

Coastal marine habitats and marine protected areas in the New Zealand Territorial Sea: a broad scale gap analysis



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SUMMARY

The Marine Protected Areas (MPA) Policy seeks to protect marine biodiversity by establishing a network of MPAs that is comprehensive and representative of New Zealand's marine habitats and ecosystems. The policy aims to protect representative examples of the full range of marine habitats and ecosystems, as well as outstanding, rare, distinctive or internationally or nationally important marine habitats and ecosystems. While it aims to achieve a target of protecting 10% of New Zealand's marine environment, the ultimate extent of protection will be determined by what coverage is required to establish a comprehensive and representative network of marine protected areas.

This report provides an analysis of which coastal habitats in the New Zealand Territorial Sea are currently represented in areas that meet the New Zealand MPA Protection Standard (the Protection Standard). The report maps approximate, predominantly physical, surrogates of habitats derived from broad categories of environmental drivers such as depth, substratum, exposure and the actions of biogenic, habitat forming organisms. It does not however, aim to assess outstanding, rare, distinctive, internationally or nationally important habitats or ecosystems, or finer scale species associations and ecosystem processes.

Nationally, 6.9% of the total area of all coastal marine bioregions (within 12 nautical miles) is protected within Type 1 marine reserve MPAs. However, the extent of this protection is strongly influenced by the large areas of marine reserve in the Kermadec Islands and Subantarctic Islands Bioregions. In other bioregions, the proportion of Type 1 marine reserve MPA ranges from zero to a maximum of only around 1%.

The minimum level of protection required for an area to meet the Protection Standard as a Type 2 MPA is the prohibition of bottom trawling, Danish seining and dredging (commercial and amateur). The Protection Standard also requires that: the prohibition of bottom gill netting and potting should be considered where these methods are being used on fragile biogenic habitats and; that other fishing and non-fishing activities shall not unduly disturb ecological systems, natural species composition and trophic linkages. This study estimates that nationally a total of 1.14% of the Territorial Sea (within 12 nautical miles) meets the Protection Standard for Type 2 MPAs.

Areas that meet the Protection Standard for Type 2 MPAs include some sections of the Fiordland (Te Moana o Atawhenua) Marine Area, some cable and pipeline zones, some marine parks, some fisheries closures and one mātaītai reserve. The highest percentage of Type 2 MPAs occurred in the Fiordland (3.7%), North Eastern (2.4%), Western North Island (2.3%), South Cook Strait (1.1%) and North Cook Strait (1.8%) Bioregions. All other bioregions had less than 1% of their area in Type 2 MPAs.

With the exception of the Kermadec Islands Bioregion, there are many large gaps in the current MPA network for a range of habitats. In some bioregions, very few, if any, habitats are protected in Type 1 marine reserves or Type 2 MPAs. In other bioregions, the number of habitats represented in potential MPAs ranges up to around half of the total number of habitats in the bioregion. In most bioregions, however, only a very limited number of habitats have more than a few percent of their area within MPAs.

1 Introduction

To achieve the objectives and actions of the New Zealand Biodiversity Strategy (New Zealand Government 2000) and meet New Zealand's commitments to the International Convention on Biological Diversity, the Marine Protected Areas (MPA) Policy (Department of Conservation and Ministry of Fisheries 2005) aims to "protect marine biodiversity by establishing a network of MPAs that is comprehensive and representative of New Zealand's marine habitats and ecosystems."

For the purposes of New Zealand's MPA policy, an MPA is defined as "an area of the marine environment especially dedicated to, or achieving, through adequate protection, the maintenance and/or recovery of biological diversity at the habitat and ecosystem level in a healthy functioning state." The policy aims to achieve a target of protecting 10% of New Zealand's marine environment, by establishing a network of representative protected marine areas. The MPA Policy covers New Zealand's entire marine environment including estuaries, the Territorial Sea (within 12 nautical miles of the coast and islands), and the Exclusive Economic Zone (12 to 200 nautical miles). However, this report focuses only on New Zealand's Territorial Sea and estuaries, as MPA planning for the Exclusive Economic Zone has been scheduled in a separate process in 2013.

The MPA Policy seeks to protect representative examples of the full range of marine habitats and ecosystems, and also outstanding, rare, distinctive or internationally or nationally important marine habitats and ecosystems. This report assesses the extent of protection for habitats defined predominantly by physical surrogates in the Coastal Classification and Mapping Scheme (Ministry of Fisheries and Department of Conservation 2008). It does not assess outstanding, rare, distinctive, internationally or nationally important habitats or ecosystems or finer scale species associations and ecosystem processes.

1.1 COASTAL CLASSIFICATION AND MAPPING SCHEME

The first task scheduled by the MPA Policy was to develop the Coastal Classification and Mapping Scheme as an approximate surrogate to describe broad spatial patterns in marine biodiversity where more detailed biological information was unavailable (Department of Conservation and Ministry of Fisheries 2005). This hierarchical classification nests broad combinations of depth, substrata and exposure within the estuarine and marine environments of 14 marine biogeographic regions (i.e. bioregions, Figure 1). The resulting classification is described in "Marine Protected Areas: Classification, Protection Standard and Implementation Guidelines" (Ministry of Fisheries and Department of Conservation 2008) and in Appendix 1.

1.2 MPA PROTECTION STANDARD

In Task 2, a Protection Standard was developed to assess which management tools offered sufficient protection to habitats and ecosystems for areas to be considered as MPAs. In order to meet this Protection Standard the management tool(s) at a particular site must provide for the maintenance and recovery of:

- a) physical features and biogenic structures that support biodiversity;
- b) ecological systems, natural species composition (including all life-history stages), and trophic linkages, and;
- c) the potential for the biodiversity to adapt and recover in response to perturbation.

A range of management tools may have the effect (either intended or incidental) of protecting marine habitats and ecosystems. Table 1 summarises the two main categories of MPAs (Type 1 marine reserve MPAs

and Type 2 “other MPAs”) as well as other management tools that do not meet the Protection Standard.

Marine reserves are statutory management tools that are established under the Marine Reserves Act 1971 for the purpose of preserving marine life for scientific study. A broad range of activities can be managed, controlled or excluded from marine reserves, including marine farming, fishing, other extraction, anchoring, point discharges and research. Given the high level of protection afforded by marine reserves, they are considered to contribute to marine protection goals under the MPA Policy as Type 1 MPAs (Ministry of Fisheries and Department of Conservation 2008).

Type 2 MPAs are the product of a range of management tools that provide a sufficient level of protection to meet the Protection Standard. Examples of potential Type 2 MPAs include prohibitions on fishing methods under the Fisheries Act 1996 and prohibitions on fishing in the vicinity of submarine cables and pipelines. Prohibitions on fishing methods under the Fisheries Act 1996 can be used to establish MPAs, provided those prohibitions are implemented in a manner that is consistent with statutory requirements.

In relation to fishing methods, bottom trawling, dredging and Danish seining are considered to not allow for the maintenance and recovery of physical features and biogenic structures and these methods would not be permitted within an MPA. Benthic netting and potting may also be prohibited from an MPA if they are being used on areas of fragile biogenic habitat (with the prohibition to apply to the area of fragile biogenic habitat not the whole MPA)¹.

Other fishing methods may also be prohibited if it is considered that they are having an adverse effect on the aquatic environment as defined by the Fisheries Act 1996². If these methods are not in use, or there is no evidence they are having an adverse effect, an area can be recognised as an MPA without further prohibitions.

1.3 MPA INVENTORY, HABITAT MAPPING AND GAP ANALYSIS

This report summarises progress made towards the completion of Tasks 3, 4 and 5 scheduled by the MPA Policy (Department of Conservation and Ministry of Fisheries 2005). These are to: 3) map existing management tools; 4) develop an inventory of MPAs which have management tools that meet the Protection Standard and; 5) compare the MPA inventory with the coastal habitat classification to identify gaps in the MPA network.

The report maps broad scale habitats defined by the Coastal Classification and Mapping Scheme using data consistently available at a national scale. This provides an approximate basis to determine both the extent to which habitats are protected by MPAs and other forms of marine management, and gaps in a national MPA network. It is important to note that more detailed mapping of habitats has been occurring within several bioregions that would not currently be logistically possible at a national scale. These studies are likely to provide important information to supplement this project for planning at regional scales.

¹ This may require specific boundaries to be established and enforced for this purpose.

² This definition would only apply if the Fisheries Act was the instrument being used to prohibit fishing. Other definitions would be appropriate where other legislation or tools were used to restrict fishing.

Table 1. MPA Policy Implementation – Marine Protection Types.
(Ministry of Fisheries and Department of Conservation 2008)

(1) Marine Reserve MPAs

Marine reserves established under the Marine Reserves Act 1971.

(2) Other MPAs

Fisheries Act prohibitions (i.e. those rules imposed primarily for the purpose of sustaining fisheries resources and for avoiding, remedying or mitigating the adverse effects of fishing on the environment) on:

- Dredging, bottom trawling, Danish seining
- Bottom gillnetting and potting when used on sensitive biogenic habitats
- Purse seining, midwater trawling, midwater gillnetting and bottom gillnetting. Prohibitions on other methods may be appropriate on a case by case basis.

Tools may also include cable protection zones, marine mammal sanctuaries, Resource Management Act, possibly in combination with other tools.

- Other tools may include provisions in:
 - Crown Minerals Act
 - Maritime Transport Act
 - Biosecurity Act

(3) Other Marine Protection Tools

Tools similar to those for MPAs, but which in particular cases, do not protect sufficient biodiversity to meet the protection standard.

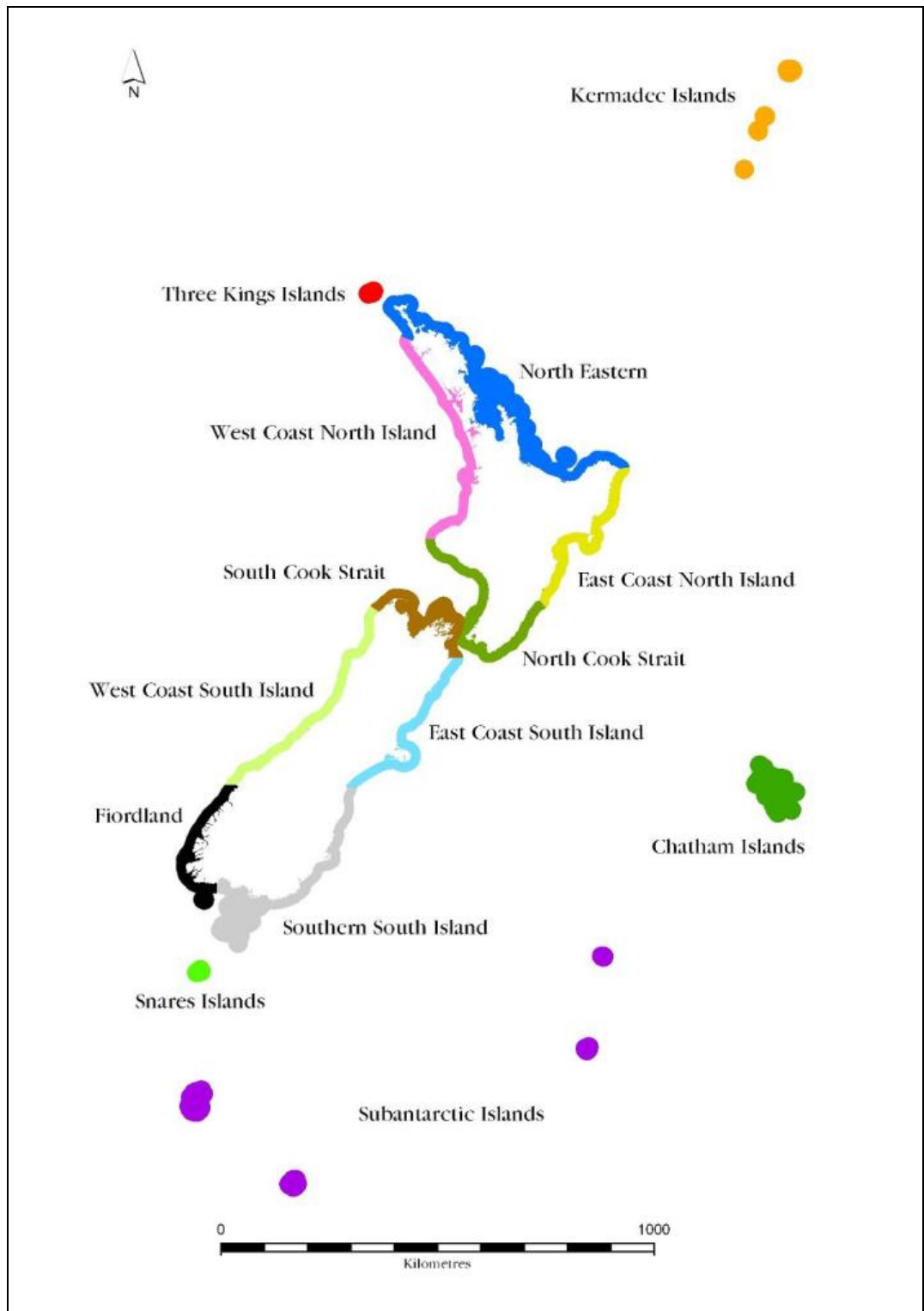


Figure 1. Coastal marine biogeographic regions (bioregions) in the New Zealand Territorial Sea (within 12 nautical miles of coast and islands).

