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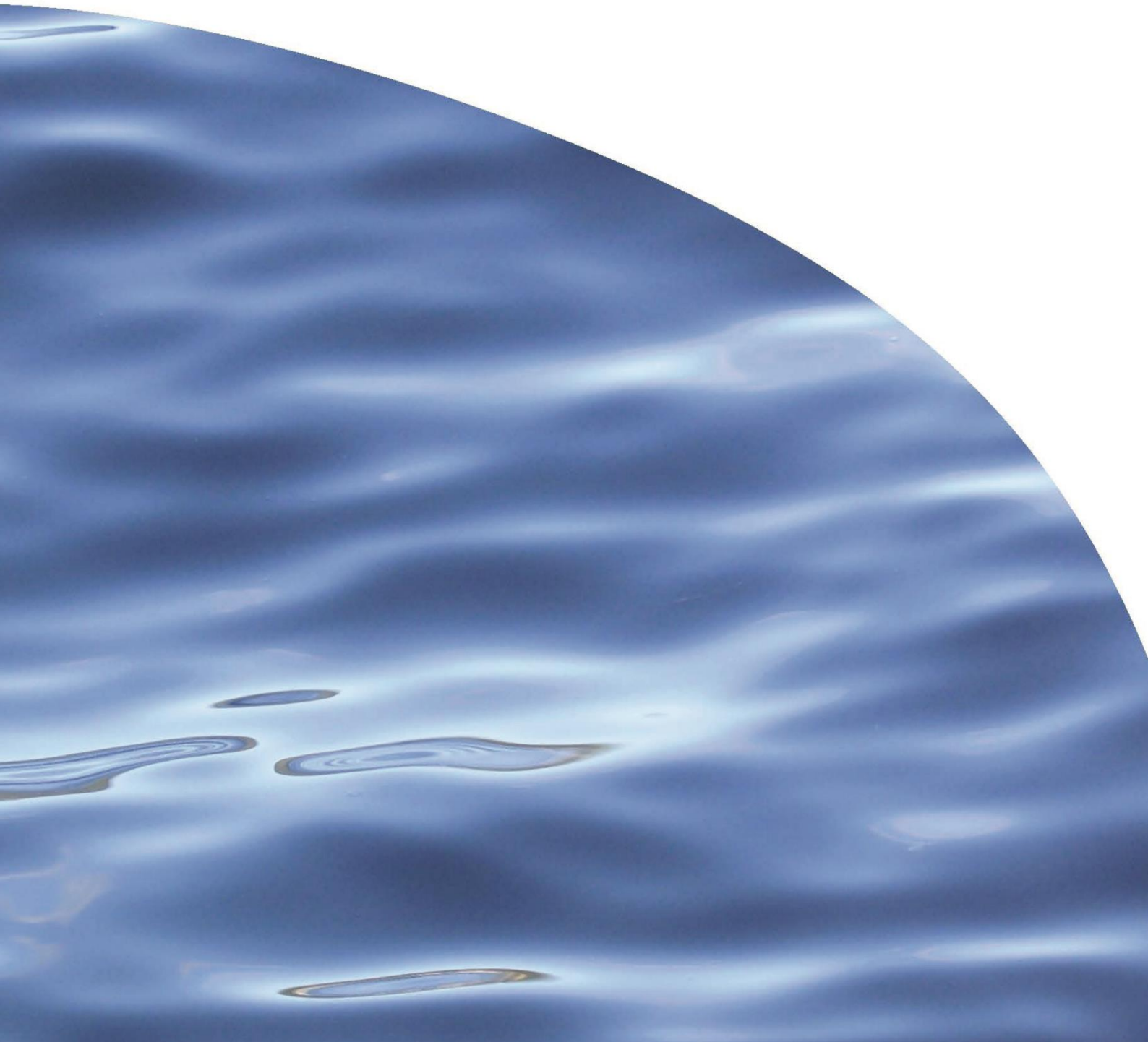

SENSITIVE HABITATS AND THREATENED SPECIES IN THE TARANAKI COASTAL MARINE AREA (TCMA) — DATABASE INVESTIGATION

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EXECUTIVE SUMMARY

Taranaki Regional Council (TRC) has commissioned Cawthron Institute to provide a desktop investigation for the assessment of outstanding and sensitive substrates/benthic habitats and threatened marine taxa in the Taranaki coastal marine area (TCMA), with particular emphasis on the less well known offshore areas. In order to address tier-one of the investigation, the Ocean Biogeographic information System (OBIS) online database was cross-referenced (compared) against threatened species lists and possible sensitive habitat indicator species lists. This resulted in the following findings:

- There were no 'threatened' invertebrate species matches within the TCMA boundaries.
- In the regional vicinity of the TCMA (within ~200 km from the boundary) there were records of five 'threatened' invertebrate species matches. The record matches suggest that these species, might be present within the TCMA: the hydroid *Nemertesia elongata,* the whelk *Cominella quoyana griseicalx,* the crab *Leptomithrax tuberculatus mortenseni*, the pin-cushion star *Eurygonias hyalacanthus)* and the stony coral species *Madrepora oculata*.
- Of the 13 EEZ (2012) sensitive environment groupings, there were 11 with indicator species matches[1] within, and in the regional vicinity of, the TCMA, as summarised below.

Sensitive habitats (EEZ 2012)	Within the TCMA	In vicinity* of the TCMA
(Beds of) large bivalve molluscs	x	-
Brachiopods	x	-
Bryozoans (thickets)	x	-
Calcareous tube worm (thickets)	x	-
Macro-algal (beds)	x	-
Sponge (gardens)	x	-
Rhodolith (maerl beds)	x	-
Chaetopteridae worm (fields)	-	x
Sea pens (field)	-	x
Stony coral (thickets)	-	x
Xenophyophores (sessile protozoan beds)	-	x
Deep-sea hydrothermal vents	-	-
Methane or cold seeps	-	-

*Within 200 km of the TCMA boundary

- Within the TCMA there were 220 unique taxa records (158 species), when compared to the rest of New Zealand's taxa records (using OBIS 2016). While some

[1] Where OBIS species records were sparse other information sources were investigated e.g. sea pens, coral, Chaetopteridae worms (using Cawthron's offshore database and Beaumont et al. 2013).

of these records appear to have resulted from Type 1 errors, results suggest that the TCMA could be more ecologically significant than previously thought.

- While this investigation yielded results that suggest sensitive marine habitats and threatened taxa are likely to exist within the TCMA, further physical investigation would be required to confirm the records, densities and spatial extents.

1. INTRODUCTION

1.1. Background

Taranaki Regional Council (TRC) has commissioned Cawthron Institute (Cawthron) to provide a desktop investigation for the assessment of outstanding and sensitive substrates/benthic habitats and threatened (and at-risk) marine taxa in the Taranaki coastal marine area (TCMA), with particular emphasis on the less well known offshore areas.

1.2. Scope

This report represents the first tier of a potentially two-tiered investigation. The scope of tier-one is comprised of the following components:

- identify and map threatened (and at-risk) taxa within, and in the wider vicinity of, the TCMA
- identify and map sensitive habitat within, and in the wider vicinity of, the TCMA
- identify unique taxa records within the TCMA (*i.e.* not occurring elsewhere in New Zealand)
- make recommendations for further investigation.

Each of these components is accompanied by support documentation in the form of GIS mapping packages (for external use) and Excel™ spreadsheets (for internal use).

If necessary, a second tier would follow on from this report, providing further investigation to address any identified information gaps.

1.3. Taranaki Coastal Marine Area (TCMA)

The coastal marine area (CMA) is the area between the territorial sea limit (12 nautical miles offshore) and the line of Mean High Water Spring (MHWS). The following sections describe characteristics of the Taranaki Coastal Marine Area (TCMA, Figure 1) from publicly available information sources.

1.3.1. Physical description

The Department of Conservation (DOC 2011) describes North Taranaki Bight and the South Taranaki Bight as different marine biogeographic regions (Figure 1). The South Taranaki area is comprised of more gravel, sand and rock (higher energy) habitats, whereas there are generally more muds, fine sands and depositional sediments occurring in the North Taranaki Bight area.

TCMA depths at the 12 mile boundary (territorial sea limits) range from 17 m to 130 m. The TCMA shallows to the north and south, with the deepest area (130 m) in the middle of the CMA, closest to the 12 mile boundary, northwest of Cape Egmont (approx. 1645387.626E; 5666699.104N).

The shallow shelf area in the southern TCMA is large with a greater proportion of shallow patchy bank/reef high energy habitat compared to other North Island coastlines (NZ LINZ chart). The southern shallow shelf area extends offshore approximately 2.5 km from adjacent Opunake, and increases in size to the south, extending approximately 25 km just west of Patea (100% of the CMA in this area). This area includes Patea Banks, and the North Trap, South Trap, Whenuakura Spur, Graham Bank and while outside the TCMA, the Rolling Ground (a shallow offshore reef —16 m depth) is near to the boundary (~4 km away). Within this shallow shelf area there are a number of even shallower patches (reefs/banks). Given that this area is very shallow, the prevailing weather and currents are likely to have strong effects on the benthic environment. The shallow shelf reduces to 7–10 km from shore adjacent Waiinu Beach (the inner edge of the TCMA), and continues to reduce in size and depth to the south (outside of the TCMA).

