aim

To investigate the spatial and temporal distribution of Māui dolphin in the Taranaki coastal area using C-POD technology.

Methods

To investigate the occurrence of Māui dolphin at various sites along the West Coast of the North Island, underwater bioacoustics devices called C-PODs were used. C-PODs detect odontocete click trains in the range of 20 – 160 kHz. Each C-POD sits one to two meters above an attached float, anchored by a 30 - 35 kg weight at the base (Hupman et al. 2018; Fig. 2). This positions the C-POD approximately three to four metres above the seabed.

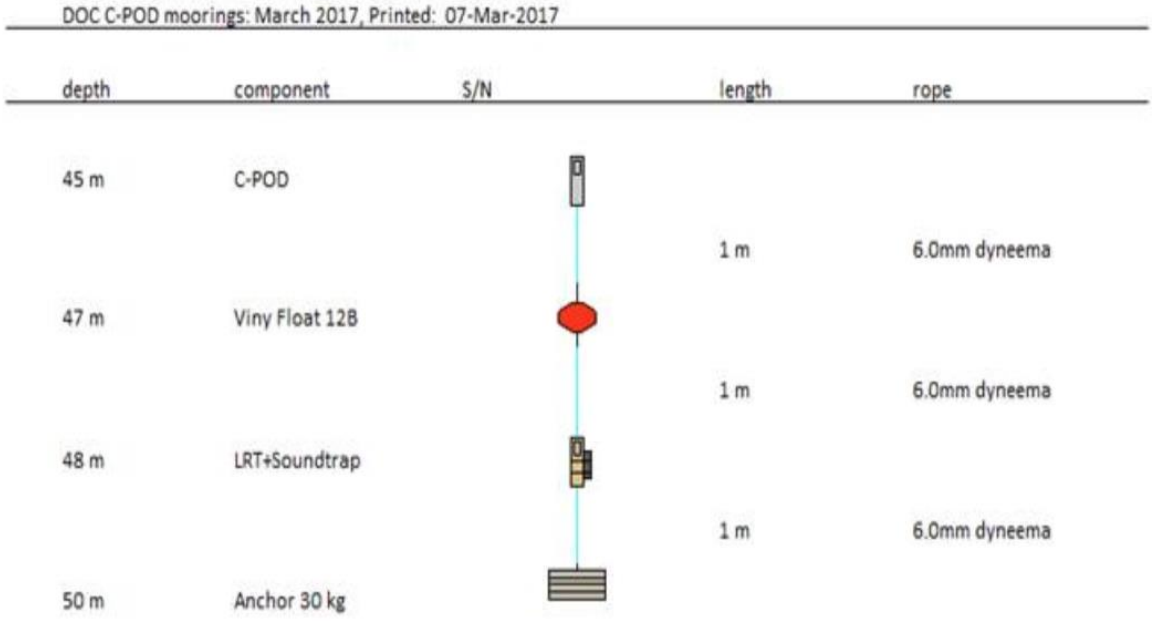


Fig. 2: Set-up of an underwater bioacoustic C-POD device with anchor placed on seabed (NIWA, 2018).

A total of two C-PODs were placed in the Taranaki coastal area (Fig 3). C-POD 2720 was placed 1.03 nautical miles (1.9km) offshore from Tongaporutu. C-POD 2718 was placed 1.12 nautical miles (2km) offshore from Motunui. Both C-PODs were deployed on the 15th of February 2018 and collected on the 3rd of July 2018. Further details of deployment and collection dates and times are presented in *Appendix D*.