2 Methods

2.1 MAPPING THE NATIONAL COASTAL HABITAT CLASSIFICATION

In order to map marine habitats consistently across all bioregions, Geographic Information System (GIS) datasets were sourced, where possible, that extended across all of the New Zealand Territorial Sea. The intent was to avoid bias in the representation of habitats associated with differences in the extent and detail of surveys in different regions. The disadvantage of this approach, however, is that the more detailed surveys available or underway in some regions (Neale et al. 2007, WCMPF 2010, Benn 2009; Kettles & Hughes 2009; Kerr 2010, Morrison et al. 2010) are not included in this broad scale analysis. These surveys should be included in more detailed regional assessments.

The extent of habitat mapping was mainly defined by the Land Information New Zealand (LINZ) coastline, the LINZ boundary (2004) to the New Zealand Territorial Sea (within 12 nautical miles of the coast and islands), estuaries from the National Institute for Water and Atmospheric Research (NIWA) New Zealand Estuary Environment Classification (Hume 2007) and bioregions defined in the Marine Protected Areas Policy and Implementation Plan (Department of Conservation and Ministry of Fisheries 2005).

Within these bioregions, spatial data layers for depth, substrata and exposure were overlaid in ArcGIS to approximate the habitat categories described in the Coastal Classification and Mapping Scheme (Appendix 1, Ministry of Fisheries and Department of Conservation 2008). In some cases, categories were modified according to what data were available and to provide consistent, justifiable, readily interpreted habitat descriptions that adequately reflect major patterns in marine environments. The data sources and habitat categories that were used are described below and in Appendix 2.

Shallow (0-30m) and deep zones (30-200m) were mapped from contours provided by NIWA, with some interpolation in areas where contours were incomplete (using LINZ hydrographic charts and depth soundings) (Figure 2). In the Subantarctic Islands bioregion, a 30m contour was not available to define depth zones so the 50m contour was used as the closest approximation available.

The Coastal Classification and Mapping Scheme extends only to the 200m isobath, but waters deeper than 200m exist within the 12 nautical mile boundary of several bioregions. For these areas, categories from the deep water classification (Ministry of Fisheries and Department of Conservation 2008) were used to map upper (200-500m), mid (500-1000m) and lower continental slope (1000-4000m) habitats within the 12 nautical mile limit. Areas below 200m deep are therefore only classed by depth category. The resolution of the broad scale data for substrata in these areas was judged to be too low to reliably describe the complex features on the edge of the continental shelf.

Data for subtidal sediment substrata (Figure 3) were derived from the NZ Combined Ocean Sediments (NZCOS) GIS coverage, a combined digital representation of published charts of coastal (1:200,000 scale), oceanic (1:1,000,000 scale) and regional sediments (1:6,000,000 scale). This dataset was developed by NIWA (Bardsley et al. 2008) under contract to the Ministry of Fisheries. Detailed sediment descriptions were then grouped into the broad categories defined by the Coastal Classification and Mapping Scheme (mud, sand, gravel and, in the Kermadec Islands bioregion, volcanic). Data were not available to consistently map subtidal cobble and boulder habitats at a national scale.

Rocky reef substrata were derived from a GIS layer of coastal reefs digitised for the Department of Conservation (Smith 2008) from shoal areas on LINZ nautical charts and a limited coverage of field surveys. While providing a national overview, this coverage is likely to miss many near shore and deeper reef habitats that at a regional scale could be mapped using sonar and aerial photography methods.

There were no nationally consistent data mapped specifically for intertidal areas. However, GIS polygons representing coastal rock, sand and mud were obtained from the LINZ 1:50,000 topographic GIS layer. These were bisected (using the LINZ 1:50,000 coastline) into areas landward and seaward of the coastline as an approximation of areas above and below mean high tide. Areas below high tide were retained as intertidal beach, mud flat and rocky shore. Insufficient data were available to consistently map the intertidal cobble and boulder categories described in the Coastal Classification and Mapping Scheme (Ministry of Fisheries and Department of Conservation 2008).

The MPA classification, Protection Standard and implementation guidelines mention the need to maintain and provide for the recovery of “biogenic structures that support diversity.” The guidelines refer to “biogenic structures” as a type of substrata in the habitat classification and refer to the impact of potting and bottom gill netting on fragile “biogenic habitats” in potential MPAs. The Coastal Classification and Mapping Scheme refers to “biogenic reef” and the glossary defines biogenic reefs as:

“Biogenic reefs (elevated structures on the seabed constructed of living and dead organisms) include fragile erect bryozoans and other sessile suspension feeders. For example: bryozoan beds, rhodolith beds, tube worm mounds and sponge gardens” (Ministry of Fisheries and Department of Conservation 2008).

This poses two practical difficulties when attempting to apply the Coastal Classification and Mapping Scheme to identify and map this habitat:

- i) the range of organisms that can form biogenic substrata is broader than the four examples identified in the guidelines, and;
- ii) these organisms are not obligate reef-builders and may grow as small, widely scattered clumps, that do not form structures that could be regarded as “reefs”.

To alleviate these uncertainties, this report defines biogenic habitat as:

“Structures created by accumulations of organisms, usually rising from the seabed, or at least clearly forming a discrete and continuous biological assemblage, which is very different from the surrounding seabed and spans a distance of at least 10m along a horizontal axis. The structure of the reef may be composed almost entirely of the reef building organisms and their tubes, shells or stems, or it may to some degree be composed of sediments, stones and shells bound together by the organisms.”

For guidance, biogenic habitat may be formed in whole or in part by any of the bryozoan, coral, gorgonian, mollusc, tubeworm, rhodolith, seagrass, mangrove, saltmarsh, algal or sponge taxa listed in Appendix 3, growing either as a monospecific assemblage, or in association with any other biogenic taxa listed in Appendix 3.

Using this definition, areas of biogenic habitat were mapped according to the dominant organisms present (rather than categorised by depth or exposure). However, they were grouped under one category (biogenic habitat) for the gap analysis of areas represented in MPAs.

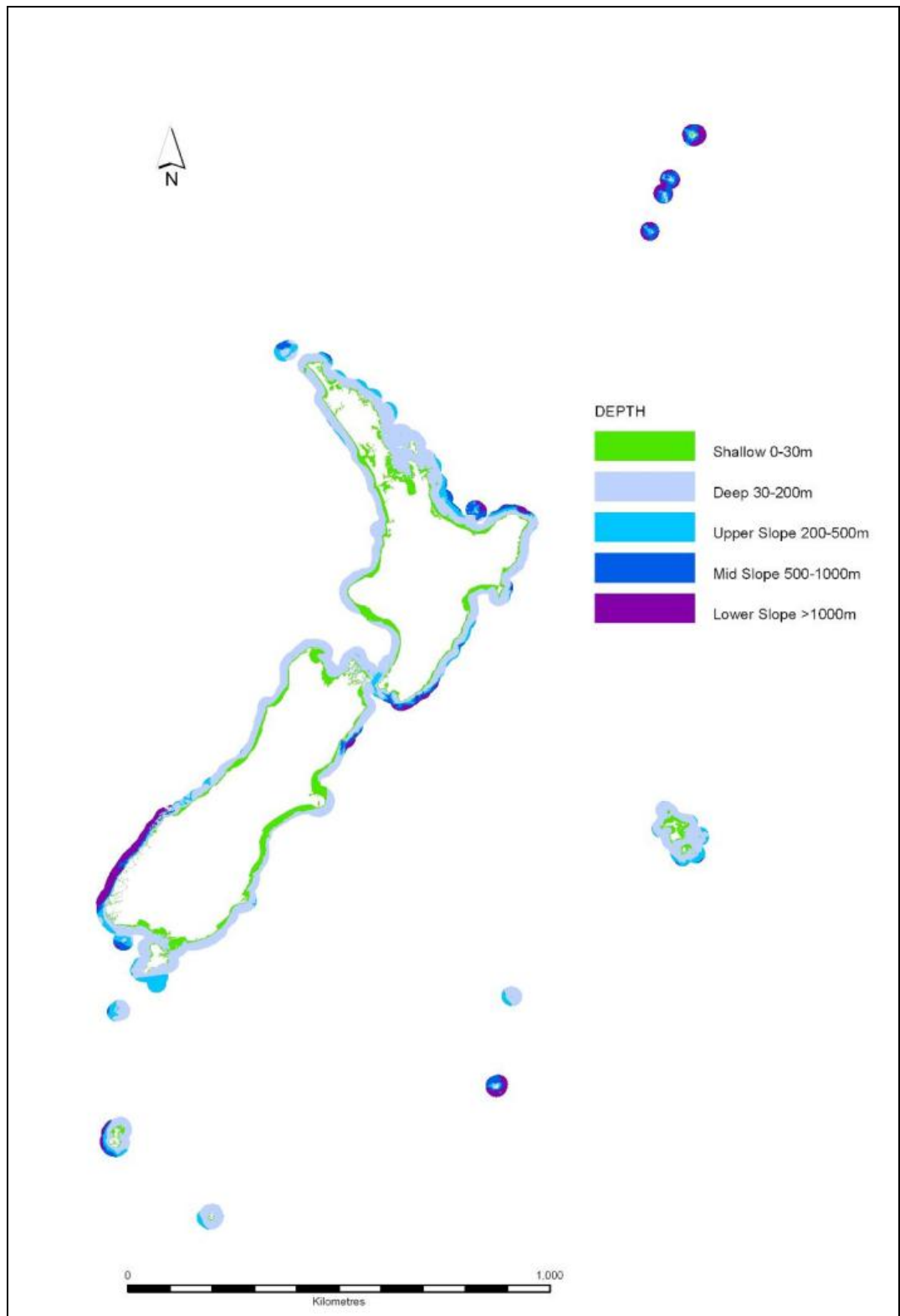


Figure 2. Depth categories used to map the coastal marine habitat classification.

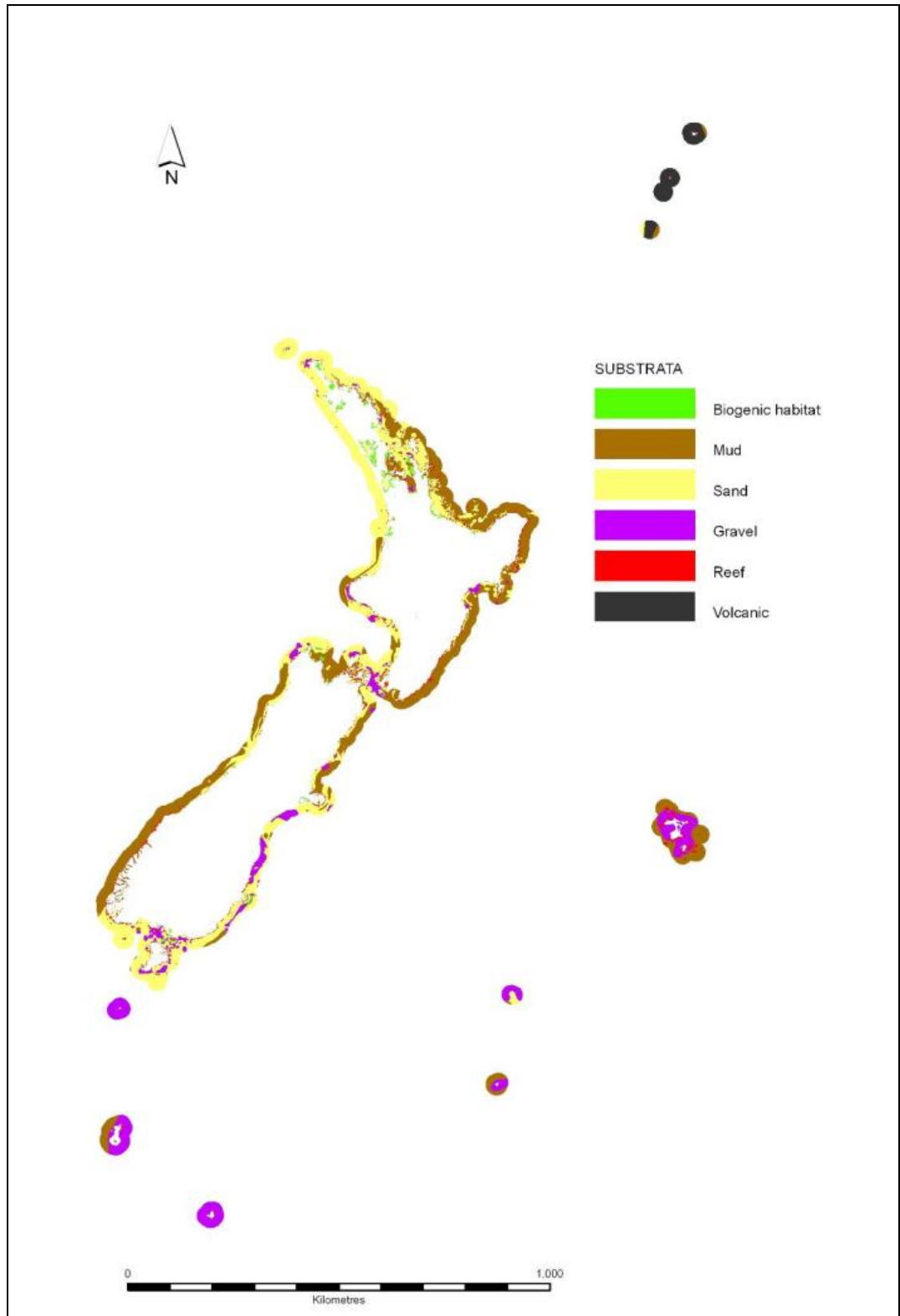


Figure 3. Substratum categories used to map the coastal marine habitat classification.