There are potential similarities between the finer sediment mud habitats and benthic communities in the Taranaki CMA and some of the Taranaki offshore areas (outside of the CMA), as described in DOC (2011), McKnight (1969), Grange (1991); and from the Cawthron offshore database (Caddis™ Database 2016). The nearby offshore habitats (outside the TCMA 12 mile zone) studied were soft sediment environments dominated by the fine silt and clay fractions, as opposed to some of the higher energy, coarser grain-size habitats found closer to shore. There may be similarities between habitats in the mid and north Taranaki Bight deep-mud lens (DOC 2011) and the offshore areas, particularly given their comparable sediment grain-size descriptions.

The South Taranaki area was noted in Beaumont et al. (2009) as being ‘important’ habitat in terms of polychaete diversity, and was noted as having three to four species (per ‘cell’[2]) of threatened invertebrate species (species undefined in report). However, the TCMA as a whole was ranked low in terms of habitat complexity, suggesting that while they are distinct biogeographic areas, the North Taranaki and South Taranaki areas are each uniform physical environments. The report specifies that the habitat and biological diversity of the Taranaki coastline ‘stand(s) out as being of overall low importance.’ However, it is noted that the ranking was generated using patchily-distributed presence-only data, and that results from Beaumont et al. (2013) suggest the South Taranaki area may be more diverse than some of the previous references and charts suggested.

[2] In order to map the measures of marine environmental value around New Zealand Beaumont et al. (2009) divided the NZ coastal area into smaller units called coastal ‘cells’. Approximately 300 cells were defined.

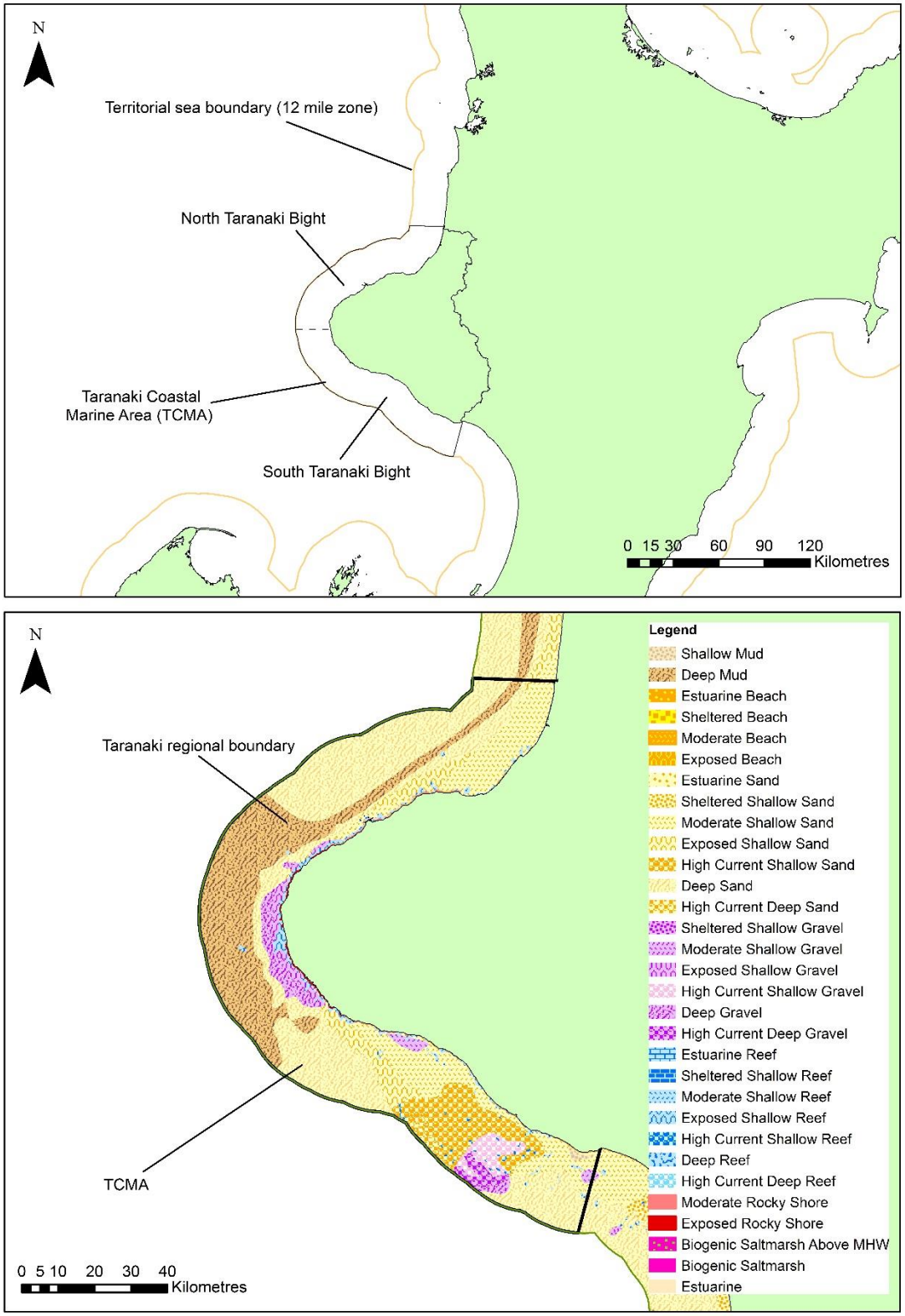

Figure 1. Top: Taranaki regional boundary and coastal marine area (CMA), New Zealand. Bottom: Map of the coastal marine habitat classification for the Taranaki coastal marine area, New Zealand (DOC 2011). Note: the key only includes those habitats present in the current map extent (~50% of the total possible habitat categories in New Zealand).

Marine protected areas

There are three main marine protected areas within the TCMA, the Parininihi Marine Reserve, Sugar Loaf Islands Marine Protected Area, and Tapuae Marine Reserve. In the North Taranaki Bight area there is also a specialised marine mammal sanctuary (Figure 2), which is part of the West Coast North Island (WCNI) Marine Mammal Sanctuary, founded in 2008 to help protect the critically endangered Māui dolphin (DOC 2015).

Anthropogenic structures

Taranaki also has areas that are restricted from marine activities (such as fishing and dredging) for the purpose of protecting anthropogenic structures and facilities relating to oil and gas production (Figure 2). The restrictions on sediment disturbance activities in these locations may have inadvertently shaped localised refuges for marine species within the TCMA.

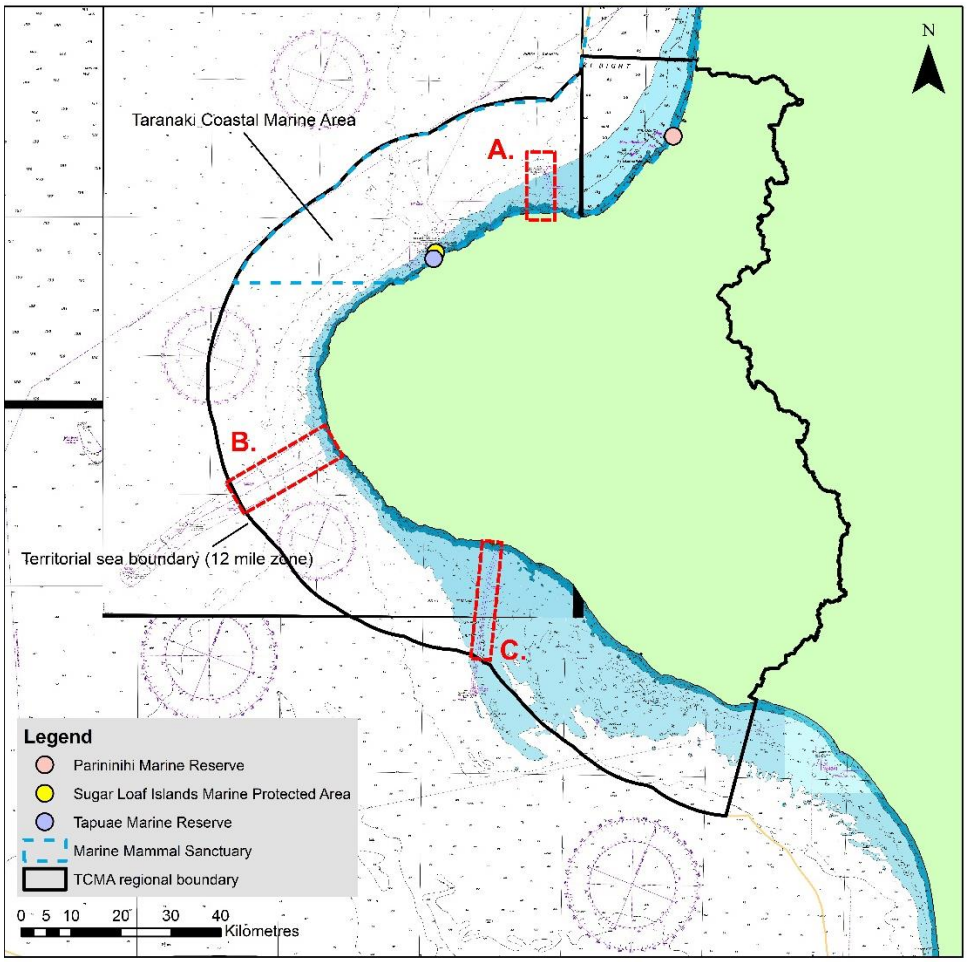

Figure 2. Taranaki coastal marine area (TCMA), anthropogenic marine structures/protection areas, marine reserves, and marine protected areas, over-laid on LINZ charts NZ43, 443 and 45. Outlined in red: A. Pohokura safety zone and protection area, B. Maui pipeline protection/restricted area, C. Kupe pipeline protection area.

