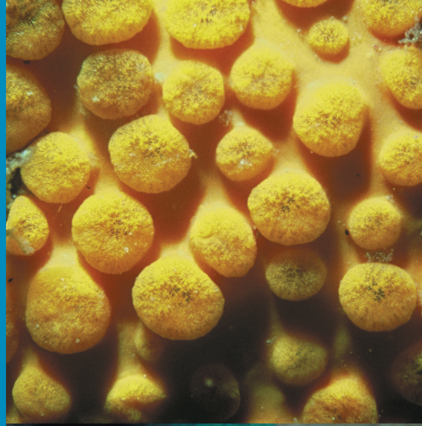


Marine Protected Areas

CLASSIFICATION, PROTECTION STANDARD AND IMPLEMENTATION GUIDELINES

FEBRUARY 2008



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New Zealand Government

Marine Protected Areas Policy and Implementation Plan – Classification and Protection Standard

Hon. Jim Anderton
Minister of Fisheries

Hon. Steve Chadwick
Minister of Conservation

In June 2007 a consultation paper on the classification and protection standard was released as part of implementing the Marine Protected Areas Policy (MPA Policy). The submissions received from fishers, iwi and other stakeholders have provided a range of ideas and perspectives that have been taken into account in finalising these important papers.

While a range of opinions were voiced, some common themes emerged. Stakeholders called for more clarity and simplicity in the papers, equal treatment of all users of the marine environment and a better appreciation of the scale of protection that is required to achieve the goals of the MPA Policy. In addition, marine scientists sought amendments to the classification system that will be used to define New Zealand's marine habitats.

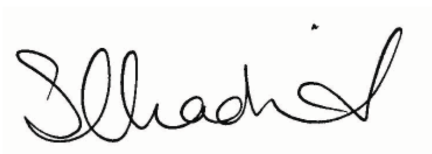
Stakeholders, both at meetings with agencies and in submissions, requested more guidance on how the MPA Policy would be implemented by forums at a regional level; particularly the nature of regional planning and decision making.

We have responded to one of the most significant of these issues by reiterating the New Zealand Biodiversity Strategy target of protection for 10% of the marine environment by 2010. We also draw attention to the Policy requirement to ensure that a marine reserve is established to protect at least one sample of each habitat and ecosystem type. A range of other tools that allow some fishing and other activities may be used to protect further samples of each marine habitat.

The guidance contained in this classification and protection standard paper will be of particular value to the community-based planning forums that will recommend areas for protection, and other agencies that will work alongside these forums. As the standards outlined in this paper are applied in practice, the results they produce will be tested against the requirements of the Policy. This monitoring will allow the way we implement marine protection to be reviewed over time.

We are satisfied that the classification approach and the protection standard, as well as the guidelines on forum structure and operation, will provide the basis to implement the MPA Policy. We look forward to positive and comprehensive results over the next phases of work.

Hon. Jim Anderton
Minister of Fisheries



Hon. Steve Chadwick
Minister of Conservation

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1.1 INTRODUCTION

The following is a short summary of the approach to classifying the coastal marine environment. The full paper is also appended to the end of this paper.

There are a number of different approaches to marine classification, and the one outlined here is designed to underpin planning for the protection of marine biodiversity.

1.2 CLASSIFICATION APPROACH

The classification system consists of a hierarchy of five layers which categorise the physical environment (Table 1).

The first layer of the classification is the biogeographic region. Fourteen biogeographic regions have been identified in the classification (Figure 1). This approach assumes that physical habitats and ecosystems, if separated by enough space (100s to 1000s of kms), will contain different biological communities due to a combination of broad-scale factors. Such factors may include water temperature, oceanography, current dynamics, large-scale latitudinal gradients, climate or barriers to dispersal.

The second layer of the classification is the environment: estuarine and marine. This recognises that there are fundamental differences in biology associated with estuarine and marine environments.

The third, fourth and fifth layers of the classification are depth, exposure and substrate type. These three factors are thought to most strongly influence a site's biology. Within each biogeographic region and environment type, combinations of depth, exposure and substrate type will represent habitats to be protected. This means that within each biogeographic region, there are 44 potential habitats that should be protected; however, not all of these will be present in every biogeographic region. This will be discussed further in the section on MPA implementation.