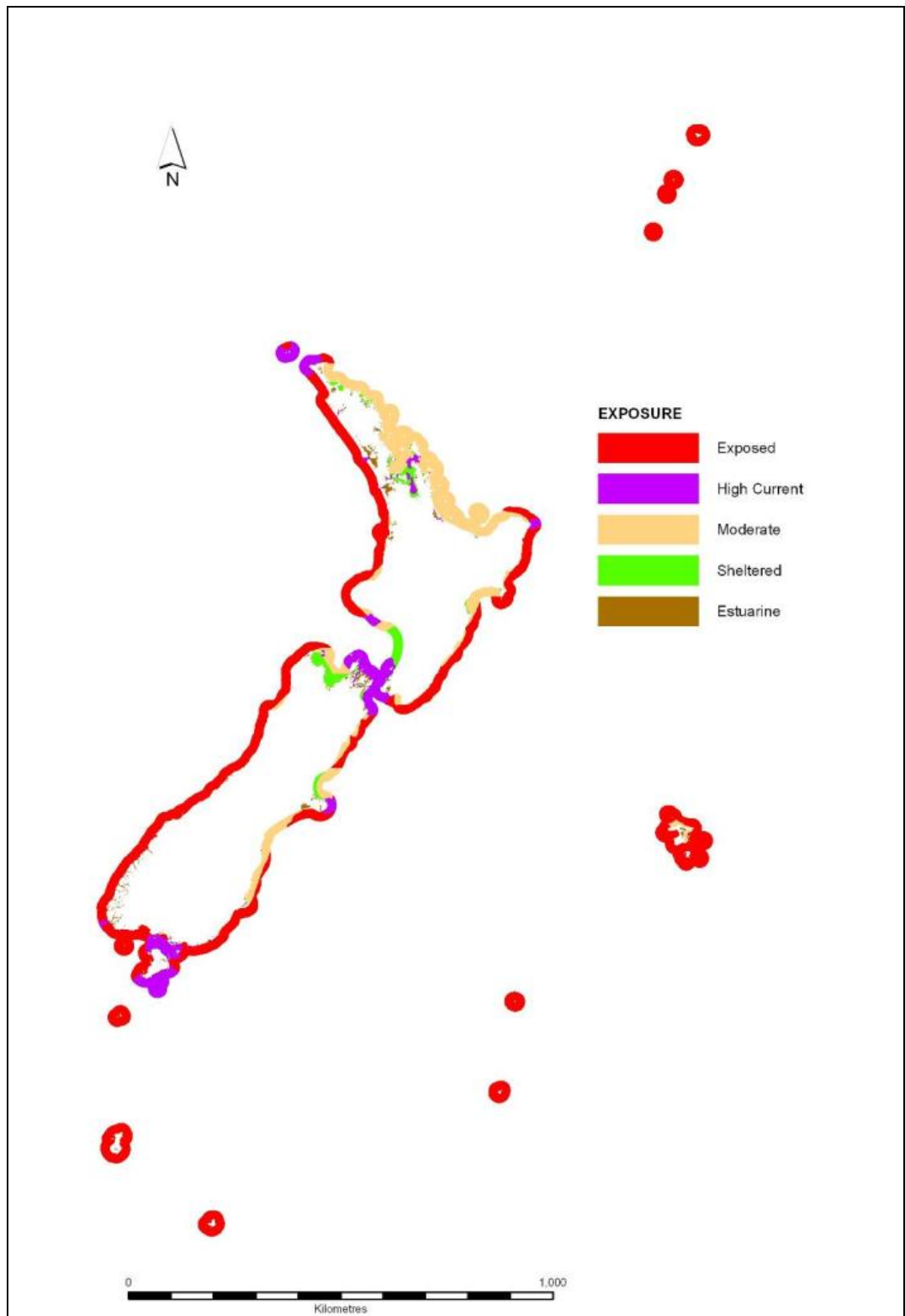


Figure 4. Exposure categories used to map the coastal marine habitat classification.

Data on the extent and distribution of biogenic habitat is relatively scarce for many areas, particular in deeper environments. Data from many sources were compiled and digitized to GIS by Ministry of Fisheries (Grace & Hayward 1980; Hayward et al. 1981; Batson & Probert 2000; Grange et al. 2003; Cranfield et al. 2004; Smith et al. 2005) and from a survey of marine scientists (S. Byers and K. Sivaguru, unpublished data), aerial photo interpretation (S. Byers and A. Wild, unpublished data), mangrove polygons from the LINZ 1:50,000 topographic database, saltmarsh coverages from the Land Cover Database 2 (Thompson et al. 2004) and from many published and unpublished reports (Robertson et al. 2003, 2004; Stevens & Clarke 2004; Hewitt & Funnell 2005; Stevens & Asher 2005; Robertson & Stevens 2007a, b, 2008, 2009a, b, c; Schwarz et al. 2006; Stevens & Robertson 2007, 2008a, b, c, 2009).

Mapping of biogenic habitat in deeper water was approximate and more detailed sonar and video surveys would assist in mapping these habitats at local scales. New information of this kind is likely to become available from projects currently underway, but these data were not available for use in this report.

While seagrass, mangrove and saltmarsh habitats do not fall within the range of examples for biogenic reef habitat in the Coastal Classification and Mapping Scheme, these plant communities were mapped because of their important role in structuring and supporting coastal habitats and ecosystems (Saintilan & Williams 2000; Adam 2002; Alongi 2002; Morrison et al. 2005; Morrissey et al. 2007). Only data seaward of the LINZ topographic coast were used in these analyses. The estimates given here are therefore conservative, given that the mapping of the marine / terrestrial boundary is approximate. Data for all habitats, above and below the coastline, were however retained for future analyses.

Large brown algae like *Macrocystis*, *Ecklonia*, *Durvillaea*, *Sargassum* and *Carpophyllum* form extensive, highly productive, biogenic habitats that support distinctive, diverse assemblages of other organisms and have a strong structural influence on coastal habitats, (Choat & Schiel 1982; Schiel & Foster 1986; Schiel 1990; Anderson et al. 2005). However, algal forests were not included in the Coastal Classification and Mapping Scheme. While these habitats were not mapped for this gap analysis, they should be included in the coastal classification and taken into consideration in more detailed regional planning and mapping for MPAs.

To map exposure, a GIS raster (grid) of mean annual significant wave height modelled by NIWA (Gorman et al. 2003) was simplified into three categories: exposed (>1.8m), moderate (1-1.8m) and sheltered (<1 m). The wave category grid was then converted to vector format and boundaries between categories were smoothed to be compatible with other data sets. Some areas that differed markedly from surrounding areas in mean significant wave height were judged to be model artefacts and these areas were merged with neighbouring zones.

As the Coastal Classification and Mapping Scheme (Ministry of Fisheries and Department of Conservation 2008) also defined exposure as a function of current, areas of high tidal current (>0.5 m/second) derived from the Marine Environment Classification (Snelder et al. 2005) were also mapped (Figure 4). Estuarine and ocean environments in the Coastal Classification and Mapping Scheme were demarcated by treating estuaries as a level of exposure.

The above GIS datasets were then combined using the union command in ArcGIS and ArcINFO 9.3. This command overlays and dissects the intersections between overlapping areas from different datasets. The function creates polygon features attributed with fields of variables from each of the source data sets. These fields were used to create composite

categories derived from combinations of the different levels in the depth, substrata and exposure fields. The ArcGIS 'eliminate' command was used to minimise the large numbers of elongate 'sliver polygons' resulting from overlaying disparate datasets. Slivers less than 1 hectare in area were dissolved into the adjacent polygon with the longest joint boundary.

In some cases, datasets did not completely overlap and for some areas a full classification using all environmental drivers was not possible. In most cases the area involved was small and polygons were merged with the nearest feature with the longest joint boundary. For parts of some estuaries, no nationally consistent data on substrata were available. These areas were mapped simply as unclassified estuary. This category was not however included within habitat counts for each bioregion.

2.2 INVENTORY OF MPAS

GIS data for management tools potentially able to meet the Protection Standard (Ministry of Fisheries and Department of Conservation 2008) were compiled from several sources, including: GIS maps of commercial and amateur fishing restrictions (data from Ministry of Fisheries Spatial Information Management Team 2009); mātaihai reserves and taiapure-local fishery; cable and pipeline zones (Froude & Smith 2004); marine reserves, and other reserves that extend below mean high water (data from Department of Conservation 2009).

Datasets were combined to assess where different management tools might jointly meet the Protection Standard as Type 2 MPAs (with a minimum prohibition on bottom trawl, Danish seine and amateur and commercial dredging). A range of other tools that currently do not meet the protection standard were also mapped.

2.3 CASE BY CASE ANALYSIS OF POTENTIAL MPAS

A joint workshop of scientists and managers from the Ministry of Fisheries and the Department of Conservation was held to assess potential MPAs on a case by case basis and classify these as Type 1 or Type 2 MPAs. Marine habitats, potential MPAs and other management areas were mapped and labelled in ArcGIS 10 and ArcView 3.3 and projected onto a whiteboard along with legislation and other background material. Individual cases of different types of management were examined systematically to assess whether these met the Protection Standard.

Areas where trawling, Danish seine and all dredging (commercial and amateur) are prohibited were mapped and assessed as to whether bottom gill netting and potting were likely to damage fragile biogenic habitats and whether other fishing practices or environmental impacts were likely to unduly disturb ecological systems, natural species composition and trophic linkages. In these analyses, prohibition of dredging was in some cases inferred from bans on taking dredge oysters or scallops.

2.4 GAPS ANALYSIS

GIS data for the coastal classification were overlaid (unioned in ArcGIS) with the MPA inventory dataset and the areas within each combination of habitat and management tool were calculated, summarised and exported for cross tabulation in Microsoft Excel.

3 Results

3.1 COASTAL HABITAT CLASSIFICATION

The range of different habitat types defined using the Coastal Classification and Mapping Scheme are shown in Figure 5 and broad scale maps of these habitats across the New Zealand Territorial Sea are provided in Figures 6-8. More detailed maps (1:400,000) are shown in Appendix 8. The area, percentage area and number of different habitats in each bioregion are shown in the bioregional total columns in Appendices 4-6.

3.2 CASE BY CASE ANALYSIS OF POTENTIAL MPAS

3.2.1 Type 1 marine reserve MPAs

The workshop to assess potential MPAs on a case by case basis identified marine reserves established under the Marine Reserves Act 1971 as Type 1 MPAs, because of the high level of protection afforded and the broad range of activities that can be managed, controlled or excluded (Ministry of Fisheries and Department of Conservation 2008).

3.2.2 Type 2 MPAs

The case by case workshop identified Mimiwhangata Marine Park (North Eastern Bioregion), the Sugar Loaf Islands Marine Park (Western North Island Bioregion), and parts of the Fiordland (Te Moana o Atawhenua) Marine Area as Type 2 MPAs. These areas met the Protection Standard because trawling, Danish seine and commercial and amateur dredging are prohibited. Although some potting can occur in these areas, the workshop concluded that this activity was unlikely to damage fragile biogenic habitats in these areas.

A case by case analysis of cable and pipeline zones where fishing and anchoring were prohibited indicated that, with one exception, the cable zones in the Hauraki Gulf, off the west coast of the North Island, and in Cook Strait meet the Protection Standard for Type 2 MPAs.

The zone for the sand mining pipeline at Taharoa south of Kawhia failed to meet the Protection Standard as a Type 2 MPA, because of the scale of this industrial operation. The pipeline is used to pump a slurry of iron sand concentrate and water into ore carriers 3 kilometres offshore and large quantities of excess water containing sediment is pumped overboard from the ship's bilge (IPENZ Engineers New Zealand). Other pipeline zones north and south of New Plymouth were included as Type 2 MPAs, subject to any evidence that indicates the Protection Standard is not being met in these areas.

Many different commercial and amateur fishing restrictions are mapped in detail in the GIS database. Most of these, however, do not provide sufficient protection for biodiversity to meet the Protection Standard; for they fail to meet one or more of the criteria prohibiting trawling, Danish seine and commercial and amateur dredging.

However, the workshop identified two areas that meet these and other criteria. They were the fisheries closure at Pukerua Bay in the North Cook Strait Bioregion (where all fishing except handlining is prohibited) and the Te Whaka a Te Wera Mātaitai and an adjacent area in Paterson Inlet, Stewart Island (where trawling, Danish seine and commercial and amateur dredging are prohibited).

If there are any significant changes in the management regime of the Type 2 MPAs identified, it may be necessary to undertake a subsequent analysis to determine if MPA status is still warranted.

3.2.3 Other marine protection tools

The workshop agreed that apart from the Te Whaka a Te Wera Mātaitai in Paterson Inlet, mātaitai reserves and taiapure-local fisheries did not currently meet the Protection Standard. Mātaitai reserves are established for the purpose of recognising and providing for customary management practices and food gathering by tangata whenua. Mātaitai reserves will generally exclude commercial fishing but not exclude recreational fishing and they are not currently closed to amateur dredging.

Taiapure-local fisheries are management tools established in areas that are of special significance to an iwi or hapu as a source of food or for spiritual or cultural reasons. Taiapure-local fisheries make provision for a management committee to provide advice and recommendations to the Minister of Fisheries on regulations for the conservation and management of the fish, aquatic life, or seaweed and to manage the fisheries in the taiapure-local fishery. While these areas may not currently meet the Protection Standard, there is the potential for this to occur if additional restrictions on fishing activities are formalised. These areas were therefore mapped and analysed under “other marine protection tools.”

The workshop agreed that other management tools do not provide sufficient protection to meet the Protection Standard for Type 2 MPAs, although they may have general objectives to protect biodiversity.