1.3.2. Sensitive habitats background

The initial investigative letter by Johnston (2015) summarised sensitive and outstanding taxa/habitats within the TCMA. It outlined habitats and substrate which might warrant protection, based on a limited number of information sources (references therein). These taxa/habitats are listed as follows:

- sensitive coastal habitats: Taranaki Regional Council has defined a list of 66 sites as 'sensitive' habitats along the Taranaki coastline (MOSCP 2012)
- possible sensitive 'offshore' habitats—generic: The sensitive habitat types described in Schedule 6 of the EEZ Act (Exclusive Economic Zone and Continental Shelf Act; EEZ 2012) and MacDiarmid et al. (2013) represent a reasonable bench mark, or at least a starting point, for which habitats should be protected
- possible sensitive nearshore habitats within the TCMA:
    - North and South Traps. These are already identified as sensitive habitats in TRC's Marine Oil Spill Contingency Plan (MOSCP 2012), but could be investigated further
    - Patea Shoals / Rolling Ground area (LINZ charts and Beaumont et al. 2013) are worth considering as outstanding habitats in terms of ecological sensitivity (EEZ 2012), particularly the following sensitive habitats:
        - bryozoan rubble (possible thickets)
        - bivalve rubble
        - bivalve beds
        - other possible sensitive habitat identifiers (brachiopods, algae and sponges) described in the report by Beaumont et al. (2013)
    - Graham Bank has not been investigated (as far as is known), and may be a potentially outstanding area.

As per the recommendations from Johnston (2015), in order to identify additional outstanding habitats/substrates within the TCMA, marine taxa databases have been explored further for:

- characteristic species of sensitive environments (EEZ 2012)
- the New Zealand Threat Classification System lists (Freeman et al. 2010).

2. METHODS

Methods used for this investigation were desk-top based, with specific focus on examination of existing information in the form of databases, regional taxa lists, reports and legislation. How each of these information sources was used to assess the sensitive taxa and habitats of the TCMA is described in the following sections.

2.1. Obtaining a New Zealand marine invertebrate species list

In the first instance, a robust New Zealand marine invertebrate species list was required for comparison with threatened species lists, indicator taxa of sensitive environments and Taranaki-region specific records.

Taranaki-regional and New Zealand-wide taxa lists were obtained from the Ocean Biogeographic Information System (OBIS) online database (OBIS 2016). The spatial extent of the Taranaki OBIS taxa export was defined as including any record from within approximately 200 km from the TCMA boundary. The spatial extent of the New Zealand OBIS (2016) taxa export was defined as any invertebrate record with the spatial extent listed as 'New Zealand.'

Note: While OBIS is useful to provide context on sensitive environments in the TCMA, it is worth highlighting that OBIS records are derived from patchy presence/absence data, and are by no means a complete record of taxa in the region. The OBIS (2016) taxa list is therefore only intended to be indicative. Also, while the overall accuracy of the OBIS record locations were reliable, there were occasional outliers. Where these were considered extreme, the records were removed from the data-set.

2.2. Determining threatened taxa

To gain some insight into which taxa may be threatened or at risk within the TCMA, the 'conservation status of New Zealand marine invertebrates' list ('Excel™ spreadsheet' file derived from; Freeman et al. 2010, containing 311 invertebrate taxa) was cross-referenced against Taranaki regional taxa lists obtained from the Ocean Biogeographic information System (OBIS) online database (OBIS 2016).

Taxa listed in Freeman et al. (2010), are classified using a combination of terms, e.g., 'threatened', 'at-risk', 'naturally uncommon', 'nationally vulnerable' or 'range-restricted'. However, for the purpose of this assessment any taxa described using these terms are summarised as 'threatened.' Further details of the nature of the threat are provided in the individual results Sections (3.1.1 to 3.1.5).

2.3. Determining sensitive and/or outstanding habitats

For the purpose of this investigation (and in the absence of any other relevant guidance) the EEZ (2012) sensitive environments list[3] has been used as an indication of sensitive and/or outstanding habitats that might be present in the deeper, outer-reaches of the TCMA.

The 'sensitivity' of environments is described in MacDiarmid et al. (2013) as being defined by:

- **Tolerance** - of a species or habitat to damage from an external factor. Tolerance also incorporates rarity; the rarer a habitat is, the more an external factor is likely to damage a significant proportion of the habitat, and therefore it is assigned a lower tolerance rating.
- **Recovery time** - the time taken for its subsequent recovery from damage sustained as a result of an external factor.

Sensitive and/or outstanding habitats were identified by cross-referencing the indicator taxa specified in Schedule 6 of the EEZ Act (2012) (Summary table in Appendix 1) against Taranaki regional taxa lists obtained from the Ocean Biogeographic Information System (OBIS) online database (OBIS 2016). Where the OBIS database was found to be particularly low in indicator taxa data, other available databases and reports were investigated. Specifically:

- For additional sea pen and worm species records, the Cawthron database (Caddis™ Database 2016) was interrogated. However as these are client-owned data, only limited detail (presence/absence only) could be used without client approval.
- Beaumont (2013) was often referred to for information on other potential biogenic habitats in the area.

2.3.1. Possible indicator taxa selection

Where indicator taxa were not specified in the Exclusive Economic Zone and Continental Shelf Act (EEZ 2012) or MacDiarmid et al. (2013), possible 'indicator' taxa for these habitats were identified from publicly available references (references listed in Appendix 5). This method of selecting indicator taxa is therefore referred to here as 'possible indicator taxa,' and should not be used as a definitive list, as they are only approximations based on available information.

[3] The EEZ (2012) sensitive environments list was developed for use in New Zealand's exclusive economic zone, rather than the territorial seas.

2.4. Unique taxa records

In order to gain some idea of whether unique species occur within the TCMA, the OBIS (2016) database was investigated further. Taxa records within the TCMA were compared to those recorded elsewhere in the New Zealand Exclusive Economic Zone (EEZ). This provided a list of taxa exclusive to the TCMA area (unique taxa records).

Note: Some of these taxa record comparisons were impacted by Type 1 errors (detecting an effect that is not present). This was caused by differences in taxonomic resolution, typographic errors and patchy taxa records (in the OBIS database). However, it was outside of the scope of this investigation to groom the data further; therefore these errors have not been identified/removed.

Regional (within the TCMA) and national (NZ wide) distributions of potentially outstanding or sensitive habitats and threatened taxa were also discussed in each species- or habitat-specific report section. MacDiarmid et al. (2013) was often referred to for information regarding the regional and national distributions of sensitive species/habitats.

2.5. Data presentation

Results have been presented in Excel™ spreadsheets (lists). Species match locations have also been presented as geographic information system (GIS) mapping packages (using ArcMap 10.2.2). Maps were designed and edited for the purposes of adding future data, and public distribution. Excel™ sheets were designed for the purpose of internal use only.

3. RESULTS

The OBIS database extraction yielded over 150,000 taxa records in the vicinity of the TCMA (Appendix 3). Cross-referenced results for Taranaki CMA's threatened, at-risk and regionally significant taxa and possible sensitive environments/habitats are discussed in the following sections.

3.1. Threatened taxa

There were no threatened species list (Freeman et al. 2010) matches within the actual TCMA (OBIS 2016). However, there were five species detected in the vicinity of the TCMA (i.e. offshore and in neighbouring CMAs). These species are listed and described below in order of proximity to the CMA boundary. Cross-referenced results for Taranaki CMA's threatened, at-risk and regionally significant taxa are mapped in Figure 3 (with lists and GIS mapping files in Appendix 4).

3.1.1. Nemertesia elongata (Totton 1930)

Nemertesia elongata is a leptolid hydroid. It is a habitat-forming hydroid, with large colonial growths. It is considered an ecologically important biogenic substrata and is recorded from Spirits Bay to Foveaux Strait (Freeman et al. 2010). The *N. elongata* is classified by the threatened species list as 'at risk' and 'naturally uncommon,' and is reportedly threatened by bottom trawling and dredging (Freeman et al. 2010).

Given that *N. elongata* has been found nearby in the surrounding CMAs 17-14 km from both the most northern and southern boundaries of the TCMA, located between depth contours 0-50 m), it is possible that it also inhabits the TCMA.

3.1.2. Cominella quoyana griseicalx (Willan 1979)

Cominella quoyana griseicalx is a marine gastropod mollusc (snail) in the family Buccinidae. The threatened species list specifies that it is 'at risk' and 'naturally uncommon' with a 'range restricted' distribution (Freeman et al. 2010).

This marine snail was recorded approximately 42 km from the TCMA boundary (WNW of New Plymouth). Given the reasonably close proximity of the records to the TCMA boundary, and that there are some benthic substrates similar to that within the TCMA (~130 m depth mud and fine sand), it is possible that *C. quoyana griseicalx* may be present in the TCMA.