Table 1. Coastal classification and mapping scheme (MHWS – 200 metre depth)

Level 1	Biogeographic region (14)									
Level 2	Environment type	Estuarine		Marine						
Level 3	Depth	Intertidal	Subtidal	Intertidal (MHWS – MLWS)			Shallow Subtidal (MLWS – 30m)			Deep Subtidal (30m – 200m)
Level 4	Exposure	low	low	low	med	high	low	med	high	low
Level 5	Habitat type	Mud flat Sand beach Gravel beach Cobble beach Boulder beach Rocky platform	Mud flat Sand flat Gravel field Cobble field Boulder reef Rocky reef Biogenic reef	Mud flat	Sandy beach Gravel beach Cobble beach Boulder beach Rocky platform	Sandy beach Gravel beach Cobble beach Boulder beach Rocky platform	Shallow mud	Shallow sand Shallow gravel field Shallow cobble field Shallow boulder reef Shallow Rocky reef Shallow Biogenic reef	Shallow sand Shallow gravel field Shallow cobble field Shallow boulder reef Shallow Rocky reef Shallow Biogenic reef	Deep mud Deep sand Deep gravel field Deep cobble field Deep boulder field Deep rocky reef Deep Biogenic reef

Notes:

- Terms above are defined in the Appendix 1 Glossary
- Biogenic reefs include habitats such as bryozoan beds, rodolith beds, tube worm mounds and sponge gardens
- Artificial substrate such as marine farms and marinas has not been included in the classification as it is not considered important for representation in the network of protected areas, however, it should be considered for the purposes of mapping all features present in a biogeographic region
- This list presents the proxies for habitat types. Each listed category may not occur in every bioregion. Marine habitats do not typically function independently and these habitat types frequently occur in combination
- A proportion of all habitats identified in Table 1 that occur in a given Biogeographic Region are required to be protected in at least one marine reserve and at least one other form of marine protection