The Hauraki Gulf Marine Park has among its objectives the “protection and, where appropriate, the enhancement of the natural, historic, and physical resources of the Hauraki Gulf...” The Hauraki Gulf Marine Park Act 2000 states that activities carried out under other legislation are obliged to have “particular regard” for the national significance and objectives of the Hauraki Gulf Marine Park. However the Hauraki Gulf Marine Park Act does not confer the power to regulate fishing or other activities and therefore does not meet the Protection Standard.

The RAMSAR Convention’s mission is “the conservation and wise use of all wetlands through local, regional and national actions and international cooperation.” However, the convention has no direct powers to regulate activities listed under the Protection Standard. The workshop therefore agreed that RAMSAR areas did not meet the Protection Standard.

Many Department of Conservation managed areas (including nature, scientific, recreation, historic, scenic, government purpose and local purpose reserves, conservation areas, wildlife refuges, wildlife sanctuaries, national parks and wildlife management areas) overlap with marine habitats and have general objectives to preserve wildlife, landscapes and other natural resources. They are usually part of larger terrestrial reserves and do not specifically prohibit fishing activities. The workshop therefore agreed that these do not provide sufficient protection to meet the Protection Standard¹.

The workshop agreed that the existing marine mammal sanctuaries established under the Marine Mammal Protection Act 1978 do not directly regulate fishing activities and therefore do not qualify as Type 2 MPAs.

¹ The West Coast Protection Forum process previously identified sections of national park, stewardship area and scenic reserve as MPAs in the West Coast South Island Bioregion. While the previous assessment identified these areas as MPAs, for the purpose of the broad scale gap analysis these areas were not included as MPAs.

Although such regulations are possible under the Act, these functions are currently implemented through Fisheries regulations.

The workshop agreed that most of the many different commercial and amateur fishing restrictions mapped in the GIS database do not meet the Protection Standard. However, those that meet some, but not all of the main criteria for the Protection Standard were mapped and broadly grouped for analysis into three categories, where:

- bottom trawl, Danish seine and commercial (but not amateur) dredging are prohibited;
- only two of these commercial fishing activities are prohibited, and;
- areas where only one of these activities is prohibited.

These categories provide an indication of what additional restrictions on amateur dredging and commercial fishing may be required for an area to meet the Protection Standard, providing that other criteria set out in the Protection Standard are also met.

3.3 MPA INVENTORY

Broad scale maps of marine protected areas are shown for all New Zealand Territorial Waters, and around the North and South Islands, in Figures 9, 10 and 11. Broad scale maps of other management tools assessed are shown for all New Zealand Territorial Waters, and around the North and South Islands, in Figures 12, 13 and 14. More detailed maps (1:400,000) are shown in Appendix 7. All of these maps are a simplified representation of many overlapping regulations and jurisdictions. For analysis, management tools were grouped into broad categories as shown in Tables 2 to 5.



Figure 5. Legend for maps of marine coastal habitats.

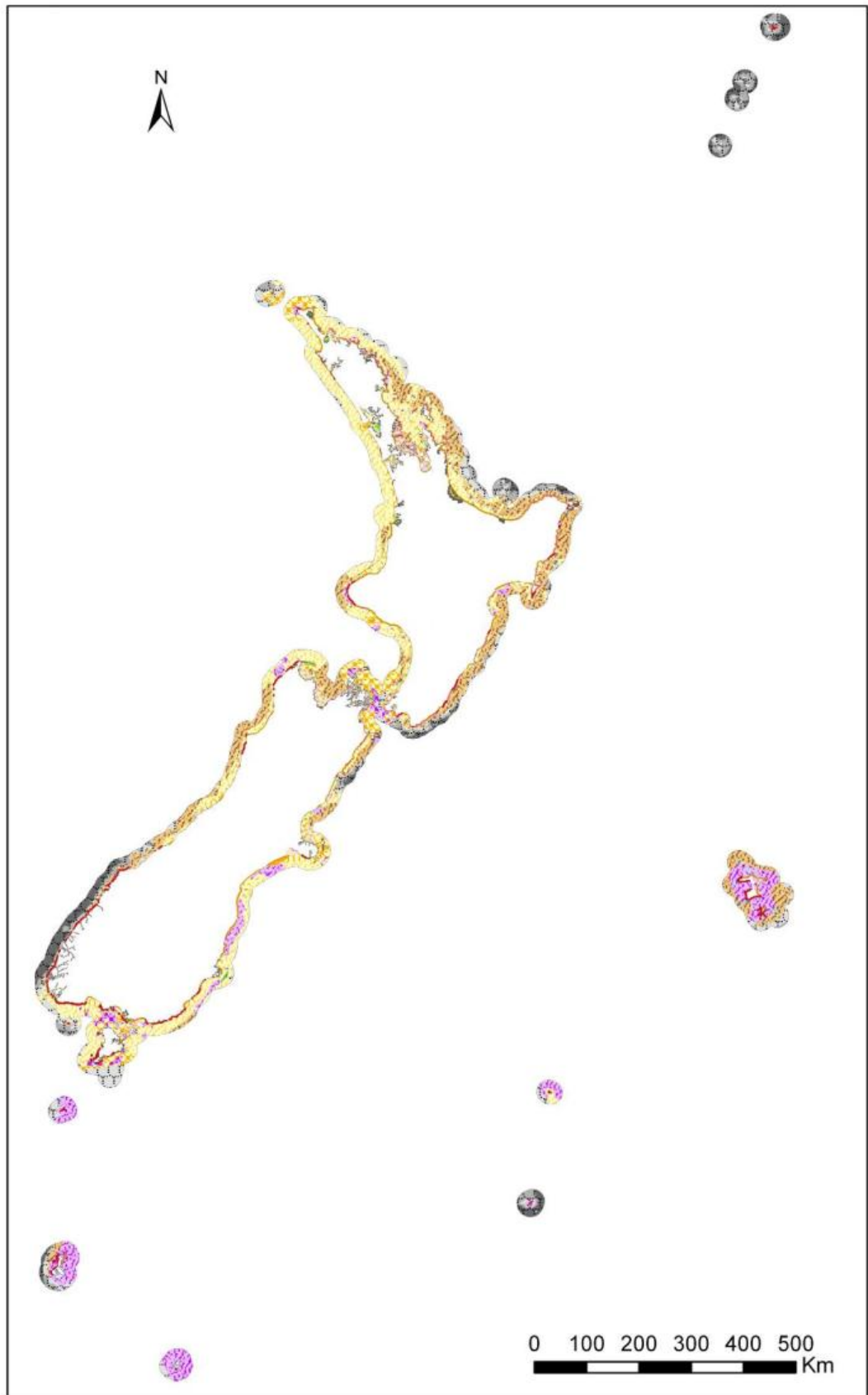


Figure 6. Map of the coastal marine habitat classification for New Zealand.

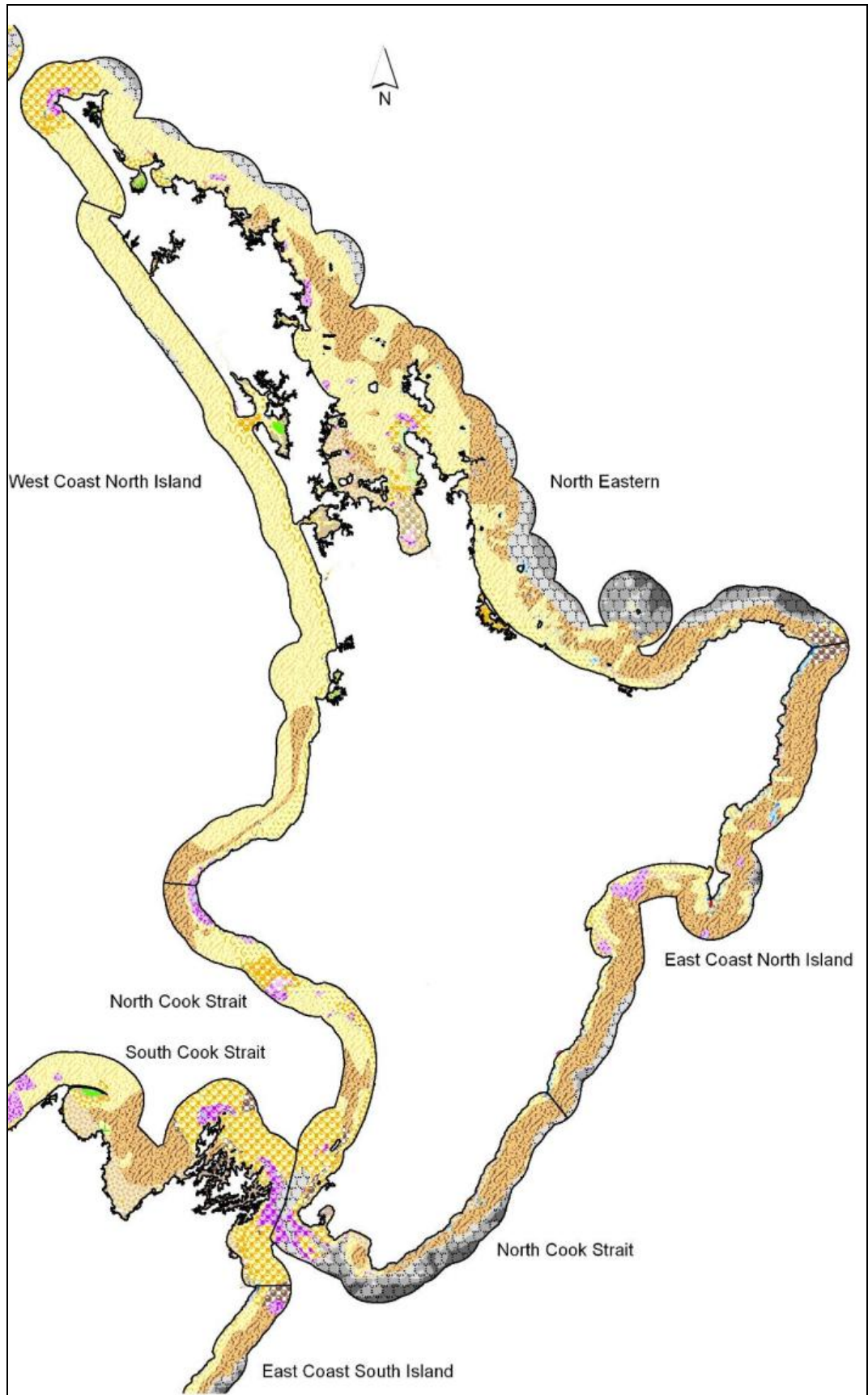


Figure 7. Map of the coastal marine habitat classification for the North Island.

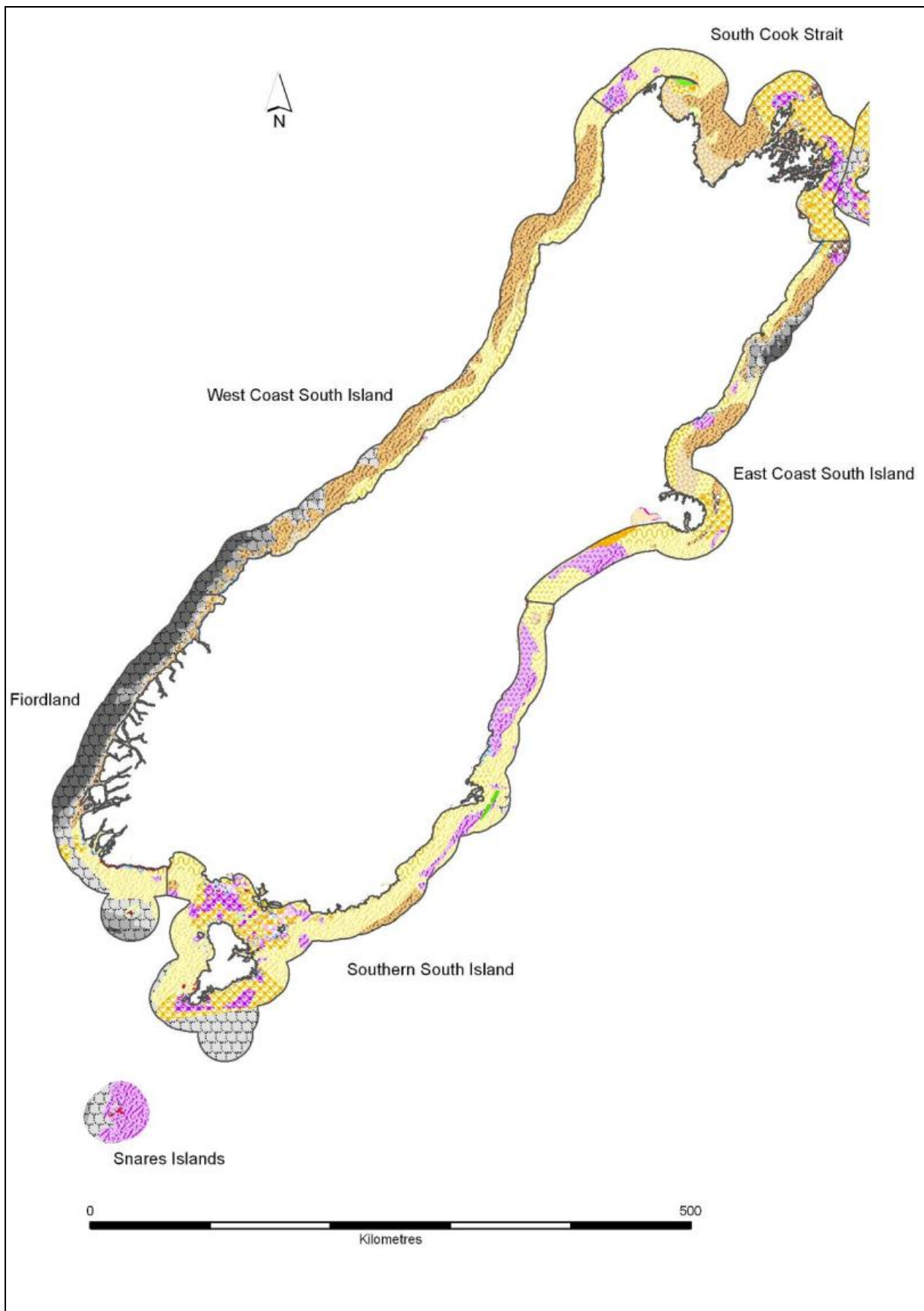


Figure 8. Map of the coastal marine habitat classification for the South Island.