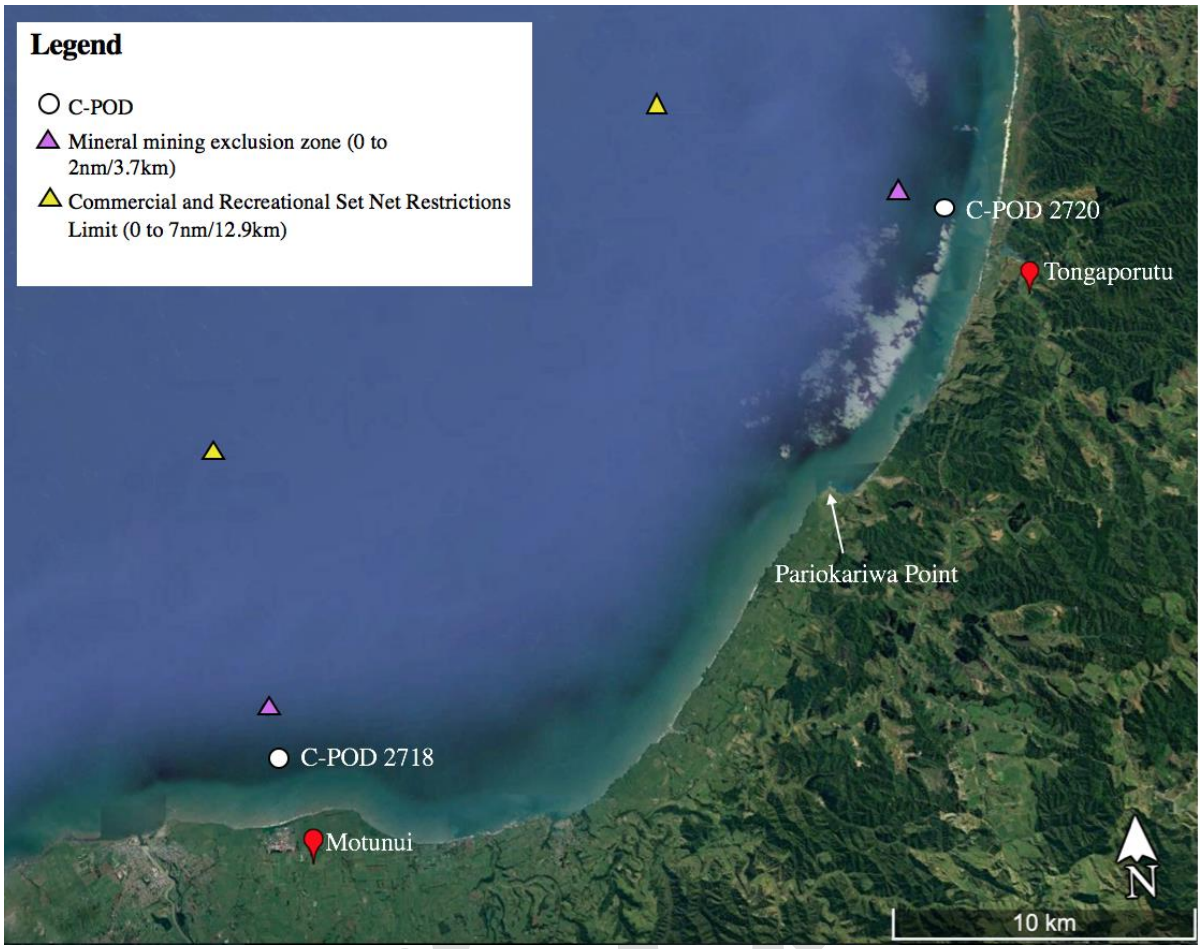


Fig. 3: Locations of C-PODs placed offshore from Tongaparoutu; C-POD 2720 at 1.03 nautical miles (1.9km), and offshore from Motunui; C-POD 2718 at 1.12 nautical miles (2km) in the Taranaki coastal area with limits of protection zones displayed in relation to C-POD location (Google Earth Pro, 2018).

Data Analysis

The data from each C-POD was downloaded and verified using C-POD.exe 2.064 software. The data was processed using the KERNO classifier and the train filter set to high quality. These filters improve the classification of detections and allow discrimination between species based on their click parameters. The KERNO classifier groups the data into four categories; Narrow Band High Frequency clicks (NBHF, see *Appendix C*), Other cetaceans, Sonar, and Unclassified source (e.g. Weak Unknown Train Sources). Māui dolphin have high frequency, narrow-band clicks (NBHF) with frequencies of between 120 - 125 kHz (Thorpe & Dawson, 1990). It is likely that the NBHF clicks are Māui dolphin's echolocation clicks.

The data were then manually analysed by looking through the file and ensuring the classifications were correct with any false positives being re-classified. Through the verification process 37% of the total number of high quality NBHF clicks were removed from the initial KERNO classification (see *Appendix C)*. The verified data from all C-PODs was exported as detection positive minutes (DPM; see *Appendix C*). The verified data was then run through Matlab software to produce click plots.