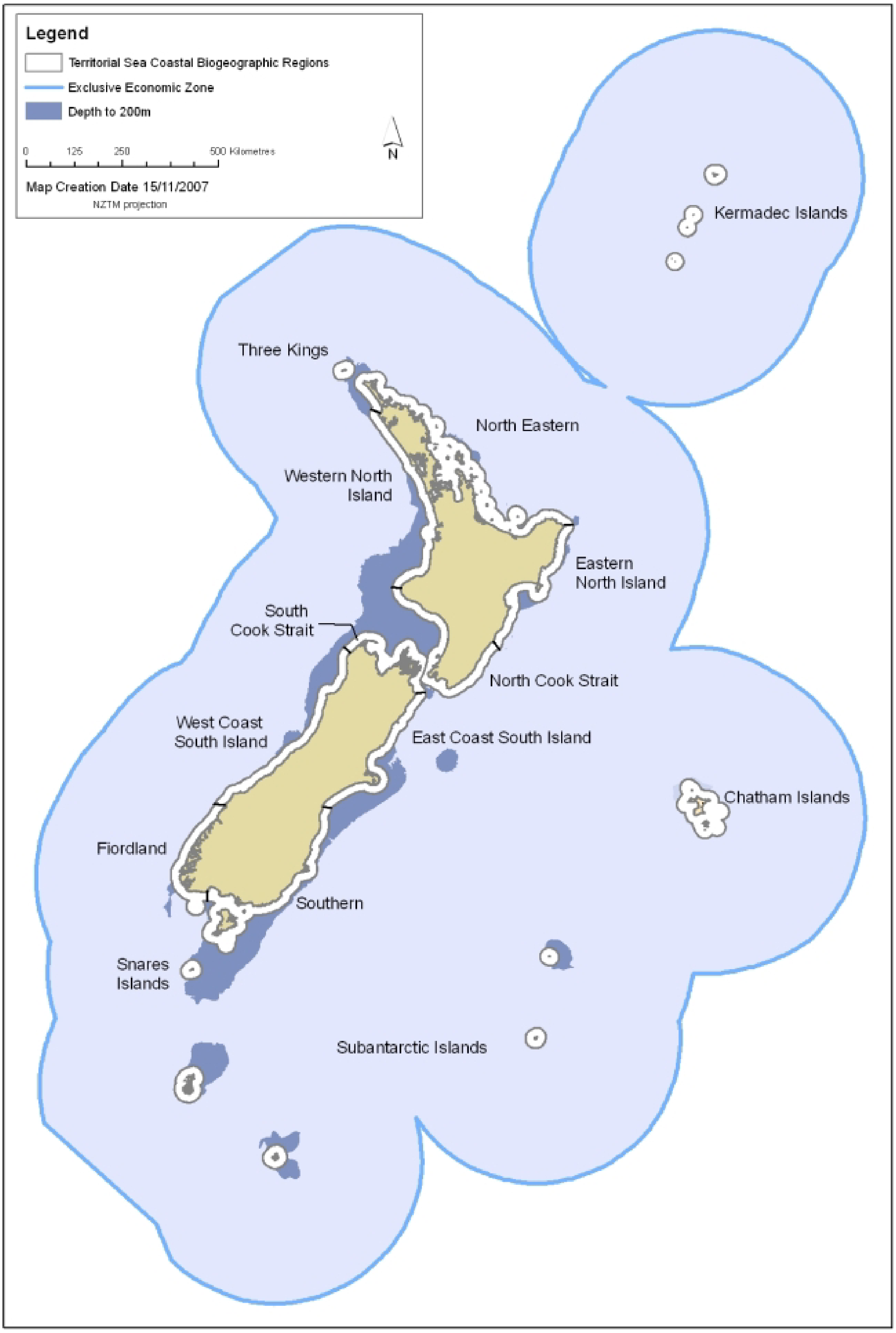

Figure 1. New Zealand’s coastal biogeographic regions.

SECTION TWO:

MARINE PROTECTED AREAS PROTECTION STANDARD

MARINE PROTECTED AREAS PROTECTION STANDARD

2.1 INTRODUCTION

To implement the MPA Policy, management tools will be put in place to protect the habitats described in the classification system. This protection can be given using a range of tools of three types: Marine Reserve MPAs, other Marine Protected Areas and other Marine Protection Tools. All forms of marine protection (i.e. all three types in Table 2) are relevant when measuring progress towards the NZ Biodiversity Strategy target. However, only types 1 and 2 are considered to be MPAs for the purpose of the MPA Policy. MPAs may be created using Fisheries Act tools. Whether the tool in an individual circumstance meets the protection standard, i.e. creates an MPA, must be assessed on a case by case basis.

The marine protection types described below focus solely on fishing impacts. Considerations about whether areas offer sufficient protection to be called a protected area will also include consideration of non-fishing impacts.

Generally, non-fishing impacts will need to be assessed on a case-by-case basis using best available information. For example, whether mining and prospecting activities are appropriate will depend on the extent and frequency of the operation and its impacts on the physical structures of the seafloor and the species resident in the area.

Similarly, the effects of pollutants depend on their concentration, toxicity and how quickly they disperse or break down in the marine environment.

The MPA Policy requires that the impacts on existing users of the marine environment should be minimised when selecting new protected areas. The extent to which new protected areas will impinge on existing activities will depend on how widespread the activity is. Those activities that are spatially confined may not be affected, while other more widespread activities, such as fishing, may have greater limitations placed on them when establishing protected areas.

All uses of the marine environment will be given the same priority and the requirement to minimise impacts on existing users will be applied equally regardless of the activity. When a protected area is established officials will seek additional protection from regional councils through inclusion of the protected areas on relevant regional coastal plans.

2.2 MARINE RESERVE MPAS

Marine reserves are statutory tools that are established under the Marine Reserves Act for the purpose of preserving marine life for scientific study. A broad range of activities can be managed, controlled or excluded in marine reserves, including marine farming, fishing, other extraction, anchoring, point discharges, research, bio-prospecting and commercial tourism.