Figure 9. Type 1 and Type 2 marine protected areas in the New Zealand Territorial Sea.

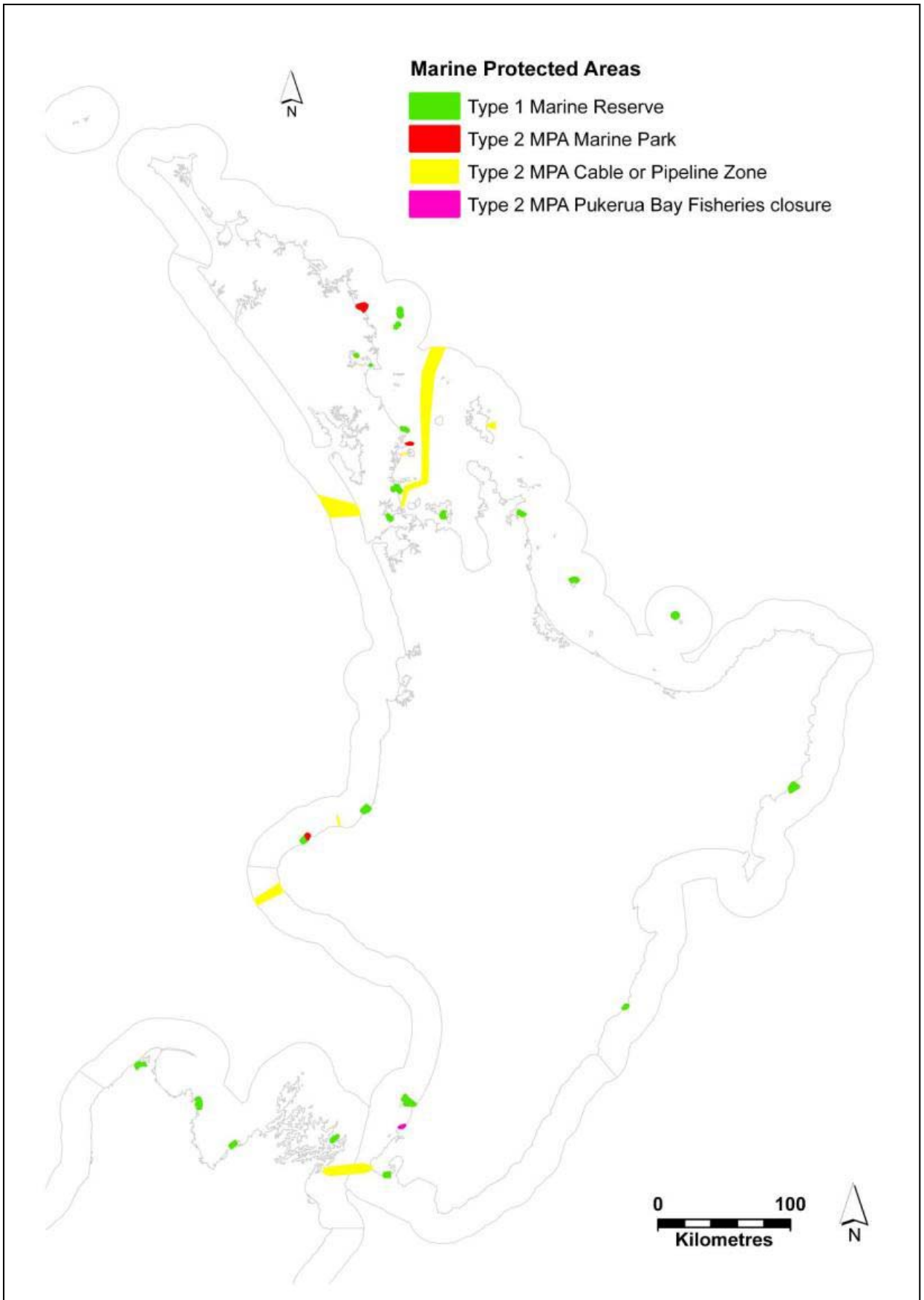


Figure 10. Type 1 and Type2 marine protected areas around the North Island.

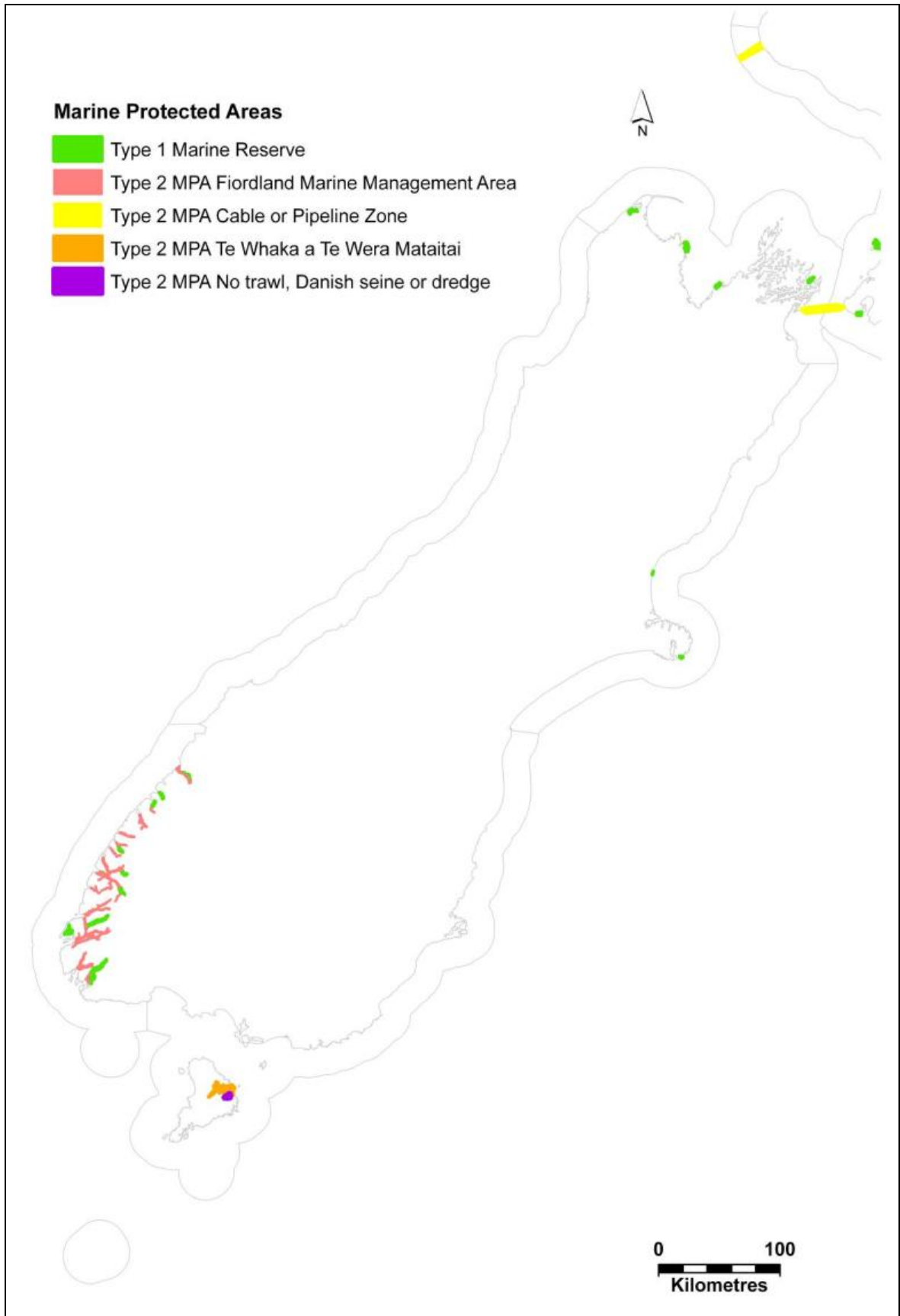


Figure 11. Type 1 and Type 2 marine protected areas around the South Island.

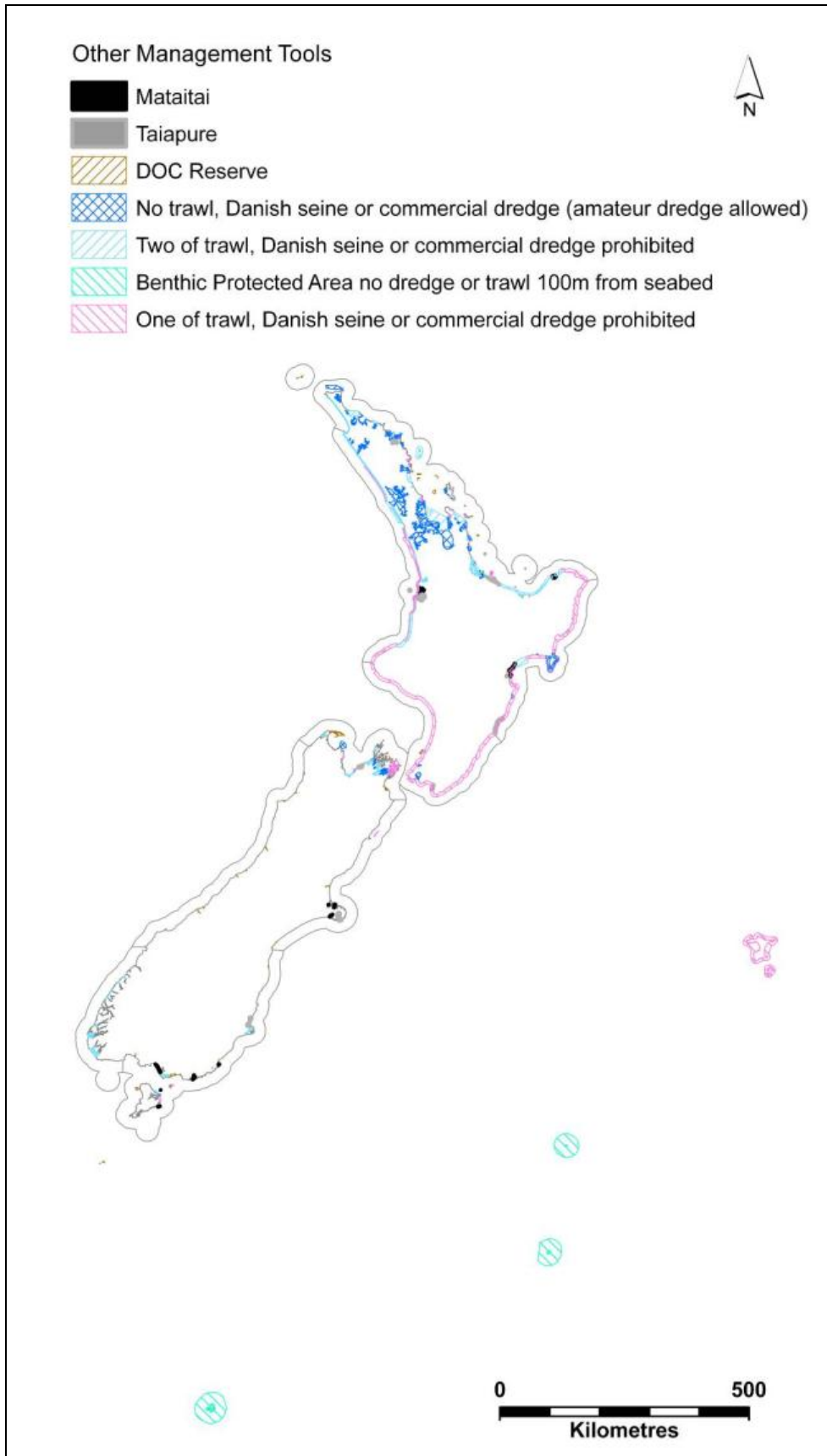


Figure 12. Other management tools in the New Zealand Territorial Sea.