Results

Tongaporutu

A total of 11 DPM for high quality NBHF were recorded on the C-POD deployed offshore from Tongaporutu (Fig. 4, Fig. 5). These detections were made during mid-April and late June, with all detections recorded during night time hours (Fig. 4, Fig. 5).

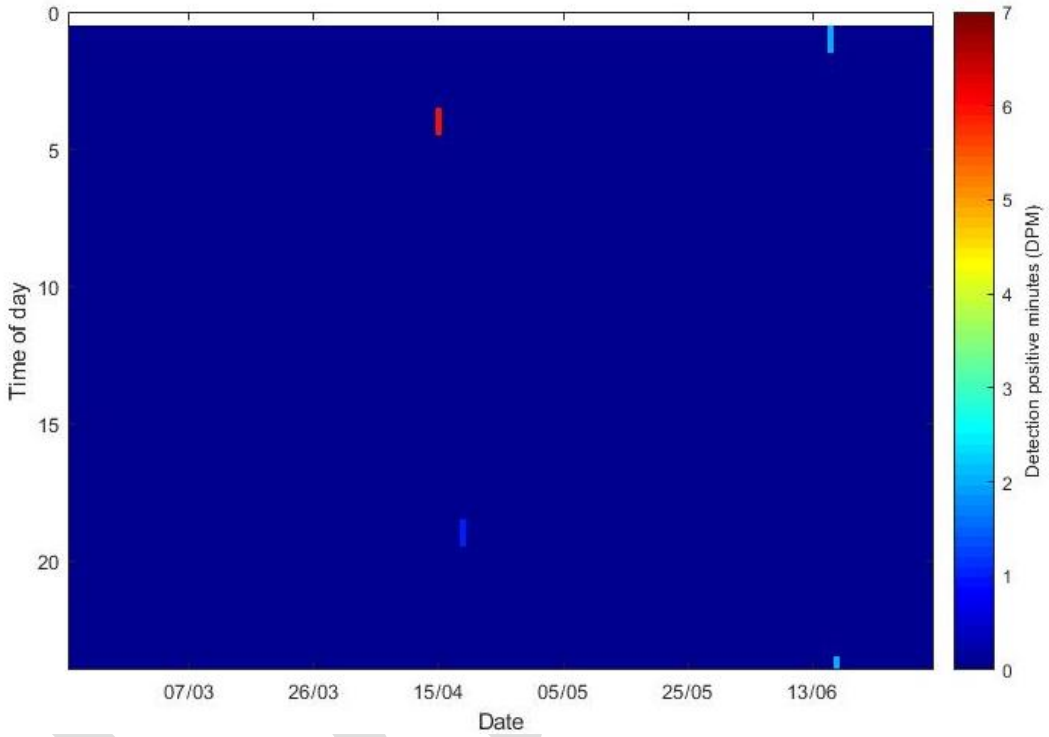


Fig. 4: Detection positive minutes (DPM) for high quality NBHF click trains detected at Tongaporutu C-POD positioned 1.03 nautical miles (1.9km) offshore from Tongaporutu coastline from the 15th January 2018 09:22 NZST to the 3rd July 2018 12:11 NZST.