Given the high level of protection afforded by marine reserves, they will be considered as contributing to marine protection goals under the MPA Policy, and will meet the requirements of Planning Principle 2.

2.3 OTHER MARINE PROTECTED AREAS

Marine Protected Areas can be established using a range of management tools. The MPA protection standard sets the outcome that we want our MPAs to achieve irrespective of the management tool employed. That outcome is described in the MPA

Policy as enabling the maintenance or recovery of the site's biological diversity at the habitat and ecosystem level to a healthy functioning state.

The MPA Policy gives some further guidance about other particular factors that should be considered when deciding if an area should be an MPA. The management regime must provide for the maintenance and recovery at the site 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) potential for the biodiversity to adapt and recover in response to perturbation

It is considered that, if (a) and (b) are satisfied, then (c) will have been provided for. These first two factors are discussed below and more detail is provided on how government will determine if these have been met at any potential MPA site. A summary of the approach is described in Table 2.

2.4 MAINTENANCE AND RECOVERY OF PHYSICAL FEATURES AND BIOGENIC STRUCTURES

This aspect of the MPA protection standard looks to ensure the seabed in an MPA is protected from physical damage. To ensure this, activities that may cause significant damage to the seabed and its associated biodiversity should be prohibited from an MPA.

Whether a particular activity causes damage to the seabed will depend on the nature of the seabed. Those seabed habitats that are particularly fragile will be damaged more easily than those that are exposed to natural disturbance.

When considering the effect of fishing activity, the main fishing methods used in New Zealand waters were ranked according to the relative damage they cause to the seabed. As a result, bottom trawling, dredging and Danish seining were considered not to allow maintenance and recovery of physical features and biogenic structures. As such, the presumption is that these methods would not be permitted within an MPA.

Benthic netting and potting were considered to cause only moderate damage. These methods would be allowed in an MPA unless the seabed was comprised of particularly fragile biogenic habitats. Other methods may be deemed acceptable but would need also to be considered as part of the second half of the MPA protection standard.

2.5 ECOLOGICAL SYSTEMS, NATURAL SPECIES COMPOSITION AND TROPHIC LINKAGES

This second aspect of the MPA protection standard looks to ensure any activity within an MPA does not unduly disturb ecological systems, natural species composition and trophic linkages.

When considering the effect of fishing activity, it is difficult to set a level of extraction that would ensure the MPA protection standard is met. Setting an acceptable quantity of extraction would require large amounts of information about the species present in an area and how they contribute to the associated ecological system. There are also considerable problems with compliance when setting catch limits at small spatial scales. Because of these difficulties, fishing methods have been used as a proxy for extraction from potential MPAs.

2.6 COASTAL MPAS

It is considered that purse seining, midwater trawling, midwater gillnetting and benthic netting either extract large quantities of fish over short time periods and/or are relatively unselective in nature. Many of the species harvested by the methods in coastal areas could have close affinities to the benthic environment. As such, these methods will probably not be permitted within an MPA.

Other methods such as benthic longlining, potting, pelagic longlining and hook and line fishing do not generally extract such quantities of fish over short time frames and are more selective. These methods may be allowed within an MPA subject to the case by case analysis as described below.

Case by case analysis

A case by case approach is necessary for two reasons. First, using fishing methods as a proxy may not accurately reflect the actual extraction from a site as much depends on the frequency and intensity with which that method is used.

Second, there are statutory requirements in the Fisheries Act that mean such an analysis is necessary prior to any method prohibition.

The factors that would be considered in a case by case analysis are further outlined in the implementation section.

2.7 DEEPWATER MPAS

In November 2007, government established 17 Benthic Protection Areas; primarily in New Zealand's Exclusive Economic Zone (EEZ). These areas protect about 30% of the seabed in the EEZ. Because of the contribution these protected areas make to benthic protection, government has chosen not to implement the MPA Policy in the EEZ until 2013. Implementing the MPA Policy will concentrate on Territorial Sea until then.

Prior to implementing the MPA Policy in the EEZ, government will revisit both the classification system and protection standard to incorporate improved knowledge and research conducted between now and 2013.