3.1.3. Madrepora oculata (Linnaeus 1758)

Also called the zigzag coral, *Madrepora oculata* is a stony coral (order: Scleractinia) that is found worldwide (excluding polar regions), growing at depths of 80–1500 m. It

is one of the protected coral groups listed in both the Wildlife Act (Wildlife Act 1953) and the Coral Identification Guide by Tracey (2014). The threatened species list (Freeman et al. 2010) identifies *Madrepora oculata* as 'threatened' and 'nationally vulnerable' with a, 'D' status (5000–20,000 mature individuals) and '1/1' trend (decreasing 30–70%). In comparison to NZ populations, this coral is noted to have secure populations overseas.

The record for this coral in closest proximity to the TCMA was approximately 52 km WNW of the TCMA boundary. This area has many similarities in habitat, including depth (~130 m), and benthic substrate (mud and fine sand) to the marine areas adjacent Cape Egmont, within the TCMA. Given these similarities, and the relatively close proximity of other *Madrepora oculata* records, it is possible that the coral may also be present within the TCMA.

3.1.4. Leptomithrax tuberculatus mortenseni (Bennett 1964)

Leptomithrax tuberculatus mortenseni is a decapod crustacean (crab) in the family Majidae. The species was described in Yaldwyn and Webber (2011) as endemic to northern New Zealand and the Kermadec Islands, with a prevalence on inner shelf areas. The threatened species list (Freeman et al. 2010) identifies it as 'at risk' and 'naturally uncommon' with a 'range restricted' distribution.

This crab was recorded approximately 94 km from the TCMA boundary, near the 50 m depth contour on the eastern side of D'Urville Island (South Island). The DOC (2011) habitat type layer describes the substrate off D'Urville Island as 'High Current Shallow Sand'. Similar substrate, and inner shelf habitat, is prevalent in the vicinity of Patea within the TCMA, which suggests that *Leptomithrax t. mortenseni* may occur in this area of the TCMA.

3.1.5. Eurygonias hyalacanthus (Farquhar 1913)

Eurygonias hyalacanthus is a type of pin-cushion star with short arms, covered in distinctive bumps. The threatened species list (Freeman. 2010) identifies it as 'at risk' and 'naturally uncommon' with a 'sparse,' 'range restricted,' distribution. It is noted as present in the following locations: Cook Strait/Kapiti Island area, Stewart Island, Snares Islands, Cape Palliser/Wairarapa, Ruby's Reef (Kaikoura).

The closest record for *E. hyalacanthus* from the OBIS (2016) database was from the Cook Strait, about 156 km from the TCMA boundary, on the 100–150 m depth contour. *Eurygonias hyalacanthus* was (in this instance) found in high current deep sands and gravels (DOC 2011), similar to those found offshore from Patea. While the TCMA and Cook Strait areas are spatially distinct with undoubted differences in coastal currents, the similarities in habitat/sediment type suggest that *E. hyalacanthus* could potentially occur in areas of the TCMA.

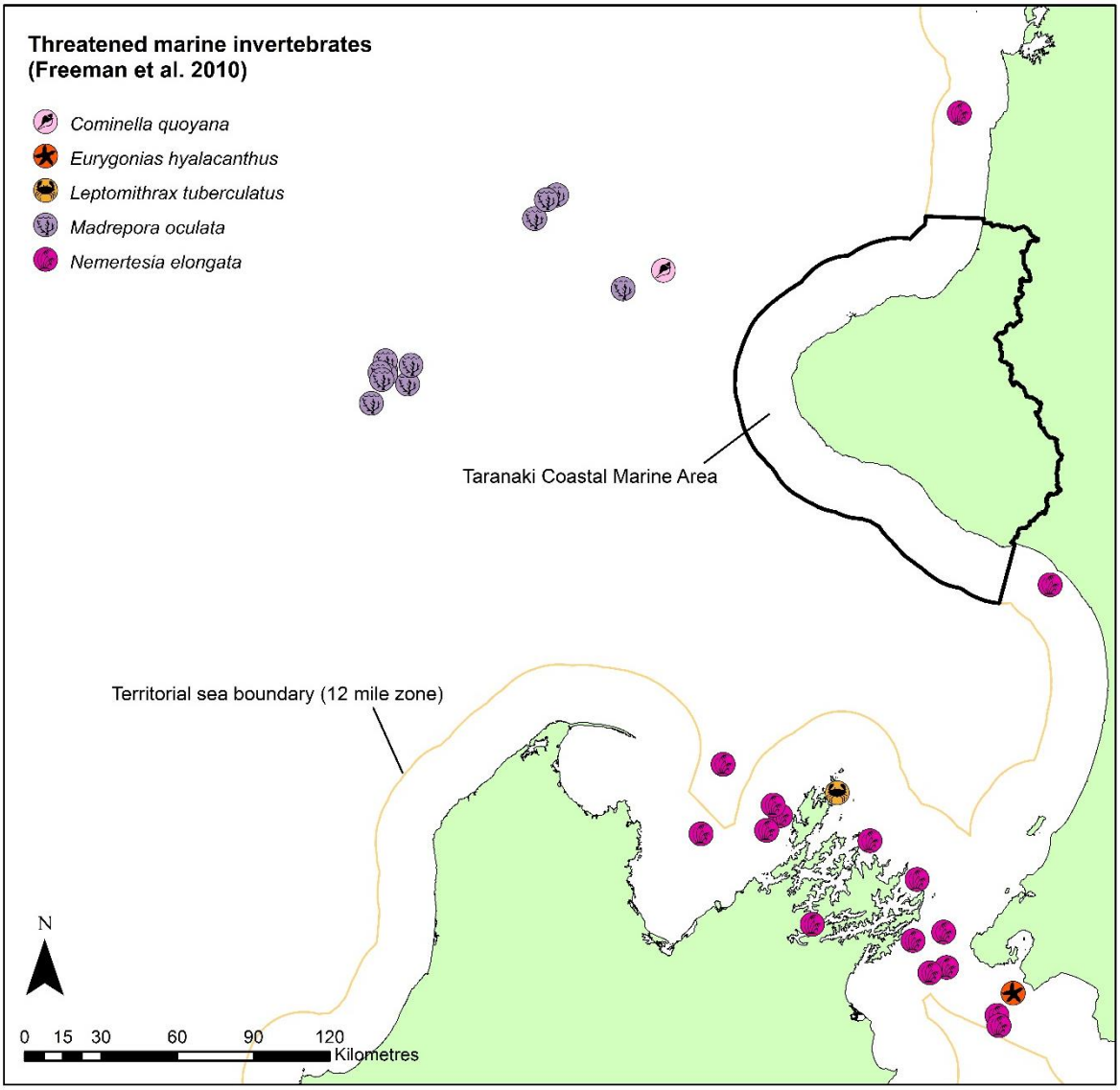

Figure 3. Taranaki coastal marine area (TCMA), in relation to the closest recorded instances of threatened marine invertebrates, as listed in the Excel™/electronic version of Freeman et al. (2010).

3.2. Sensitive and/or outstanding habitats

Of the thirteen EEZ (2012) sensitive environment (habitat) groupings (Appendix 1), 11 exhibited indicator species matches for locations within, and in the vicinity of, the TCMA. For each of these 11 sensitive habitats, possible indicator species and likelihood of occurrence within the TCMA are described in the following sections. Cross-referenced results for possible sensitive environments/habitats are mapped in Figure 4 (with lists and associated GIS mapping files in Appendix 5).

Note: none of the indicator species listed (by EEZ 2012) for deep sea hydrothermal vents or methane / cold seeps were present in the OBIS (2016) taxa list export.

3.2.1. Beds of large bivalve molluscs

Bivalvia is a superorder within the phylum Mollusca, commonly called shellfish. They are characterised by their shell, which has two halves (valves) connected by a ligament, hinge and adductor muscles (clams, mussels, oysters, scallops, etc.).

The EEZ (2012) criteria for identification of sensitive 'bed of large bivalve' habitats, appears to refer to biomass (Appendix 1), rather than the individual size (e.g. shell length) of the bivalve (as the category suggests). Therefore, it may be more appropriate to think of this category as 'large beds of bivalve molluscs'.

Out of 98[4] possible bivalve indicator taxa (obtained from; Tracey et al. 2011; Caddis™ Database 2016) cross-referenced against the OBIS database, 54 matches (over 36 sites) were identified as occurring within the TCMA (Figure 4). The 5 most common bivalve taxa records within the TCMA were; *Glycymeris modesta, Scalpomactra scalpellum*, *Nemocardium pulchellum*, *Notocallista multistriata* and *Tawera spissa.* With 2608 OBIS record matches within approx. 200 km of the TCMA boundary, bivalves were the most common of the possible habitat indicators detected in the TCMA (Figure 4).

As the OBIS (2016) results related to presence/absence rather than biomass or abundance, it was not possible to accurately determine whether the records constituted 'large' bivalve beds (based on the EEZ 2012 criteria). Also, the criteria specifies that the bivalves can be living or dead. To what extent broken shell / dead shell constitutes a bivalve bed is not specified. However, the shelly sand types occurring predominantly in the Southern Taranaki Bight region (LINZ marine chart NZ45), and *Tucetona* bivalve beds (live and dead/rubble) found at Patea Shoals (South Taranaki; Beaumont et al. 2013) could potentially fit the EEZ (2012: Appendix 1) description of a sensitive offshore habitat as well.

[4] According to Tracey et al. (2011) there are 680 species of bivalve in NZ, with 231 still undescribed. However, only 98 taxa names have been used in this analysis, as that was all that was obtainable from the available references.