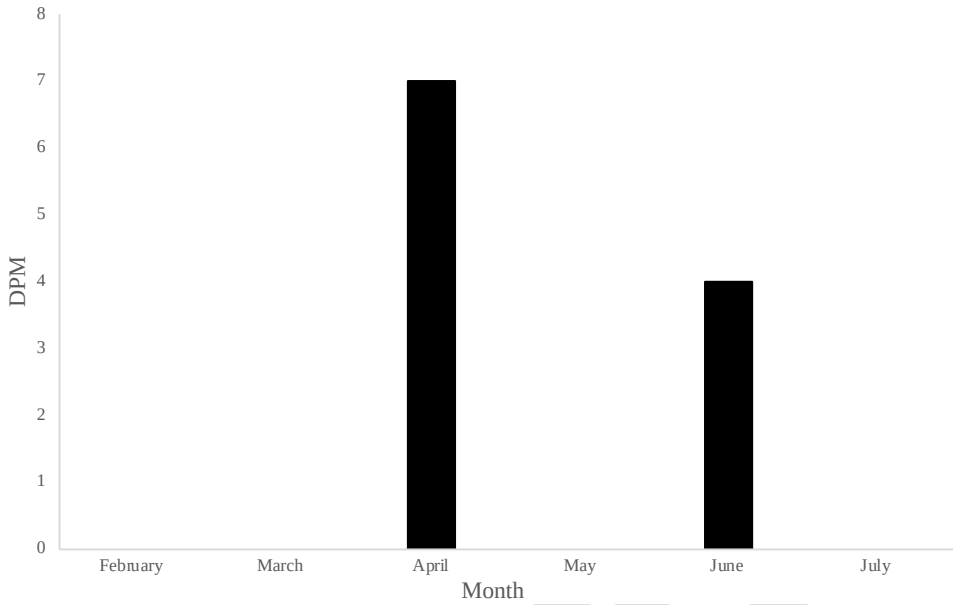


Fig. 5: Detection positive minutes (DPM) for high quality NBHF click trains detected offshore from Tongaporutu (C-POD 2720) from February to July 2018.

Motunui

There were no high quality NBHF detections recorded on the C-POD located offshore from Motunui.

Discussion

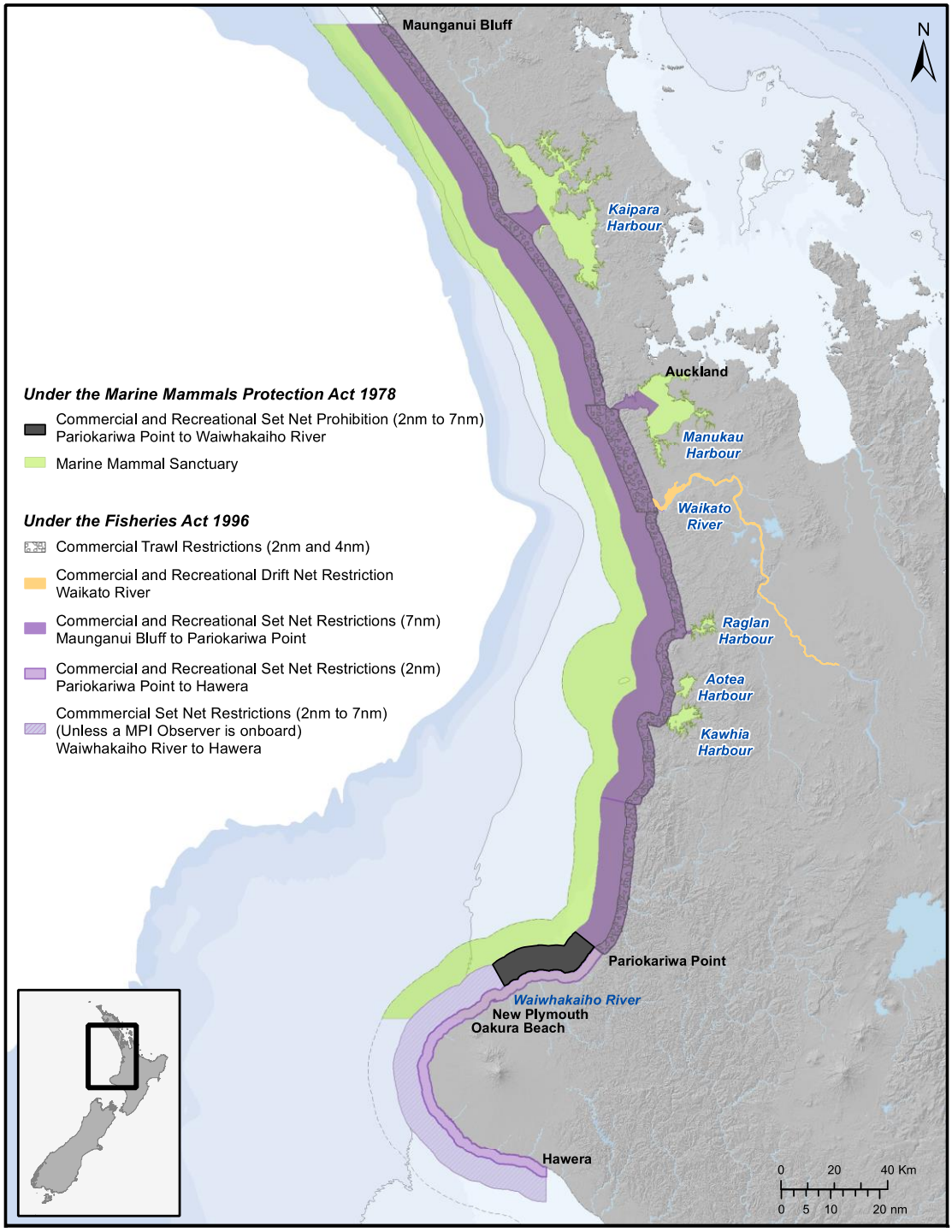
Current research is largely focused on Māui dolphin distribution within their core range. However, previous studies have given some insight into the overall distribution of this small population. For example, Oremus (2012) concludes that for the summer months of February and March, Māui dolphin have a small frequently used core area including two areas of high density; south of Manukau Harbour, offshore from Hamilton's Gap and south of the Waikato River mouth. Results gained from the previous deployments of C-PODs in these regions agree with these results. The aim of the Taranaki deployments was to determine how far south Māui dolphin venture. The data in this report shows a reasonable number of detections (11 DPM) at the C-POD placed offshore from Tongaporutu. These detections occurred in the months of April and June, with no detections from February to March. When considering previous research, C-PODs in Manukau coastal region find the highest amount of detections in the month of January. This may indicate a seasonal movement of Māui at the end of summer, down to more southern areas. However, current data from the Department of Conservation sightings database shows no such trend, with a biased towards summer months across all regions due to more people being out on the water (Department of Conservation, 2018). In order to better understand whether these movements are significant, more research is required to be carried out over longer periods of time.