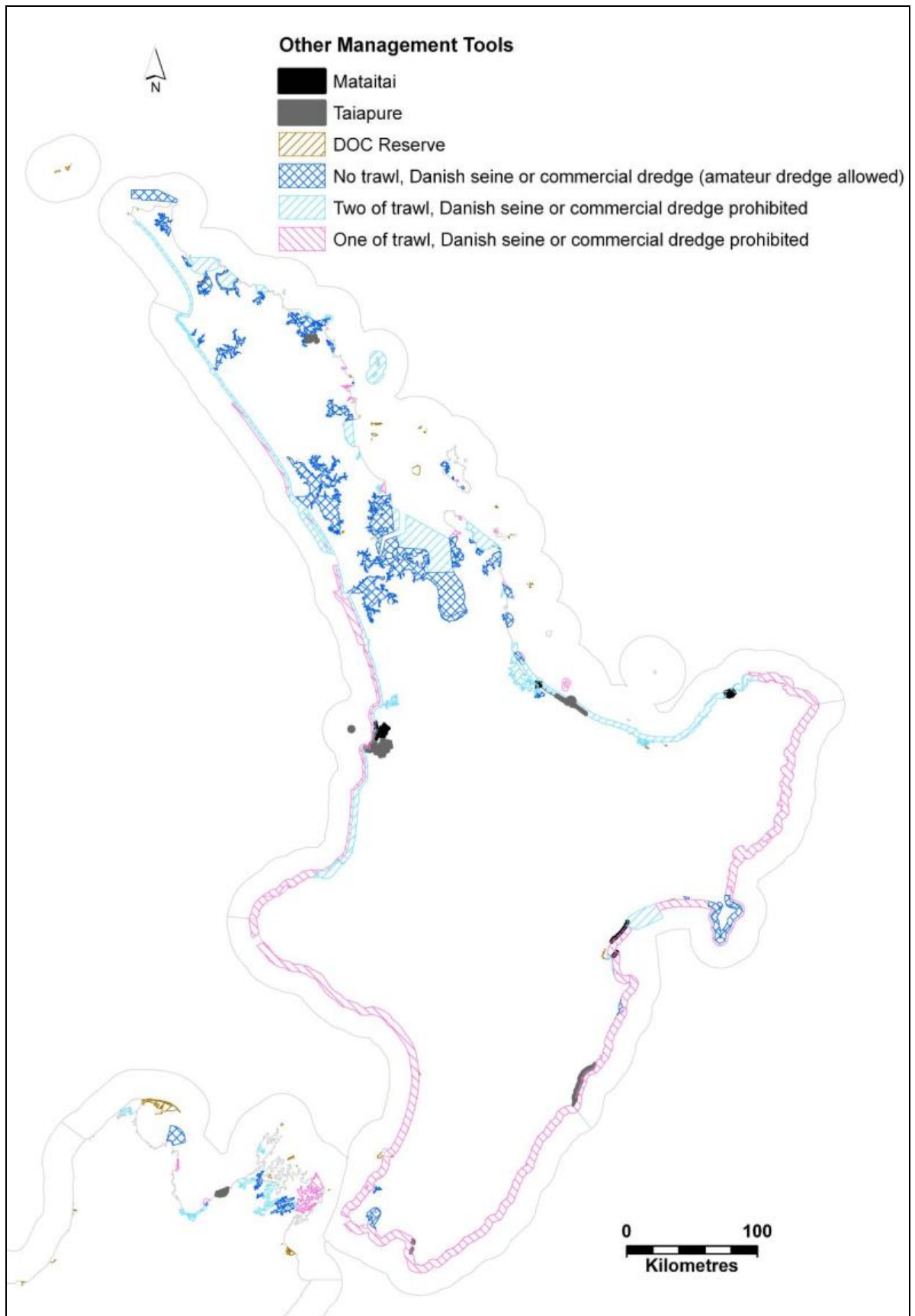


Figure 13. Other management tools around the North Island.

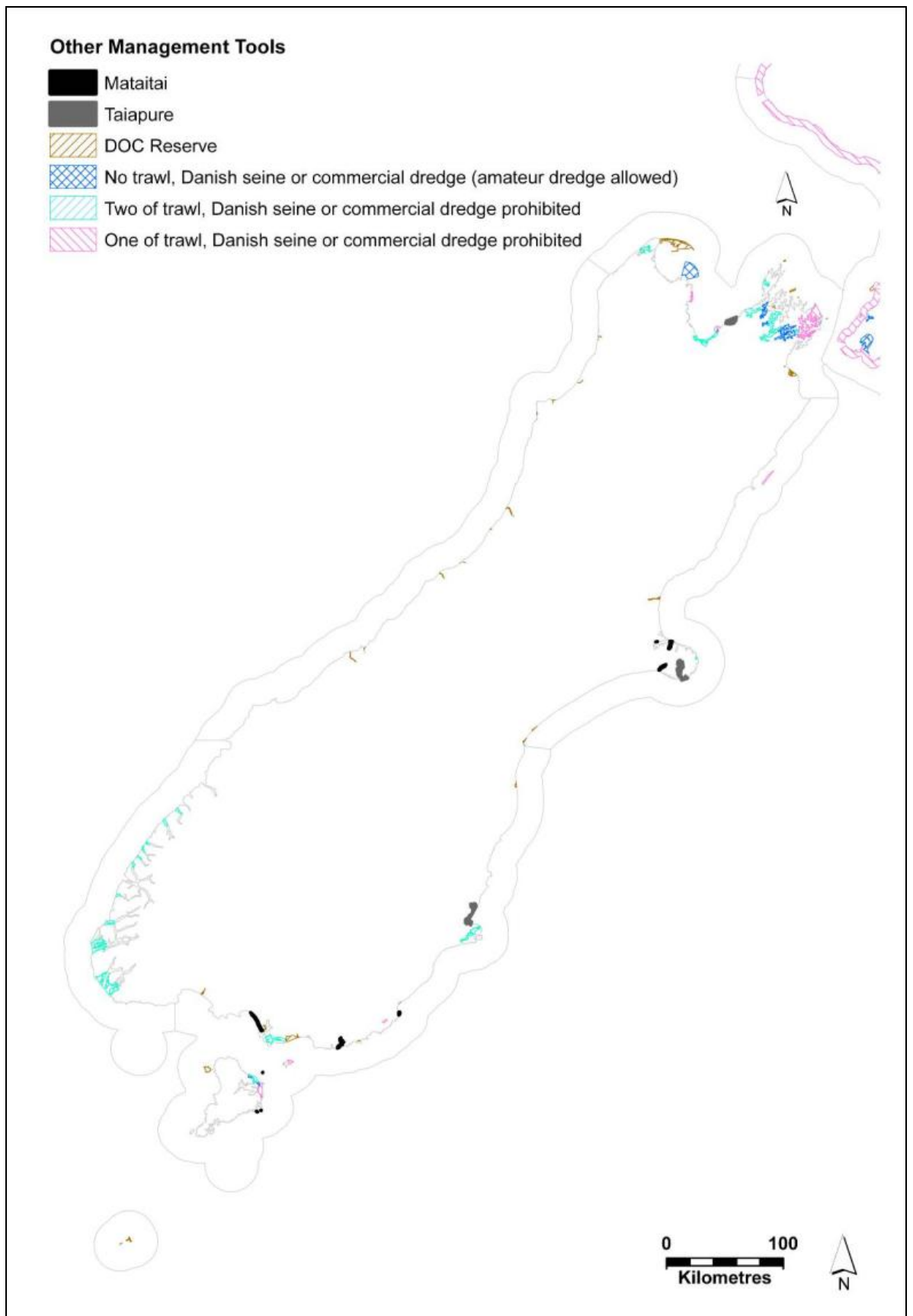


Figure 14. Other management tools around the South Island.

3.4 GAP ANALYSIS OF PROTECTION FOR MARINE HABITATS

The areas (in km²) and percentages of mapped marine habitat within marine protected areas in each bioregion, and in all of the New Zealand Territorial Sea and estuaries, are shown in Table 2 and Table 3. The areas and percentages of mapped marine habitat subject to other management tools assessed in each bioregion, and in all of the New Zealand Territorial Sea and estuaries, are shown in Table 4 and Table 5.

For clarity, all categories with no marine habitat are left blank and decimals are rounded except for very small amounts¹.

3.4.1 Type 1 marine reserve MPAs

The largest area of Type 1 marine reserve is in the Kermadec Islands Bioregion, where all coastal marine habitats (within 12 nautical miles) are protected in the Kermadec Islands Marine Reserve. In the Subantarctic Islands Bioregion, large areas of habitat (within 12 nautical miles) are protected in the Auckland Islands Marine Reserve and recently announced plans to establish marine reserves around the Campbell, Bounty and Antipodes Islands, will increase the extent of Type 1 marine reserves to 79 % of the Subantarctic Islands bioregion. All of the Territorial Sea around the Auckland Islands is currently protected in Type 1 marine reserve. Under the new plans 39% of the Territorial Sea around Campbell Island, 58 % of the Territorial Sea around the Bounty Islands and all of the Territorial Sea around the Antipodes Islands will also be protected in Type 1 marine reserve.

In other bioregions, the largest areas of marine reserve occur in the Fiordland, North Eastern, Western North Island, South Cook Strait, North Cook Strait, and Eastern North Island Bioregions. Approximately 1% of the Fiordland Bioregion is within marine reserve, while marine reserves occupy only 0.3% or less of the remaining bioregions in this group.

The Southern South Island and East Coast South Island Bioregions have 0.05% or less of their area in marine reserve but the Three Kings, Chatham Islands and Snares Islands Bioregions have no marine reserves.

The West Coast South Island Bioregion currently has no marine reserves but a MPA planning process has developed recommendations for marine reserves and other MPAs (West Coast Marine Protection Forum 2010).

3.4.2 Type 2 MPAs

The minimum criteria that Type 2 MPAs must meet is for all bottom trawling, Danish seine and dredging (amateur and commercial) to be prohibited. Table 2 and Table 3 show the areas and percentages of each bioregion in Type 2 MPAs where these activities are prohibited.

The largest areas where these activities are prohibited are parts of the Fiordland (Te Moana o Atawhenua) Marine Area and in cable and some pipeline zones in the North Eastern, Western North Island, North Cook Strait and South Cook Strait Bioregions.

Some marine parks in the North Eastern (Mimiwhangata) and Western North Island (Sugar Loaf Islands) Bioregions are also Type 2 MPAs.

There are also three areas where trawling, Danish seine and dredging (commercial and amateur) are prohibited. These are in the Southern South Island Bioregion (Te Whaka a Te Wera Mātaitai in Paterson Inlet at Stewart Island), an adjacent area in Big Glory Bay and in Pukerua Bay in the North Cook Strait Bioregion.

¹ Areas and percentages less than 0.0005 are displayed as “0.000”.

The Fiordland Bioregion has 3.7% of its total area included in Type 2 MPAs. The North Eastern (2.4%), Western North Island (2.3%), South Cook Strait (1.1%) and North Cook Strait (1.8%) have slightly less area in Type 2 MPAs but all other bioregions have 0.5% or much less of their area in Type 2 MPAs.

3.4.3 Other marine protection tools

Mātaitai reserves and taiapure-local fisheries

The areas and percentages of mapped marine habitat in mātaitai reserves and taiapure-local fisheries within each bioregion are shown in Table 4 and Table 5. Areas managed using these customary management tools occur in the Western North Island, North Eastern, Eastern North Island, North Cook Strait, East Coast South Island, South Cook Strait and Southern South Island. The Te Whaka a Te Wera Mātaitai in Paterson Inlet, Stewart Island is closed to amateur dredging and also closed to trawl, Danish seine and commercial dredging. Its area is therefore also included as a Type 2 MPA, percentages and habitat counts. The largest area of mapped marine habitat in mātaitai reserves and taiapure-local fisheries occurs in the Western North Island and this represents 1.1% of the bioregion.

Reserves managed by the Department of Conservation

In addition to marine reserves, the Department of Conservation manages a range of other reserves under the Conservation Act 1987, Reserves Act 1977, Wildlife Act 1953 and the National Parks Act 1980.

Some of these reserves include marine habitats, particularly in the South Cook Strait, North Eastern, Southern South Island, West Coast South Island and Western North Island Bioregions. These include nature, scientific, scenic, historic, recreation, government purpose and local purpose reserves, conservation parks, national parks, ecological areas and wildlife sanctuaries, refuges and management areas.

The areas and percentages of these reserves below mean high water in each bioregion are shown in Table 4 and Table 5. They occur in all mainland bioregions except Fiordland but the largest areas are in the North Eastern, South Cook Strait and Southern South Island Bioregions. All include less than 1% of the total area of each bioregion.

Commercial fishing regulations

Table 4 and Table 5 show the extent of areas where bottom trawl, Danish seine and commercial (but not amateur) dredging are prohibited. The tables also show where there are prohibitions on two, or only one of the bottom trawl, Danish seine or commercial dredging methods.

There are areas in seven bioregions with bans on commercial bottom trawling, Danish seining and dredging. The largest of these areas are in the North Eastern (8%), Western North Island (8.4% of bioregion), East Coast North Island (3.1%) and South Cook Strait (2.2%) Bioregions.

In addition, there are areas where two of the three mobile bottom fishing methods used by commercial fishers (bottom trawling, Danish seining and dredging) are already prohibited. The largest is in the Subantarctic Islands Bioregion (56.3% of bioregion) where Benthic Protection Areas prohibit bottom trawl and commercial dredging but not Danish seining. The North Eastern (8.6%), Western North Island (10.2%), and several other bioregions also have substantial areas in this category.

There are also several bioregions with areas protected from one of the critical commercial fishing methods. These include the North Cook Strait (23%), Eastern North Island (20%), Chatham Islands (15%) and Western North Island (8%) Bioregions.

Table 2. Areas (km²) of marine protected areas in coastal marine bioregions.

Area (km ²)	Type 1 MPA Marine Reserve	Type 2 MPA Cable or Pipeline Zone	Type 2 MPA Marine Park ¹	Type 2 MPA Fiordland Marine Management Area	Type 2 MPA - No trawl, Danish seine or dredge ²	Total MPA Type 2	Total MPA	Total Bioregion Area
Chatham Islands								12,318
East Coast South Island	2.2						2.2	11,288
Eastern North Island	27						27	11,637
Fiordland	103			379		379	482	10,241
Kermadec Islands	7,179						7,179	7,179
North Cook Strait	33	239			2.0	241	274	13,671
North Eastern	79	879	22.2			901	981	38,073
Snares Islands								2,154
South Cook Strait	38	139				139	177	12,241
Southern South Island	11				89	89	99	20,986
Subantarctic Islands	5,057						5,057	11,936
Three Kings								2,226
West Coast South Island								13,158
Western North Island	32	322	4.3			326	359	14,589
Total area in NZ territorial waters	12,563	1,577	26.5	379	91	2,073	14,636	181,699

¹ Sugar Loaf Islands, Tāwharanui and Mimiwhangata Marine Parks

² Pukerua Bay, Paterson Inlet and Big Glory Bay

Table 3. Percentage of each bioregion in marine protected areas.