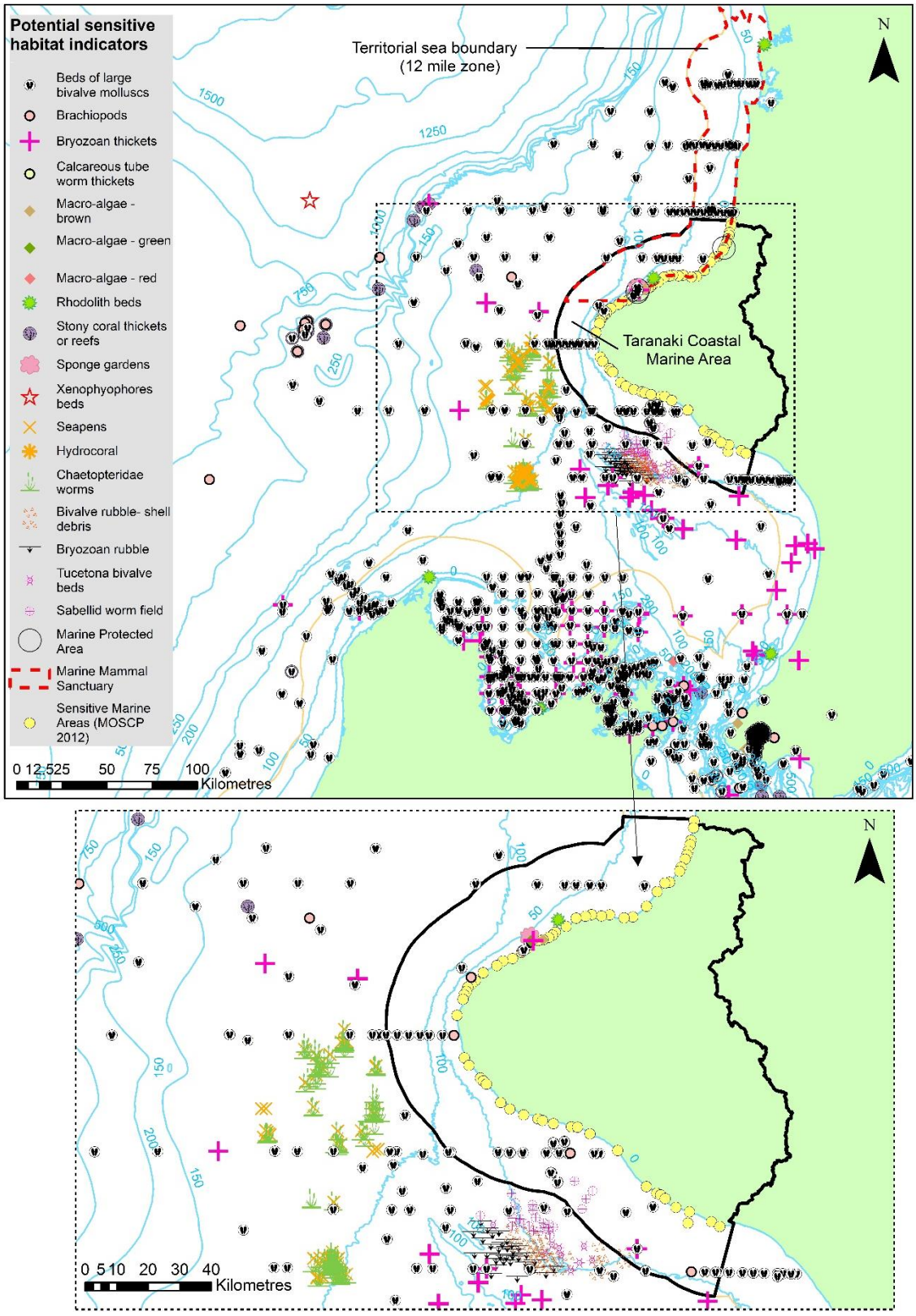

Figure 4. The Taranaki coastal marine area (TCMA), in relation to records of possible sensitive marine habitat indicators (as described in Wildlife Act 1953; EEZ 2012; MOSCP 2012). within the wider regional area. Inset map (lower) is a magnified subset, South Taranaki Bight. For further detail refer to Appendix 5.

3.2.2. Brachiopods

Brachiopods (lamp shells) are a phylum of organisms that resemble bivalve molluscs, but the valves enclose the body dorsally and ventrally rather than laterally. Some species attach to substrate via a short stalk emerging from the hinge area of the valves (Tracey et al. 2011). Bowen (1968) described Brachipoda as a 'rare or minor element of the marine fauna' and a 'declining group of marine organisms'.

Out of 10 possible brachiopod indicator taxa (obtained from Bowen 1968) cross-referenced against the OBIS (2016) database, three matches[5] (over eight sites) were identified within the TCMA (Figure 4); *Liothyrella*, *Magasella* and *Waltonia* (synonym *Calloria*). The locations of brachiopod records within the TCMA were reasonably wide spread, extending north adjacent to Puniho/Okato, and south, to the southernmost extent of the region. The furthest offshore of these records were for *Magasella*, located near the TCMA boundary (12 miles) to the south and southeast of Patea Shoals. In addition to this, there were 93 taxa matches from the wider surrounding area, around 200 kms from the TCMA boundary.

Beaumont (2013) collected a total of 395 brachiopod specimens from three species (*Calloria inconspicua, Neothyris lenticularis* and *Terebratella* sp.) in dredge samples from Patea Shoals, predominantly from bryozoan rubble habitats (Figure 4; inset map), with some from the mid-shelf areas. Brachiopods were also recorded as prevalent in the still photographs taken at most sites in the bryozoan rubble habitats (Section 5.3.3 below).

Given these findings, and the EEZ (2012) habitat criteria (Appendix 1), the TCMA does appear likely to have sensitive brachiopod habitat present.

3.2.3. Bryozoan thickets

Bryozoans mostly form calcium carbonate crusts or tufts that may superficially resemble other forms of marine life. They occur in a range of forms including; encrusting (resembling a moss-like layer), mats with upright folds (resembling small corals), perforated mats (i.e. lace 'corals'), tufted or bushy species (resembling hydroids or small seaweeds). Some large and abundant marine bryozoans form a type of bottom habitat referred to as a thicket. Bryozoan thickets (in particular frame-building varieties) provide habitat, refuge and resources for other organisms (e.g. hydroids, ascidians, barnacles, worms, sponges, sea stars, crustaceans, and fish; Smith & Gordon 2011).

Out of 86 possible bryozoan indicator taxa (obtained from Smith & Gordon 2011; Environment Guide 2016) cross-referenced against the OBIS database, 11 matches

[5] Identified to genus level only.

(over two sites[6]) were identified within the TCMA (Figure 4); *Akatopora circumsaepta, Cellaria immerse, Celleporaria agglutinans, Diaperoecia purpurascens, Escharoides angela, Escharoides excavate, Hippellozoon novaezelandiae, Hippomenella vellicata, Odontionella cyclops, Telopora lobata, Watersipora subtorquata.* The locations of these two sites within the TCMA were relatively distant, with one record to the north on the shoreline near the Sugar Loaf Islands, and the other to the south of the TCMA, near Grahams Bank (approx. 40 m depth, 17 km offshore). There were more than 20 bryozoan record matches outside of the TCMA (Figure 4, Appendix 5).

The Environment Guide[7] (2016) described two of the habitat-forming bryozoan species from the cross-reference matches (*Celleporaria agglutinans* and *Hippomenella vellicata),* found at the site furthest offshore (Figures 4, Appendix 5), as being important indicators of sensitive environments.

Beaumont et al. (2013) describes presence of 'bryozoan rubble' in the region (Figure 4).The rubble consisted of shell debris (below 60 m) heavily encrusted with late stage colonisers, dominated by branching bryozoans and other sessile suspension-feeding invertebrates. Their descriptions of the rubble habitat indicate it was fragile and of 'breakable nature.' Dredge samples of bryozoan rubble collected up to 3896 live specimens across combined taxa, with a total of 14,680 live bryozoan colonies from 161 species recorded from the dredge data. Several of the species collected by Beaumont et al. (2013) are known to form significant habitats in other parts of the country[8].

Given these findings and the EEZ (2012) habitat criteria (listed in Appendix 1), the TCMA appears to have sensitive frame-building bryozoan thicket habitat present.

3.2.4. Calcareous tube worm thickets

Calcareous tube worm thickets are formed by calcium carbonate secreting tube worm species that are large and abundant enough to provide biogenic habitat for other species. They occur at all depths in coastal, intertidal and abyssal waters (MacDiarmid et al. 2013; Environment Guide 2016).

Out of three possible calcareous tube worm indicator taxa (obtained from Morrison et al. 2014; Environment Guide 2016) which were cross-referenced against the OBIS (2016) database, one taxa match *Galeolaria hystrix* was identified over two sites within the TCMA (and the general vicinity, Figure 4, Appendix 5). Both records were on the rocky shore within and just south of the Sugar Loaf Marine Protected Area. In

[6] For better resolution the reader is referred to the electronic mapping files in Appendix 5.
[7] Environment Guide (2016): Sensitive environments were identified using the MarLIN method developed by the United Kingdom's Marine Life Information Network.
[8] e.g. *Cinctipora elegans* on the Otago Shelf and in Foveaux Strait, *Celleporaria agglutinans* ('Tasman Bay coral') in Tasman Bay and elsewhere, *Celleporina grandis* on Otago Shelf, *Adeonellopsis* sp. on the sills at the entrances to the fiords.