All detections were made during night time hours. This trend was also seen in the Manukau coastal region C-PODs, indicating a behavioural diurnal pattern. More research is needed in this area to better understand this pattern to determine whether it is significant and the possible reasons for this behaviour.

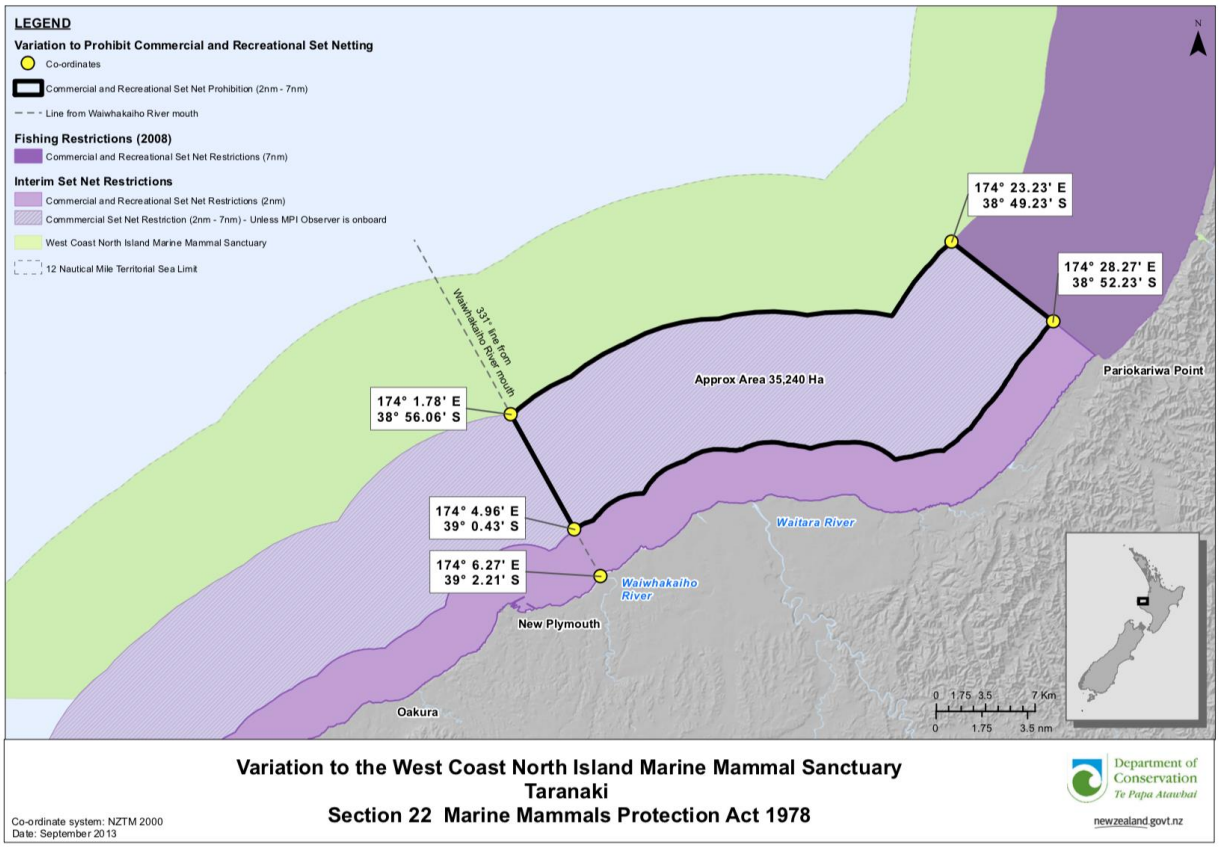
Limitations:

The main limitation to this research is that we cannot differentiate between Māui and Hector's dolphin with sound data alone, as both emit similar eco-location clicks. Genetic sampling needs to be taken alongside this data in order to determine this. The results of this study are dependent on all these NBHF detections being Māui/Hectors dolphins. Given that there are no other marine mammals in New Zealand waters that emit high frequency sound, it is safe to assume this. C-POD detections are also unreliable if the C-POD is not orientated in an upright position (*see Appendix D*). The C-PODs that had NBHF detections all were in various states of being off the vertical axis, due to wave action. When taking into consideration the angle of the C-POD, this decreases the reliability of the data gained in this study. All detections presented in this report have been verified through critical analysis of the C-POD angle and physical characteristics of the click data (including frequency, bandwidth, inter click rate, envelope etc.). High quality NBHF detections from the KERNO classification process that did not confidently satisfy all the critical factors required were removed from the data.

Appendix A: Protection measures under the Marine Mammals Protection Act 1978 and the Fisheries Act 1996 along the West Coast of the North Island, New Zealand (Department of Conservation 2017b).



Appendix B: Details of commercial and recreational set net restrictions in the Taranaki Coastal area (Department of Conservation, 2013).



Appendix C: Glossary of Terms.

Detection Positive Minutes (DPM): This is the number of one-minute periods in which click trains meet the filter criteria and is seen as a standard measure of how much time animals are present (Chelonia Limited, Cetacean Monitoring Systems, 2018). The filter criteria used in this report was High Quality detections and the species NBHF (from the KERNO classifier).

KERNO classifier*:* The C-POD.exe software runs through the file in the first analysis process. It categorises detections based on Q class (Low, medium or high quality of the detection), Species class (NBHF, other cetacean, sonar, unclassified source), species classification quality, ICI classification quality (determines if the clicks in the train are reliable or not in terms of surface echoes or missing clicks due to spikes of background noise) (Chelonia Limited, Cetacean Monitoring Systems, 2018). This classifier produces the unverified data. The second set is to go through the classified data and verify all the detections.

Narrow-Band High Frequency (NBHF): These are clicks characterised by narrow bands and high frequencies. This is typical of species including porpoises, dolphins in genus *Cephalorhynchus* and some in genus *Lagenorhynchus,* dwarf and pygmy sperm whales and Māui dolphins (Chelonia Limited, Cetacean Monitoring Systems, 2018). The only marine mammals in New Zealand waters that produce NBHF sound are Māui dolphin.

Appendix D: Summary data for Taranaki C-PODs, Second Deployment.

C-POD Mooring & Approx. distance offshore	Name	Deployment Latitude	Deployment Longitude	Total NBHF clicks found	Total Clicks in CP1 file	Clicks per hour (NBHF)	Clicks per day (NBHF)	DPM per day (NBHF)	File duration analysed (days/hours/ minutes)	Acoustic duration (days/hours/ minutes)	Mean Temp (degrees Celsius)	Mean Angle	N
Tongaporutu	POD 2720	38º48'0.146"S	174º34'0.063"E	1,169	8,502,305	0.43	10.25	0.10	138d 2h 22m	114d 44m (82%)	18	5	44
Motunui	POD2718	38º58'0.146"S	174º17'0.814"E	0	77,406,789	0	0	0	138d 2h 39m	113d 23h 54m (82%)	18	2	0

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