2.8 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.

Table 2: MPA Policy Implementation – Marine Protection Types.

(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.

SECTION THREE:

IMPLEMENTATION GUIDELINES

IMPLEMENTATION GUIDELINES

3.1 INTRODUCTION

The MPA Policy[1] takes a regional approach to planning and establishing a network of protected areas around New Zealand. This new approach is designed to be inclusive and transparent. Government wants regional councils, marine users, tangata whenua and those with an interest in marine biodiversity to all be involved. Implementation of the network is to be based on best available information and a commitment to minimise effects of new protected areas on existing users.

The MPA Policy specifies separate processes for the coastal environment and one for the deepwater environment. For the purpose of implementing the network of protected areas, the coastal/deepwater boundary will be the limit of the Territorial Sea (12 nautical miles).

Planning for the coastal marine environment will be implemented independently in 14 biogeographic regions by community-based Marine Protection Planning Forums (MPPF).

Planning for protected areas in the deepwater environment will commence in 2013 and will be implemented at a national level by an expert offshore panel. This group will have specific expertise and representation of offshore interests.

DOC and MFish officials will service both the MPPFs and the offshore panel with information, advice, facilitation and guidance. This will include provision of ecosystem and habitat maps, and information derived using the marine and coastal classification approaches.

3.2 GOVERNANCE OF COASTAL MARINE PROTECTION PLANNING FORUMS

Objective

Each MPPF will be tasked to provide a report for Ministers recommending areas for various levels of marine protection consistent with the MPA Policy. Specifically an MPPF will:

- Consider the classification and inventory information
- Consult with existing users and interests in the area
- Identify sites and potential tools for area-based protection of biodiversity
- Seek to establish consensus on proposed areas to be set aside as protected areas
- Consult on protection options and make written recommendations to Ministers

Each MPPF will be given a written brief (terms of reference) from Ministers on the task to be undertaken. The brief will include objectives for the forum and timeframes.

Scope

Protected area planning has the principal objective of biodiversity protection; in many

[1] *Marine Protected Areas Policy and Implementation Plan*, December 2005.

cases tools used will also support other objectives. MPPFs are limited to protected area planning, and should not be diverted by RMA, aquaculture, or fisheries management issues.

MPPF chairs

The MPPF chair must have the skills necessary to lead the MPPF to a successful outcome. Chairs will be appointed by Ministers and chosen for their standing in the community, facilitation and interpersonal skills, and impartiality.

MPPF members

Each MPPF is to contain a maximum of 14 people, including the chair. DOC and MFish will be ex-officio members. Expressions of interest will be called through advertising and by approaching relevant stakeholders and user groups, and departmental forums. Ministers will endorse the appointment of forum members.

Forum members should be expected to have strong links to the region, be able to negotiate, compromise and work well with other people, and have the capacity to engage with their sector of interest to bring that sector's views forward to the forum.

The sectors that should, where relevant, be represented on an MPPF include:

- Tangata whenua
- Commercial fishers
- Recreational users including fishers, charter fishers and divers
- Conservation groups
- Tourism
- Aquaculture industry
- Marine science
- Minerals industry

All members of an MPPF (apart from ex-officio members) will have collective responsibility for its decisions and have equal status in discussions. Forum members must be able to attend meetings regularly, engage actively in information sharing, and be actively involved in decision-making. Proxy members should not be permitted. Members resigning from a forum should be replaced from the same sector of interest.

All MPPFs members must disclose their interests at the time of application, including who they represent, so that it is clear where they may have any conflicts of interest. Forum members must also work to build consensus to meet the MPA Policy objectives for the region.

Consultation

Each MPPF will constructively involve and engage with tangata whenua, regional councils, marine biodiversity interest groups, and the users and stakeholders whose interest in marine areas may be affected by protected areas.

MPPFs will customise plans for regional engagement considering the best tools to build links with the community and within associated budgetary constraints. However, MPPFs must undertake written consultation (allowing a minimum of 40 working days for submissions) on the recommendations being made.