New Zealand, the range of *G. hystrix* is reported to extend from the Taranaki Coast down to Stewart Island (MacDiarmid et al. 2013).

Beaumont et al. (2013) had no record of calcareous tube worm thickets/fields in the Patea Shoal region.

Given these findings, and the EEZ (2012) habitat criteria (Appendix 1), the TCMA appears less likely to have calcareous tube worm thicket habitat present, with the exception of some nearshore/rocky shore locations. However, this may also be a result of the low level of information available for high energy shallow-shelf environments.

3.2.5. Chaetopteridae worm fields

The Chaetopteridae are a family of marine filter feeding polychaete worms that live in tunnels buried in marine sediments. In New Zealand little is known about tube-worm biogenic habitat, although low relief worm tube meadows are reported to be widespread in many areas. Of particular note is the meadow-forming species *Phyllochaetopterus socialis* (wire-weed). It forms beds of isolated individuals within mixed epifaunal assemblages, through to extensive dense meadows (MacDiarmid et al. 2013).

Out of two possible indicator taxa names (Chaetopteridae and *Phyllochaetopterus socialis*; MacDiarmid et al. 2013) which were cross-referenced against the OBIS database, there were no taxa matches identified within the TCMA or in the vicinity (within ~200 km of the TCMA boundary; Figure 4). When cross-referenced against the Cawthron database (Caddis™ Database 2016) the closest record to the TCMA boundary was 5 km from the deepest TCMA area adjacent Cape Egmont (Figure 4, Appendix 5). However, as most of the records are of single individuals (maximum 5 in one 10L sample), the densities are not likely to constitute a worm field in the context of the EEZ (2012) criteria. Despite this, Chaetopteridae worms/beds are known to occur in much higher densities (up to 600 individuals per sample) closer to the shoreline in the nearby Marlborough Sounds region (Caddis™ Database 2016)

Beaumont et al. (2013) showed no record of Chaetopteridae tube worm thickets/fields in the Patea Shoal region. However, the presence of a depauperate[9] 'worm field' dominated by the infaunal tubeworm *Euchone* sp. A was reported. Similar to chaetopterid worms, this sabellid worm binds the surrounding sediments together to form its tube. Worm field habitats were also described as abundant in sediments in mid-shelf areas to the north of the TCMA. While *Euchone* sp. A appears to be a common and abundant species within the Patea Shoals region (and adjacent northern

[9] Typically low abundance taxa were observed in the worm fields *i.e.* hermit crabs, small gastropods and the occasional bryozoan (Beaumont et al. 2013).

mid-shelf areas; Beaumont et al. 2013), it is reportedly 'undescribed' and is not yet known/described from other areas around New Zealand (Anderson 2014).

Given these findings, and the EEZ (2012) habitat criteria (listed in Appendix 1), it appears possible that there are Chaetopteridae, and potentially undescribed sabellid-dominated worm fields, present within the TCMA.

3.2.6. Macroalgae beds

Although not strictly an invertebrate species (the focus of this report), macroalgae are mentioned here due to their status as an EEZ (2012) sensitive habitat indicator. Given the availability of suitable habitat for macroalgae (Figure 1), there is potential for a diversity of macroalgal taxa within the TCMA.

Macroalgae or seaweeds are multicellular plants occurring in green, brown and red forms and frequently form mats, forests or 'beds'. Macro algal beds require the presence of enough light (for photosynthesis), and an attachment point for their root-like holdfasts (with the exception of some genera that float freely e.g. *Sargassum* and *Gracilaria*). Seaweeds tend to occupy habitat closer to the shore, frequently on rocky shorelines, but they will also grow on unconsolidated substrates, such as rubble, rodoliths and shells. In some areas, littoral seaweed can extend several kilometres out to sea. The deepest living seaweeds are some species of red algae, found at depths of 295 m in the clear waters of the Bahamas but more commonly macroalgae occur at depths less than 100 m (Fredericq 2016).

Out of 83 possible indicator taxa (obtained from Lindauer 1946; Hayward et al. 1999; Wassilieff 2015) cross-referenced against the OBIS database, three species matches were identified within the TCMA: the macroalgal taxa *Macrocystis* (brown), *Pterocladia lucida* (red) and *Ulva lactuca* (green). These species were located nearshore, directly north and south of the Sugar Loaf Islands (Figure 4, Appendix 5). No algal records were noted offshore. The taxa *Gracilaria* (red macroalgae), *Lessonia* (brown) and *Caulerpa brownii* (green) were present in the vicinity of the TCMA, particularly to the southwest of the North Island and in the outer reaches of the Marlborough Sounds (Figure 4, Appendix 5). The low level of macroalgae result matches appear to be largely attributable to differences in taxonomic ranking (Hayward et al. 1999, only reported to genus level, while OBIS [2016] was predominantly to species level).

Further investigation into the macroalgal taxa collected by Beaumont et al. (2013) revealed a total of twenty-six taxa were collected in the vicinity of TCMA's Patea Shoals (notably inner shelf, mid-shelf north and mid-shelf south, and offshore locations). Three species of red macroalgae recorded at the deeper 'offshore' sites (in bryozoan rubble habitat) in the vicinity of Patea Shoals (*n. gen. Cryptonemia-like* sp. [new species record], *Hymenena* sp. and *Haraldiophyllum crispatum*). Note: exact

locations for these records were not able to be mapped with the information provided by Beaumont et al. (2013).

Given the presence of macro-algal taxa within the TCMA and the reported red macro-algae in the offshore vicinity, it is likely that macro-algal beds occur at levels consistent with the EEZ (2012) sensitive habitat criteria, within the TCMA.

3.2.7. Sea pen field

Sea pens are colony-forming marine cnidarians (order Pennatulacea) that can inhabit widespread areas of soft-sediment sea floor. Out of 25[10] possible indicator sea pen taxa (obtained from Williams et al. 2014; Environment Guide 2016) cross-referenced with the OBIS (2016) taxa list, none were detected within, or in the vicinity of, the TCMA.

Based on records from the Cawthron database (Caddis™ Database 2016) two sea pen species matches were made in the vicinity of the TCMA: *Funiculina quadrangularis* and *Virgularia gracillima.* The most prevalent was *Virgularia gracillima* (occurring at over 40 sites, Figure 4, Appendix 5). For both species, the majority of the sample records are of single individuals (maximum 2 sea pens in one 10L sample), occasionally obtained in successive point samples.

Given the presence of sea pen taxa in the offshore vicinity, it is possible that sea pen fields may occur within the TCMA at levels that meet the EEZ (2012) habitat criteria (listed in Appendix 1).

3.2.8. Sponge gardens

Sponges (phylum Porifera) are common marine invertebrates around the New Zealand coastline. Most species encrust hard rocky substrate, but many also live embedded in sandy muddy sediments with a root-like structure (Kelly & Herr 2015). In New Zealand glass sponges (class Hexactinellida[11]) generally dominate deep water environments and demosponges (the largest poriferan class) dominate the shelf and coastal faunas (1–250 m). Regions of high sponge bio- and morphological-diversity are often referred to as ‘sponge gardens’, but typically sponge gardens are defined by their spatial characteristics (Appendix 1; MacDiarmid et al. 2013).

Out of 89[12] possible sponge garden indicator taxa, one site showed sponge taxa present within the TCMA (Sugar Loaf Islands Mare Protection Area; Figure 4): *Crella incrustans, Polymastia fusca, Raspailia topsenti, Stelletta conulosathere*. There were

[10] MacDiamid et al. (2013) reports that 31 species of sea pens are known from New Zealand waters, with 19 still to be formally described. However, only 25 sea pen species names were obtainable from available literature.
[11] Hexactinellid sponges are relatively uncommon (compared to other classes like demosponge) with a skeleton made of pointed siliceous spicules, often referred to as glass sponges.
[12] To date well over 500 sponge species have been formally described from New Zealand (MacDiarmid et al. 2013). However, only 89 sponge species names were obtainable from available literature.

no other record matches in the TCMA vicinity (approx. 200 km from TCMA boundary), which is unusual given the ubiquity of sponges. This lack of record matches is likely related to a deficit of sampling/monitoring that is appropriate for detecting sponges in the TCMA, or a lack of possible indicator taxa (89 out of a possible 500), rather than an absence of sponge taxa. Recent work from the National Institute of Water and Atmospheric Research (Michelle Kelly, NIWA), has tentatively identified a dozen different sponge species on a small patch reef approximately 11 km off shore from Patea (pers. comm. Thomas McElroy, 15 July 2016). It is also recognised that other protected areas (e.g. Parininihi Marine Reserve, Sugar Loaf Islands Marine Protected Area, and Tapuae Marine Reserve) in the TCMA are likely to have many sponge species yet to be identified (pers. comm. Emily Roberts, 19 July 2016). Clearly, there are more sponge taxa present in the TCMA than the OBIS database search was able to detect.

Glass-sponge gardens have also been reported by MacDiarmid et al. (2013) to occur in North Taranaki Bight area, at depths of 160–330 m. In this instance they were classified as of 'low species diversity, low morphological diversity, low to medium density, low percentage cover, uniform distribution'. The exact location of the North Taranaki Bight record was not able to be obtained from the report, however they appear to occur at depths near-to or greater-than the TCMA maximum depth (approximately 130 m).