% of total area of bioregion	Total MPA					
	Type 1 MPA Marine Reserve	Type 2 MPA Cable or Pipeline Zone	Type 2 MPA Marine Park ¹	Type 2 MPA Fiordland Marine Management Area	Type 2 MPA - No trawl, Danish seine or dredge ²	Total MPA Type 2
Chatham Islands						
East Coast South Island	0.02					0.02
Eastern North Island	0.2					0.2
Fiordland	1.0			3.7		4.7
Kermadec Islands	100					100
North Cook Strait	0.2	1.7			0.01	2.0
North Eastern	0.2	2.3	0.06			2.6
Snares Islands						
South Cook Strait	0.3	1.1				1.4
Southern South Island	0.05				0.4	0.5
Subantarctic Islands	42					42
Three Kings						
West Coast South Island						
Western North Island	0.2	2.2	0.03		0.03	2.5
% of area in NZ territorial waters	6.9	0.9	0.01	0.2	0.05	8.1

1 Sugar Loaf Islands, Tāwharanui and Mimiwhangata Marine Parks

2 Pukerua Bay, Paterson Inlet and Big Glory Bay

Table 4. Area (km²) of other management tools in coastal marine bioregions.

Area (km ²)	Management Tools								Total Bioregion Area
	Matatai	Taiapure	Hauraki Gulf Marine Park	Nature or Scientific Reserve	Other DOC Reserves	No trawl, Danish seine, or commercial dredging (amateur dredge allowed)	Two of trawl, Danish seine or commercial dredge prohibited	One of trawl, Danish seine or commercial dredge prohibited	
Chatham Islands				0.3		2		1,869	12,318
East Coast South Island	14	42			2.6		46	23	11,288
Eastern North Island	16	62			1.5	356	322	2,372	11,637
Fiordland							286		10,241
Kermadec Islands									7,179
North Cook Strait		3.3		1.2	2.4	94	4	3,200	13,671
North Eastern	33	73	14,165	25	82	3,051	3,262	451	38,073
Snares Islands				0.6					2,154
South Cook Strait		25		92	34	273	235	254	12,241
Southern South Island	105	25		14	23	10	123	52	20,986
Subantarctic Islands				2.9			6,715		11,936
Three Kings				0.2					2,226
West Coast South Island					11				13,158
Western North Island	40	125		7.1	11	1,219	1,493	1,184	14,589
Total area in NZ territorial waters	208	355	14,165	143.5	168	5,005	12,486	9,407	181,699

Table 5. Percentage of each bioregion in other management tools.

% of total area of bioregion			Hauraki Gulf Marine Park	Nature or Scientific Reserve	Other DOC Reserves	No trawl, Danish seine, or commercial dredge (amateur dredge allowed)	Two of trawl, Danish seine or commercial dredge prohibited	One of trawl, Danish seine or commercial dredge prohibited
	Matatai	Taiapure						
Chatham Islands				0.002		0.02		15
East Coast South Island	0.1	0.4			0.02		0.4	0.2
Eastern North Island	0.1	0.5			0.01	3.1	2.8	20
Fiordland							2.8	
Kermadec Islands								
North Cook Strait		0.02		0.01	0.02	0.7	0.03	23
North Eastern	0.1	0.2	37.2	0.1	0.2	8.0	8.6	1.2
Snares Islands				0.03				
South Cook Strait		0.2		0.8	0.3	2.2	1.9	2.1
Southern South Island	0.5	0.1		0.1	0.1	0.05	0.6	0.2
Subantarctic Islands				0.02			56	
Three Kings				0.01				
West Coast South Island					0.1			
Western North Island	0.3	0.9		0.05	0.1	8.4	10	8.1
% of area in NZ territorial waters	0.1	0.2	7.8	0.1	0.1	2.8	6.9	5.2

3.4.4 Marine habitat types protected in each bioregion

Appendices 4 and 5 show the area and percentage of individual habitats for each bioregion within Type 1 marine reserves, Type 2 MPAs, mātaïtai reserves, taiapure-local fisheries, other DOC reserves and areas with bans on three, two or one of the mobile bottom-fishing methods used by commercial fishers. Blanks and small values in the tables may represent significant gaps in representation of habitats within the various management categories.

Appendix 6 shows the number of habitats represented in different MPA types for each bioregion at percentage representations greater than 0% and greater than 1% of the total area of the habitat in the bioregion. The total number of habitats mapped in each bioregion is provided below these counts.

Chatham Islands

In the Chatham Islands Bioregion, there are no Type 1 marine reserve MPAs or Type 2 MPAs and therefore none of the 22 habitats mapped for the bioregion are represented in MPAs.

There are two intertidal habitats in the foreshores of nature reserves but no habitats in mātaïtai reserves or taiapure-local fisheries.

Small percentages (<5%) of 11 habitats are protected from trawling, Danish seine and commercial dredging and other areas are protected from at least one of these commercial activities.

East Coast South Island

In the East Coast South Island Bioregion, small areas of shallow exposed reef and sand, estuarine reef and sand and some mudflat are protected in a Type 1 marine reserve MPA but no habitats are included in Type 2 MPAs. There are therefore, major gaps in representation with only five out of a total of 37 habitats represented in MPAs. Only two habitats are represented in Type 1 marine reserve MPAs at levels greater than 1%.

There are areas of estuarine mud, reef and beach, mudflat, shallow mud and sheltered shallow reef within mātaïtai reserves. There are also areas of estuarine mud, sand, beach and reef, and smaller areas of exposed shallow reef and sand, deep sand, mudflat and high current sand and shallow reef in taiapure-local fisheries.

Mātaïtai reserves and taiapure-local fisheries include, respectively, examples from six and 11 of the 37 habitats found in the bioregion. Mātaïtai reserves include two habitats (estuarine mud and estuarine reef) at percentages greater than 1% of the total area of each habitat in the bioregion. Taiapure-local fisheries include between 25% and 35% of the bioregional area of estuarine mud, sand and reef and there are five other habitats where greater than 1% of the bioregional area is included in this management tool.

Department of Conservation reserves (other than marine reserve) include seven out of 37 habitats, but only three of these have more than 1% of their bioregional area subject to this management tool.

There are no habitats protected from all three commercial activities of trawling, Danish seine and dredging but 11 habitats have at least two of these activities prohibited for some areas.

Eastern North Island

In the Eastern North Island Bioregion, the largest areas of habitat within Type 1 marine reserve MPA are: exposed and moderate shallow reef and sand, deep sand and reef, with some deep and shallow mud, rocky shore and beach also in marine reserve. There are no areas in Type 2 MPAs.

Mātaitai reserves include areas of moderate shallow reef and sand and shallow mud, moderate rocky shore and beach and sheltered shallow sand, reef and beach. Taiapure-local fisheries include areas of moderate shallow reef and sand, and shallow mud as well as moderate rocky shore and beach.

There are small areas of some habitats in Department of Conservation reserves and substantial areas of many habitats with prohibitions on commercial trawling, Danish seine and/or dredging.

Only 13 of the 37 habitats occurring in the bioregion are protected in Type 1 marine reserve MPAs, and only seven of these are represented at greater than 1%.

Mātaitai reserves include eight of the 37 habitats in the bioregion, with five habitats having greater than 1% of their area in mātaitai reserves. Taiapure-local fisheries include five habitats, all represented at greater than 1%.

Department of Conservation reserves (other than marine reserves) include five habitats, four of which are represented at greater than 1%.

Commercial trawling, Danish seine and dredging are prohibited within some parts of 22 out of 37 habitats, with 19 of these habitats having more than 1% of their total areas in the bioregion included in these prohibitions.

Fiordland

In the Fiordland Bioregion, the largest areas of habitat within Type 1 marine reserve and Type 2 MPA protection are estuarine mud, sand, reef, mudflat, beach and rocky shore. Only small areas of exposed or high current habitat occur in Type 2 MPAs and no offshore habitat is protected.

Only six of 26 habitats in the bioregion are protected in marine reserve and 12 habitats are protected in Type 2 MPAs. Protection at levels greater than 1% of the bioregional area occurs for six habitats in marine reserves and seven habitats in Type 2 MPAs.

There are no mātaitai reserves, taiapure-local fisheries or Department of Conservation reserves (other than marine reserve) in this bioregion. There are also no areas where all three of trawling, Danish seine or commercial dredging methods are prohibited (except in Type 1 and Type 2 MPAs), but there are 18 habitats where at least two of these commercial fishing methods are prohibited and 13 habitats which have closures to two of these fishing methods across more than 1% of their area.

Kermadec Islands

All 11 habitats mapped in the Territorial Sea of the Kermadec Islands Bioregion are represented in the Kermadec Islands Marine Reserve (a type 1 MPA).

North Cook Strait

In the North Cook Strait Bioregion, the largest areas of habitat protected in Type 1 marine reserve MPA are comprised of high current deep and shallow sand, high current deep mud, high current shallow reef and moderate shallow reef and sand.

Type 2 MPAs include areas of deep mud, sand and gravel, high current deep gravel and sand, exposed shallow gravel and reef and upper slope.

Of the 39 habitats mapped in the bioregion, 12 are included in Type 1 marine reserve MPAs, and eight of these have more than 1% of their area protected. Potential Type 2 MPAs include 22 habitats with 12 of these represented at levels greater than 1%.

There are no mātaimai reserves in the bioregion but areas of moderate shallow reef, shallow mud and moderate rocky shore and beach are included in taiapure-local fisheries. Areas of high current rocky shore and beach, estuarine rocky shore, sheltered beach, estuarine sand, mudflat and biogenic habitat are found in Department of Conservation reserves (other than marine reserves).

Areas with prohibitions on trawling, Danish seine and commercial dredging occur for 15 of 39 habitats and 36 of 39 habitats have at least one of these activities prohibited.

North Eastern

In the North Eastern Bioregion, the largest areas of habitat in Type 1 marine reserve MPA are comprised of deep sand, mud and reef and upper slope and in shallow mud, mudflat, moderate shallow reef and sand, sheltered shallow sand, estuarine sand and biogenic habitat.

Large areas of deep sand, mud, reef and gravel and areas of moderate shallow gravel and biogenic habitat occur in Type 2 MPAs.

Of the 41 habitats mapped in the bioregion, 19 occur in marine reserves, but only five habitats have more than 1% of their area protected in marine reserve.

Type 2 MPAs include areas of 25 habitats and 16 habitats have more than 1% of their area in this management category.

Out of a total of 41 habitats within the bioregion, 12 have part of their area in mātaimai reserves, and taiapure-local fisheries include examples of nine habitats. Across the bioregion, two habitats have more than 1% of their total area in mātaimai reserves, and five have more than 1% of their area in taiapure-local fisheries.

Department of Conservation reserves (other than marine reserves) include areas of 18 of the 41 habitats but only three habitats have greater than 1% of their area in DOC reserve.

There are parts of 32 of the 41 habitats where trawl, Danish seine and commercial dredges are prohibited and 26 habitats which have greater than 1% of their area protected from these commercial fishing methods.

Snares Islands

In the Snares Islands Bioregion, there are no Type 1 marine reserve MPAs or Type 2 MPAs. Two intertidal habitats (moderate and exposed rocky shore) are included within the foreshore of the island nature reserve but there are no habitats in mātaimai reserves, or taiapure-local fisheries, nor are there any areas where trawling, Danish seining or commercial dredging are prohibited.

South Cook Strait

In the South Cook Strait Bioregion, the largest areas of habitat in Type 1 marine reserve MPAs are shallow mud, mudflat, estuarine sand and reef and sheltered shallow reef.

There are areas of high current gravel, high current deep sand and sheltered rocky shore and other habitats in Type 2 MPAs.

Of the 38 habitats mapped in the bioregion, 17 occur in marine reserve, with six habitats represented at over 1% of their bioregional area.

Type 2 MPAs include areas of 13 different habitats and six of these habitats have more than 1% of their bioregional area in this form of protection.

No habitats occur in mātaimai reserves, but five habitats occur in taiapure-local fisheries and four of these are represented at greater than 1% of their bioregional area.

Department of Conservation reserves (other than marine reserve) include areas of 21 habitats and eight of these are represented at greater than 1% of their total area in the bioregion.

Areas where trawl, Danish seine and commercial dredges are prohibited occur across 16 of the 38 habitats and 12 habitats have over 1% of their area protected from these commercial fishing methods.

Southern South Island

In the Southern South Island Bioregion, most of the area protected by Type 1 marine reserve MPA is estuarine mud, sand and reef and these habitats also occur in Type 2 MPA. Type 2 MPAs also include areas of estuarine gravel, unclassified estuary, mudflat, high current shallow sand, reef and biogenic habitat.

Of the 37 habitats mapped for this bioregion, 11 are represented in marine reserve but only five have greater than 1% of their area in marine reserve.

Type 2 MPAs include parts of 14 of the 37 habitats and nine habitats have greater than 1% of their area represented in this form of protection.

Out of a total of 37 habitats in the bioregion, 20 have part of their area in mātaimai reserves, and 11 have part of their area in taiapure-local fisheries. Across the bioregion, 12 habitats have more than 1% of their total area in mātaimai reserves, and 10 have more than 1% of their area in taiapure-local fisheries.