The MPPF should look to engage fully with tangata whenua as key regional stakeholders. The Crown must also meet its obligations under the Treaty of Waitangi, through direct discussion and consultation with iwi where necessary. Formal consultation with tangata whenua will also occur as part of implementing proposed new protected areas through subsequent statutory processes.

Report for Ministers

The MPPF is expected to produce a report for Ministers recommending areas for various levels of marine protection, i.e. protected areas and management tools.

Recommendations must be underpinned by a commitment to minimise the impact of new protected areas on existing users of the marine environment and Treaty settlement obligations where there are options for alternate locations to achieve protection of particular habitats. Matters to consider in choosing between minimum impact sites are: accessibility for management and enforcement requirements; and benefits such as educational, diving and tourism opportunities.

MPPFs should recommend management tools that meet the requirements described in Table Two of 'Marine Protected Areas Protection Standard' in this paper. These recommendations should be made on the basis of adequately managing foreseeable threats to a site's biodiversity. The tools selected will be implemented in accordance with legislation.

Decision making within the MPPF

Management actions to implement protected areas should not be postponed because of a lack of information.

An MPPF should try to reach consensus on recommendations. However, if consensus cannot be reached, the MPPF should provide a range of options for the consideration of Ministers, making clear which options are favoured by which elements of the community/stakeholders and the advantages and disadvantages of each.

Timeframe for establishing MPPFs

DOC and MFish will undertake preparatory work before establishing each MPPF. Once each MPPF has been established, it will be expected to produce a set of recommendations for Ministerial decision within 18 months.

Phase	Timeframe	Tasks
One	Six months	• Preparatory work (DOC & MFish) • Appoint chair and members[2]
	Six months	• MPPF convened • Consultation with community
Two	Six months	• Review information • Develop recommendations
Three	Six months	• Public consultation on recommendations • Finalise report to Ministers

[2]DOC & MFish will develop a package of documents for appointing people to the MPPFs, including an application form, person specifications (skills/competencies), and a position description.

3.3 GUIDANCE ON THE SCALE OF AREA PROTECTION REQUIRED IN EACH REGION

When implementing the MPA Policy, the primary consideration should be achieving its purpose and objective – that is, a comprehensive and representative network of protected areas.

In implementing the classification system, the MPA Policy requires the MPA forum to ensure that "a marine reserve [is] established to protect at least one sample of each habitat and ecosystem type in the network. A range of tools may be used to protect further samples." The MPA Policy suggests that the usual number of replicate MPAs (i.e. those that cover the same ecosystem type) will be two.

This does not mean, however, that a region will have 44 marine reserves (i.e. the number of potential habitats to be protected). It is more likely that there will be fewer reserves which each protect a mosaic of different habitats. Principles of good reserve design would encourage the creation of fewer larger reserves, rather than multiple small reserves.

In addition, further marine reserves may be needed to protect any areas that are distinctive or rare, and therefore not picked up by the classification of "typical" habitats.

It is noted that the Classification and Protection Standard for MPA Policy implementation will continue to evolve as more marine science, research and information become available, and that the MPA Policy itself will be subject to review. The flexibility of marine protection proposed here should itself be subject to review, along with the MPA Policy, targets and components needed to fully meet the NZ Biodiversity Strategy's 2020 goal of a comprehensive and representative network of marine protected areas.

3.4 GUIDANCE ON THE CLASSIFICATION APPROACH

The Policy gives some guidance on the use of marine and coastal classification to represent marine habitats and ecosystems within protected areas:

- **Representativeness** – It is desirable that sites be prioritised on the basis that they are representative of one or more marine habitats or ecosystems. It is desirable that each protected area will contain a number of habitat and ecosystem types.
- **International or national importance** – It is desirable that sites be prioritised on the basis that they support outstanding, rare, distinctive or internationally or nationally important marine habitats and ecosystems (which will be expected to be set aside as marine reserves).
- **Network gaps and priority habitat and ecosystems** – The classification should be used to identify gaps and set priorities for representation of habitats and ecosystems within protected areas.