Given the presence of sponge taxa within the TCMA marine protected areas and the reported glass sponge gardens in the offshore vicinity, it is possible that sponge gardens may occur within the TCMA, at volumes[13] and surface areas[14] that meet the EEZ (2012) habitat criteria (listed in Appendix 1).

3.2.9. Stony coral thickets or reefs

Corals are a group of colonial organisms belonging to the phylum Cnidaria. Deepwater (cold water) corals are found between approximately 200–2000 m depths and 4–12°C temperatures. Coldwater corals are slow growing, long-lived and fragile, often having high biodiversity associated with them. As such, these habitats are considered to be vulnerable marine ecosystems that warrant protection (MacDiarmid et al. 2013).

Out of five possible stony coral habitat-forming indicator taxa (listed in Appendix 1, EEZ 2012 and described in MacDiarmid et al. 2013), none have been recorded from within the TCMA. However, two species have been found in the vicinity (Figure 4, Appendix 5):

[13] Sponges comprising 20-25% the volume of successive point samples; or any sample collected using towed gear.
[14] Sponges comprising 25% of seabed over 100m^2 in a visual imaging survey.

- *Goniocorella dumosa*—30 km from TCMA boundary WNW of Cape Egmont, North Taranaki Bight and between the 50–100 m depth contours. Sediment types in vicinity were muddy shell (M.Sh), rubble (R), fine sand/shell/cobbles (fS.Sh.Co; LINZ chart NZ45).
- *Madrepora oculata*—50 km from TCMA boundary SW of Grahams Bank, South Taranaki Bight and between the 100 – 150 m depth contours. Sediment types in the vicinity consisted of; fine sand mixed with mud and shell, and areas of homogeneous muds (M.Sh.fS; LINZ chart NZ45).

Goniocorella dumosa and M. oculata are two of the five[15] most significant habitat-forming species of coral in New Zealand (MacDiarmid et al. 2013). MacDiarmid et al. (2013) also note that *G. dumosa is* found primarily around 400 m on slopes and rises, however the OBIS record match (Figure 4; Appendix 5) between 50–100 m depth suggests that this coral also occurs in shallower depths.

Other protected corals

Two other protected corals (as specified in; Wildlife Act 1953; Tracey et al. 2014) were detected from the OBIS database, and reported in Beaumont et al. (2013):

- the hydrocoral species *Calyptopora reticulata* was recorded in the vicinity of the TCMA, 120 km to the SW in the Marlborough Sounds (Figure 4, Appendix 5)
- while not strictly thicket or reef-forming, the protected solitary stony cup coral (Flabellidae) was reported by Beaumont et al. (2013) as occurring within the deeper bryozoan rubble habitats near Patea Shoals (South Taranaki Bight; Figure 4).

Given the presence of these taxa in the vicinity of the TCMA, it is possible that stony corals and hydrocorals occur at levels consistent with the EEZ (2012) criteria and/or the NZ Wildlife Act (1953) within the TCMA.

3.2.10. Rhodolith (maerl) beds

Rhodoliths are fragile free-living calcified red algae that occur in localised areas worldwide. They form structurally and functionally complex habitats (maerl), which feature high benthic biodiversity and support many rare and unusual species (MacDiarmid et al. 2013). Very little information exists about the spatial extent and ecosystem functioning of rhodolith beds in New Zealand. They are reported to occur at other NZ coastal localities including North Cape, Bay of Islands, Kapiti Island, Marlborough Sounds, and Foveaux Strait (MacDiarmid et al. 2013).

[15] Four of the five most significant habitat-forming species of stony coral in New Zealand waters (*Madrepora oculata, Solenosmilia variabilis, Goniocorella dumosa, Enallopsammia rostrata*) are distributed throughout the region. The fifth species, *Oculina virgosa*, is found only in warmer waters off North Cape and along the Kermadec Ridge.

Out of two possible rhodolith indicator taxa (obtained from Nelson et al. 2012) which were cross-referenced against the OBIS database, one match for *Sporolithon durum* was identified at one site within the TCMA (Figure 4; Appendix 5). The location of the rhodolith was adjacent to Bell Block (approximately 2 km offshore, near the 20 m depth contour). *Sporolithon durum* was also identified at five other sites in the regional vicinity of the TCMA boundary (~200 km).

The Environment Guide (2016) and MacDiarmid et al. (2013) state that it is likely that rhodolith species occur in the EEZ at localities characterised by strong currents to depths of 200 m (depending on water clarity), particularly around the margins of reefs or elevated banks, like much of the TCMA coastline.

Given these findings and the EEZ (2012) habitat criteria (listed in Appendix 1), the TCMA appears to feature rhodolith bed habitat, and more may exist, particularly since conditions within the TCMA appear well suited to forming this type of biogenic habitat.

3.2.11. Xenophyophore (sessile protozoan) beds

Xenophyophores are very large single-celled foraminiferal protozoans, forming as branched, transparent, organic tubes or sheaths. Xenophyophores are fragile and difficult to identify (MacDiarmid et al. 2013). They appear to be particularly abundant below areas of high surface productivity. Documented xenophyophore locations within the New Zealand EEZ are on the eastern, northern and western continental slopes, and on the Chatham Rise at depths of 500-1300 m (MacDiarmid et al. 2013).

Out of 6[16] possible xenophyophore indicator taxa, none were detected within the TCMA. The nearest record was 150 km west of the TCMA boundary (between the 1250–1500 m depth contours). Given that the TCMA depth range is much shallower, it seems unlikely that xenophyophores occur within the TCMA. However, the lack of records in this area may also be somewhat attributable to the delicate nature of the specimens, causing sample damage and consequent misidentification.

3.3. Unique taxa records

An OBIS (2016) database comparison of taxa records from within the TCMA to those recorded elsewhere in New Zealand, returned 220 unique taxa records within the TCMA (158 species; Appendix 6). Some of these records appear to have been caused by differences in taxonomic resolution, typographic errors and patchy taxa records in the database (Type 1 errors). Nevertheless, this large number of unique records suggests that the TCMA could be more ecologically significant than previously

[16] Seven species have been recorded from New Zealand, three of these are endemic (MacDiarmid et al. 2013). However, only six xenophyophore species names were obtainable from available literature.

thought. Further investigation into unique records from other New Zealand regions would potentially clarify this.

3.3.1. Extent of area investigated

It appears that much of the TCMA OBIS (2016) invertebrate records are from the north Taranaki region, with few records close to the TCMA boundary and sparse records to the south (Figure 5). While the OBIS database does not include every invertebrate record available, these results suggest that the majority of the TCMA invertebrate communities, particularly in the further offshore and southern areas, are undescribed.

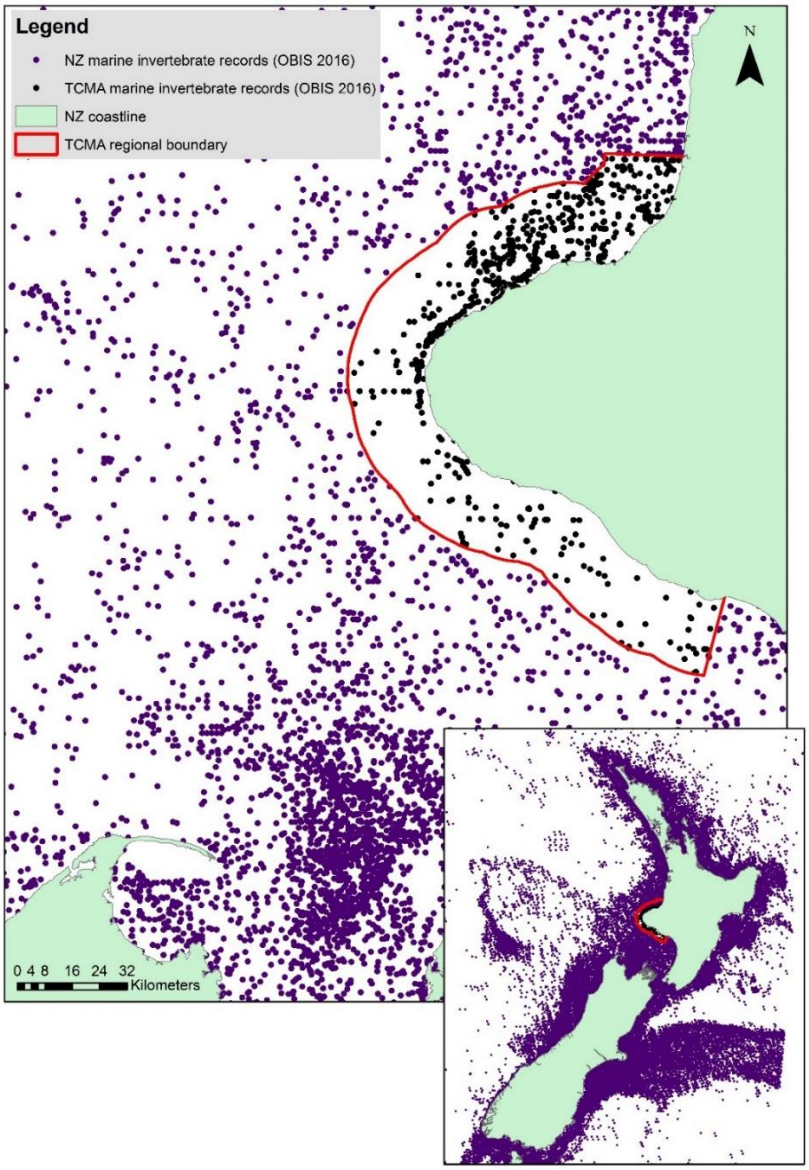

Figure 5: The Taranaki coastal marine area (TCMA), in relation to invertebrate taxa records (OBIS 2016) in the New Zealand region (inset). For further detail refer to Appendix 6.