Areas of 15 habitats occur in Department of Conservation reserves (except marine reserve) and three habitats have greater than 1% of their bioregional area in these reserve categories.

Small areas of habitat are protected from trawl, Danish seine and commercial dredging, 13 of 37 habitats are protected from all three of these commercial fishing methods and eight habitats have greater than 1% of their area protected from all three.

Subantarctic Islands

In the Subantarctic Islands Bioregion, most mapped habitats are represented within the Auckland Islands Marine Reserve, except deep sand and exposed

shallow sand. Of the 19 habitats mapped for this bioregion, 17 are represented in the marine reserve. Most areas of remaining habitat are represented within Benthic Protection Areas where bottom trawling and commercial dredging (but not Danish seining or amateur dredging) are prohibited; some intertidal habitat occurs on the foreshores of the nature reserves.

Three Kings

There are no Type 1 marine reserves or Type 2 MPAs in the Three Kings Bioregion.

Intertidal rocky shores occur within the foreshore of the island nature reserve, but no other habitats are found in any of the other management tools assessed.

West Coast South Island

In the West Coast South Island Bioregion, none of the 21 habitats mapped are currently protected in either Type 1 marine reserve or Type 2 MPAs. Small areas for seven habitats occur in Department of Conservation reserves but only four habitats have greater than 1% of their bioregional area represented.

Western North Island

In the Western North Island Bioregion, moderate shallow sand and reef are the predominant habitat types in Type 1 marine reserve MPAs. Areas of deep sand and exposed and moderate shallow sand occur in Type 2 MPAs.

Of the 32 habitats mapped for this bioregion, seven habitats are represented within Type 1 marine reserve and five of these habitats have greater than 1% of their total area in marine reserve.

Type 2 MPAs include areas of nine habitats and eight habitats are represented at levels greater than 1% of their bioregional area.

Out of a total of 32 habitats within this bioregion, 10 have part of their area in mātaihai reserves, and 15 have part of their area in taiapure-local fisheries. Across the bioregion, six habitats have more than 1% of their total area in mātaihai reserves, and 11 have more than 1% of their bioregional area in taiapure-local fisheries.

Department of Conservation reserves include parts of three habitats, two of which are represented at more than 1% of their total bioregional area.

Trawling, Danish seine and commercial dredging are prohibited in parts of 13 of the 32 habitats and for 12 habitats, more than 1% of their bioregional area is closed to all three of these commercial fishing methods.

4 Discussion

4.1 GAPS ANALYSIS

This broad scale analysis indicates that there are many large gaps in the current network of MPAs. In some bioregions, very few, if any habitats, are protected in Type 1 marine reserve or Type 2 MPAs. With the exceptions of the Kermadec Islands and Subantarctic Bioregions, the number of habitats that occur in MPAs ranges up to around half of the total number of habitats in the bioregion. In several cases, the proportion of habitats represented is considerably less. In most bioregions, only a very limited number of habitats have more than a few percent of their total area in potential MPAs.

In most bioregions, the majority of areas that meet the Protection Standard are Type 1 marine reserve MPAs or Type 2 MPAs in marine management areas, marine parks, cable zones and some pipeline zones.

There are many areas with prohibitions on commercial dredging, bottom trawling and Danish seining which do not meet the Protection Standard because amateur dredging is not prohibited. There are also other areas with prohibitions on one or two of these fishing methods.

Mātaitai reserves and taiapure-local fisheries are customary management tools that could potentially play a role in the MPA network but currently most do not meet the Protection Standard. Mātaitai reserves are established for the purpose of recognising and providing for customary management practices and food gathering. Taiapure-local fisheries are management tools established in areas that have customarily been of special significance to an iwi or hapu as a source of food or for spiritual or cultural reasons. Mātaitai reserves will generally exclude commercial fishing but not exclude recreational fishing. The Te Whaka a Te Wera Mātaitai in Paterson Inlet, Stewart Island, however, is also closed to amateur dredging, and therefore meets the Protection Standard as a Type 2 MPA.

Many Department of Conservation reserves include habitats below mean high water. Their objectives include the preservation of wildlife, landscapes and natural values but as they do not explicitly exclude trawling, Danish seine or dredging they do not meet the Protection Standard. Other areas such as the Hauraki Gulf Marine Park, RAMSAR areas and Marine Mammal Sanctuaries also provide guidance for marine protection but do not currently have regulations that meet the Protection Standard.

4.2 MPA INVENTORY

The information on management tools presented here attempts to simplify a complicated network of many overlapping boundaries, regulations and management tools. The details of these interactions are now maintained in a GIS database that will permit more complex queries and investigations to be undertaken at regional and local scales in the future. When combined with data on other marine activities, the database will provide a basis for a national marine cadastre that can be used for marine planning across a range of scales and jurisdictions.

4.3 HABITAT MAPPING AT A NATIONAL SCALE

The national coastal habitat maps provide a general indication of predominantly physical marine environments. They reflect the broad and often approximate nature of the source data available across coastal bioregions nationally and the lack of detailed surveys or models at this scale. This is apparent where the broadly mapped classification is compared with areas where more detailed surveys have been carried out.

While depth and estuarine and coastal environments are well defined, the national distributions of marine substrata, the intertidal zone and, to some extent, exposure zones are less well defined.

In particular, the nationally mapped areas of subtidal reef and biogenic habitats are likely to greatly under-represent the real extent and location of these habitats. This bias is most pronounced in deeper and offshore waters which make up a major portion of each bioregion. In many locations, areas of sand and mud depicted on the national habitat maps have subsequently been revealed to be reef, gravel and other substrata when more detailed regional multibeam and sidescan sonar, fair sheet soundings and fishing data are examined.

While biogenic habitats may be relatively small in area and restricted to specific locations, they can include very diverse communities and are particularly sensitive to damage from disturbances, such as bottom fishing methods. The biogenic habitats mapped here include bryozoan, rhodolith, dog cockle and tube worm beds as well as seagrass, mangrove and saltmarsh assemblages. While most estuarine habitats are reasonably well mapped, only isolated cases of the coastal and deep water communities are recorded here.

One approach to address this gap is through mapping expert anecdotal knowledge from scientists and from stakeholders, such as fishers. This approach has been used to provide approximate locations of some biogenic habitats in the North East Bioregion. A nationwide survey of biogenic habitat, commissioned by the Ministry of Fisheries, is collating local ecological knowledge through interviews with commercial fishers. Dedicated surveys using towed underwater cameras and multibeam sonar are underway to investigate many of these areas.

The mapped areas of mud, sand and gravel habitat are simplified categories derived from a continuum of sediment types, often mixing components from each of these classes. The broad scale nature of these interpolations also ignores the structural complexity inherent in some of these habitats and its role in shaping ecological communities (Thrush et al. 2001). Using three different charts to derive the combined sediment map (Bardsley et al. 2008) also introduces discontinuities between sediment types mapped at different scales. In addition, there were insufficient data to consistently map boulder and cobble habitats.

In estuarine waters, important biogenic habitats such as seagrass, mangrove and saltmarsh have been mapped quite comprehensively. This has mainly

been done from aerial photo interpretation and often ground truthed by field surveys. Coverages of mangrove and saltmarsh were available nationally but mapped seagrass habitats were collated from many different sources.

The national coastal habitat maps of intertidal beach, rocky shore and mudflat provide a general indication of the location of many of these habitats. However, there may be omissions and a lack of detail in portraying the extent of many areas. In particular, gravel, cobble and boulder beaches are not mapped in the national habitat classification. At regional scales, this gap can be addressed through aerial photo interpretation. In this way, a range of intertidal habitats and shallow subtidal reef can be mapped. Aerial photo interpretation has been used to map these habitats for all of the North East Bioregion, the West Coast South Island Bioregion, parts of the South Cook Strait and East Coast South Island Bioregions and several other locations (Byers et al. unpublished data; Robertson & Stevens 2008; Kerr 2010).

The modelled values of mean significant wave height provide a useful regional interpretation of wave climate. However, its application here to classifying individual habitat features should be regarded cautiously given the effects of fine scale topography and aspect.

The national marine coastal habitat GIS layer provides a consistent, broad scale view of predominantly physical patterns in the New Zealand coastal environment. However it does this at the cost of largely overlooking the more detailed information available and being collected at many regional and local scales around country. This more detailed information includes data compiled for the North East, Southern South Island, Cook Strait, and East Coast South Island Bioregions (Benn 2009; Kerr 2010; Kettles & Hughes 2009; Byers et al. unpublished data).

In particular, some of these studies address the major information gap that exists for offshore habitats which are poorly described in the broad scale national classification. Recent multibeam and sidescan surveys in regions off East Northland (Morrison et al. 2010), Auckland, Coromandel, Gisborne, Cook Strait and Foveaux Strait (LINZ shipping lane surveys) provide detailed views of extensive systems of reef, gravel and other habitats which are not recorded in the national habitat map. It is likely that similar habitat features are present for many other areas and surveys planned for the future may help address some of these gaps.

The preferred methods to map these large areas of shelf are multibeam and sidescan sonar which are able to record, in detail, broad swaths of habitat hundreds of metres wide. These surveys provide 3-D bathymetric models of the seafloor and backscatter and other data that can distinguish a range of hard and soft habitats. When coupled with remote underwater photography or video and other benthic sampling at selected spatial scales, this information can be used to develop more ecologically relevant models of marine habitats and ecosystems.

The recent Oceans 20/20 Bay of Islands survey of Northland (Morrison et al. 2010) is one example of this approach, which is being adopted at many other locations throughout the world. Continuing this work at other targeted locations throughout the New Zealand Territorial Sea will substantially benefit many different aspects of marine ecosystem management, commercial use and public understanding.

While the national coastal habitat maps provide a broad overview across the entire Territorial Sea, finer scale regional maps are likely to be more useful for identifying where MPAs should be located within particular bioregions. In addition, comprehensive modelling of fish (Leathwick et al. 2008, 2009), invertebrate and algae distributions and detailed habitat models (Snelder et al. 2005; Kerr 2010; Morrison et al. 2010) now exist at regional and national scales and could facilitate improved MPA planning. For several bioregions,

detailed surveys of recreational and commercial fishing and other marine interests are also able to provide important measures of the potential costs of alternative strategies for the design and placement of MPAs.

Progress on this essential survey work is at different stages in different regions. Those regions currently with the least MPAs are often those with the least data available. However, while some bioregions have markedly fewer MPAs than others, it is clear that there are gaps in the MPA network for almost all bioregions.

A strategy to address this problem is to target data collection in data and MPA poor regions, while progressing spatial planning in regions where detailed habitat, species and human use data are available.

However, while the best available information should be taken into account, decision-making should be guided by a precautionary approach and actions to implement MPAs should not be postponed because of a lack of full scientific certainty, especially where significant or irreversible damage to ecosystems could occur or indigenous species are at risk of extinction.

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7 Glossary

Biodiversity - the variability among living organisms from all sources; this includes diversity within species, between species and of ecosystems.

Biogenic - produced by living organisms or biological processes.

Biogenic reef - elevated structures on the seabed constructed of living and dead organisms.

Bioregion - a biogeographic region, an area constituting a natural ecological community with characteristic flora, fauna, and environmental conditions and bounded by natural rather than artificial borders.

Bryozoan - one of a phylum of aquatic invertebrate animals known as bryozoa.

Danish Seine - a fishing method in which a net is operated by surrounding the fish and being drawn over the seabed toward one or more vessels.

Dredging - towing a device over the seabed primarily for the collection of shellfish.

Ecosystem - an interacting system of living and non-living parts.

Estuary - a partially enclosed coastal body of water that is either permanently or periodically open to the sea in which the aquatic ecosystem is affected by the physical and chemical characteristics of both runoff from the land and inflow from the sea.

Exclusive Economic Zone (EEZ): the area of ocean from the outside edge of the territorial sea out to 200 nautical miles from the coast.

Exposure - how exposed (as opposed to how sheltered) a place is to waves and currents.

GIS - a Geographic Information System.

Gorgonian - any of various corals of the order Scleractinia, having a flexible, often branching skeleton of horny material.

Habitat - The area or environment where an organism or ecological community normally lives or occurs.

Intertidal - the region between the high tide mark and the low tide mark.

Isobath - a contour line on a map connecting points of equal depth in a body of water.

MPA - Marine Protected Area, an area of the marine environment especially dedicated to, or achieving, through adequate protection, the maintenance and/or recovery of biological diversity at the habitat and ecosystem level in a healthy functioning state.

Mātaimai reserve - an identified traditional fishing ground which has special status under the Fisheries Act 1996 to protect customary fishing values.

Mean high water - the average height of all high waters recorded at a given place over a period of time.

Monospecific - consisting of only one species.

Obligate - by necessity.

Polygon - an area fully encompassed by a series of connected lines.

RAMSAR Convention - an international convention to protect internationally important wetlands, signed by New Zealand in 1976.

Rhodolith - a kind of algae that resembles coral.

Sessile - fixed in one position, immobile.

Substratum - a substance or layer that underlies something.

Subtidal - the benthic ocean environment below low tide that is always covered by water.

Taiapure-local fishery - an area that is given special status to recognise rangatiratanga; management arrangements can be established (under the Fisheries Act 1996) for a taiapure-local fishery that recognise the customary special significance of the area to iwi or hapu as a food source or for spiritual or cultural reasons.

Taxon (plural taxa) - a named biological classification unit assigned to individuals or sets of species, for example species, sub species, genus or order.

Territorial sea - the area of sea from the coastline of New Zealand out to 12 nautical miles.

Trophic linkages - involving the feeding habits or food relationships of different organisms in a food chain.