4. SUMMARY

The OBIS (2016) search results in the regional vicinity of the TCMA yielded 150,000+ taxa entries which were assumed to be indicative of that which might be present in the TCMA. When the OBIS results were cross-referenced against the threatened species list (Freeman et al. 2010), the following findings were made:

- there were no threatened or at-risk species matches within the TCMA boundaries
- in the regional vicinity of the TCMA (within ~200 km from the boundary) there were five 'threatened' invertebrate species record matches. The record matches suggest that these species might be present within the TCMA:
    - the hydroid *Nemertesia elongata*
    - the whelk *Cominella quoyana griseicalx*
    - the crab *Leptomithrax tuberculatus mortenseni*
    - the pin-cushion star *Eurygonias hyalacanthus*)
    - the stony coral species *Madrepora oculata*.

When the OBIS results were cross-referenced against possible EEZ (2012) sensitive habitat indicator species, the following finding was made:

- of the 13 EEZ (2012) sensitive habitat groupings, there were 11 with indicator species matches[17] within, and in the regional vicinity of, the TCMA. These matches are listed in Table 1.

The presence of threatened and sensitive habitat indicator species, within and in the vicinity of the TCMA (~200 km) suggests that these species, and the associated sensitive and/or outstanding habitats, may also be present within the TCMA.

Regional significance of sensitive and threatened taxa/habitats.

When the OBIS records from within the TCMA were compared to those occurring outside its boundaries (in the wider New Zealand region), there were 220 taxa records (158 species) unique to the TCMA. While some of these records appear to have been caused by Type 1 errors, results suggest that the TCMA could be more ecologically significant than previously thought. Further investigation into unique records from other New Zealand regions would potentially clarify this.

Overall, this investigation has yielded results that suggest sensitive marine habitats exist within the TCMA. However, there were a number of information gaps which, if addressed, would better aid the understanding of sensitive habitats and threatened species in the TCMA:

[17] Where OBIS species recorded were scarce for other information sources were investigated e.g. sea pens, coral, Chaetopteridae worms (using Cawthron's offshore database and Beaumont et al. 2013).

- the nature of the present/absence data obtained from OBIS was not sufficient to determine whether the criteria's densities had been met (e.g. for a 'bed', 'thicket' or 'field, shown in parenthesis in Table 1)
- low numbers of species records from within the TCMA
- patchy data, from a range of sources
- particularly low levels of data on the habitats around the mid and northern TCMA boundaries
- possible Type 1 errors, particularly when comparing the large OBIS datasets with EEZ possible indicator taxa, there were differences in taxonomic resolution, dataset typographic errors.

Table 1. Possible sensitive habitat indicator species matches within and in the regional vicinity (within approximately 200 km) of the TCMA boundary, using the OBIS (2016) database.

Sensitive habitats (EEZ 2012)	Within the TCMA	In vicinity of the TCMA*
(Beds of) large bivalve molluscs	x	-
Brachiopods	x	-
Bryozoans (thickets)	x	-
Calcareous tube worm (thickets)	x	-
Macro-algal (beds)	x	-
Sponge (gardens)	x	-
Rhodolith (maerl beds)	x	-
Chaetopteridae worm (fields)	-	x
Sea pens (field)	-	x
Stony coral (thickets)	-	x
Xenophyophores (sessile protozoan beds)	-	x
Deep-sea hydrothermal vents	-	-
Methane or cold seeps	-	-

*Within 200 km of the TCMA boundary

5. RECOMMENDATIONS

In response to the gaps in information identified in this investigation, a second tier of this investigation could be implemented. It is recommended that this should utilize video sled and drop camera monitoring methods, ground-truthed with physical sampling. A particular focus would be on searching for the listed possible sensitive habitats and threatened/at-risk species in key habitat types throughout the north and south Taranaki biogenic regions.

This tier-2 fieldwork may align well with current National Science Challenge investigations, potentially cutting down costs whilst increasing the information returns for TRC.

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7. APPENDICES

Appendix 1. Summary table of EEZ Act 2013. Schedule 6 - Sensitive environments

Sensitive environment	**Indicator of existence of sensitive environment**
Stony coral thickets or reefs	A stony coral reef or thicket exists if— a colony of a structure-forming species (i.e., *Madrepora oculata, Solenosmilia variabilis, Goniocorella dumosa,Enallopsammia rostrata, Oculina virgosa*) covers 15% or more of the seabed in a visual imaging survey of 100 m^2 or more; or a specimen of a thicket-forming species is found in 2 successive point samples; or a specimen of a structure-forming species is found in a sample collected using towed gear.
Xenophyophores (sessile protozoan) beds	A xenophyophore bed exists if average densities of all species of xenophyophore found (including fragments) equal or exceed 1 specimen per m^2 sampled.
Bryozoan thickets	A bryozoan thicket exists if— colonies of large frame-building bryozoan species cover at least 50% of the of an area between 10 m^2 and 100 m^2; or colonies of large frame-building bryozoan species cover at least 40% of an area that exceeds 10 km^2; or a specimen of a large frame-building bryozoan species is found in a sample collected using towed gear; or 1 or more large frame-building bryozoan species is found in successive point samples.
Calcareous tube worm thickets	A sensitive tube worm thicket exists if— 1 or more tube worm mounds per 250 m^2 are visible in a seabed imaging survey; or 2 or more specimens of a mound-forming species of tube worm are found in a point sample; or mound-forming species of tube worm comprise 10% or more by weight or volume of a towed sample.
Chaetopteridae worm fields	A sensitive Chaetopteridae worm field exists if worm tubes or epifaunal species— cover 25% or more of the seabed in a visual imaging survey of 500 m^2 or more; or make up 25% or more of the volume of a sample collected using towed gear; or are found in 2 successive point samples.
Sea pen field	A sea pen field exists if— a specimen of sea pen is found in successive point samples; or 2 or more specimens of sea pen per m^2 are found in a visual imaging survey or a survey collected using towed gear.
Rhodolith (maerl) beds	A rhodolith bed— exists if living coralline thalli are found to cover more than 10% of an area in a visual imaging survey: is to be taken to exist if a single specimen of a rhodolith species is found in any sample.
Sponge gardens	A sponge garden exists if metazoans of classes Demospongiae, Hexactinellida, Calcerea, or Homoscleromorpha— comprise 25% or more by volume of successive point samples; or comprise 20% or more by volume of any sample collected using towed gear; or cover 25% or more of the seabed over an area of 100 m^2 or more in a visual imaging survey.
Beds of large bivalve molluscs	A bed of large bivalve molluscs exists if living and dead specimens— cover 30% or more of the seabed in a visual imaging survey; or comprise 30% or more by weight or volume of the catch in a sample collected using towed gear; or comprise 30% or more by weight or volume in successive point samples.
Macro-algae beds	A macro-algae bed exists if a specimen of a red, green, or brown macro-algae is found in a visual imaging survey or any sample.
Brachiopods	A brachiopod bed exists if 1 or more live brachiopods— are found per m^2 sampled using towed gear; or are found in successive point samples.
Deep-sea hydrothermal vents	A sensitive hydrothermal vent exists if a live specimen of a known vent species is found in a visual imaging survey or any sample. The following vent species are known to exist in New Zealand waters: *Vulcanolepis osheai*: *Ashinkailepas kermadecensis*: *Gigantidas gladius*: *Vulcanidas insolatus*: *Alvinocaris niwa*: *A. longirostris*:

Sensitive environment	Indicator of existence of sensitive environment
	A. alexander: *Lebbeus wera*: *Nautilocaris saintlaurentae*: *Gandalfus puia*: *Xenograpsus ngatama*: *Paralomis hirtella*: *Bathyaustriella thionipta*: *Siboglinum* sp: *Oasisia fujikurai*: *Lamellibrachia juni*: *Sclerasterias eructans*: *Parachnoidea rowdeni*: *Pyrolycus moelleri*: *Symphurus thermophiles*.
Methane or cold seeps	A methane or cold seep exists if a single occurrence of one of the following taxa is found in a visual imaging survey or any sample: large siboglinid tubeworms *Lamellibrachia sp:* vesicomyid clams *Calyptogena sp:* mussels in the family *Bathymodiolinae:* solemyid clams *(Acharax clarificata):* the sponges *Stelletta n sp* and *Pseudosuberites sp:* *ampharetid, dorvilleid, and pogonophoran (Siboglinum sp) polychaete worms.*

Appendix 2. EEZ (2012) possible indicator species list and source references. Presented as an excel list. See attached electronic files.

Appendix 3. OBIS (2016) data export. Presented as an excel list. See attached electronic files.

Appendix 4. Threatened and/or at-risk species from within, and in the vicinity-of, the TCMA. Presented as an excel list (Freeman et al. 2010) and GIS mapping package. See attached electronic files.

Appendix 5. Possible sensitive environment indicator species EEZ (2012) from within in the vicinity-of, the TCMA. Presented as an excel list and GIS mapping package. See attached electronic files.

Appendix 6. Unique taxa within the TCMA data spreadsheet (OBIS 2016) and GIS mapping package. See attached electronic files.