The classification approach adopted defines habitats and ecosystems at a scale suitable for implementing the MPA Policy. This does not constrain the collection of further information, or the expansion of the classification systems by incorporating as much information as is available to support site selection.

Note that it is important to distinguish between the collection and classification of information and the implementation of the MPA Policy. It is not desirable, nor the intent of the MPA Policy, to acquire information at very fine scale, to use that information to classify habitats and require additional protection at increasingly finer scales. However, there is some value in collecting new information, or analysing existing data, to expand our knowledge of the marine environment.

Habitats in the coastal and deepwater classification systems will be separated into those that are "required" to be protected within protected areas, and those that would be "desirable" to protect.

For the purposes of the implementing the MPA Policy in the coastal marine environment, the definition of "habitat" is confined to those that are "required" to be represented in the network as identified in the Classification paper. The requirements for deepwater protection will be identified in the preparatory work leading up to implementation in 2013.

When recommending the protection of required habitats, or choosing among potential sites, MPPFs and the expert offshore panel may consider that additional desirable habitats could also be protected within a protected area to increase the biodiversity value of the network.

3.5 DESIGN GUIDELINES USED TO IDENTIFY AND SELECT POTENTIAL PROTECTED AREAS

Guidelines have been developed to help plan a representative network of protected areas. While the diversity of marine species, habitats and human uses thereof prevent a single optimum network design for all environments, the guidelines aim to provide a consistent starting point for discussions. Not all guidelines will necessarily be achieved in every protected area.

The guidelines fall into three categories and are further explained below:

- Site identification and protected area design guidelines: These provide guidance for identifying a potential protected area; and
- Site selection guidelines: These provide guidance for selecting candidate protected areas from among potential sites which will then be recommended to Ministers for protection
- Tool selection guidelines: The description of one of the three classes of protected area, class (b), requires that a case by case analysis be conducted. Guidelines on relevant considerations are given.

Site Identification and Protected Area Design Guidelines

The site identification and protected area design guidelines provide the basis for identifying potential sites as candidates for protected area status. Sites identified using these criteria will be considered in the context of selection guidelines (outlined below) to determine which should be developed as proposals that can be progressed through relevant statutory processes.

- **Protect whole habitats and ecosystems** – It is desirable that sites be selected on the basis that whole habitats or ecosystems can be protected, particularly where a habitat or ecosystem represents a relatively small mapped unit. For example it would be desirable to incorporate a whole reef in a protected area rather than establishing a boundary that cuts across the reef.
- **Size of protected areas** – Protected areas may be of various shapes and sizes

but should be of sufficient size to provide for the maintenance of populations of plants and animals. For the same amount of area to be protected it is desirable to protect fewer, larger areas rather than numerous smaller areas. This helps maintain healthy self-sustaining populations resilient to 'edge effects' resulting from use of the surrounding/adjacent areas. This also allows for more efficient and cost effective compliance and law enforcement.

- **Maximise connectivity** – the design of the protected area network should seek to maximise and enhance the linkages among individual protected areas, groups of protected areas within a given biogeographic region, and across biogeographic regions.
- **Represent latitudinal and longitudinal variation** – Many processes create latitudinal and longitudinal (cross-shelf) differences in habitats and ecosystems. This diversity is reflected partly in the distribution of the biogeographic regions, but care should be taken to identify potential protected areas sites that include differences in habitats and ecosystems that cover both latitudinal and longitudinal or cross-shelf ranges. It may be convenient to extend protected areas from the intertidal zone to deep waters offshore.
- **Consider sea and adjacent land uses in planning protected areas**– Placement of protected areas should take into account the adjacent terrestrial environment (including islands) and associated human activities. Past and present uses may have influenced the integrity of the biological communities, and designers should consider these effects, where known, when proposing the location of protected areas. For example, existing no-take protected areas and areas adjacent to terrestrial national parks are likely to have greater biological integrity than areas that have been used heavily for resource exploitation.
- **Keep boundaries simple and aim for low boundary to area ratio** – To achieve this, protected area design should aim for simple shapes and reduced fragmentation of areas. This can be achieved by using straight boundary lines and minimising the perimeter-to-area ratio. Protected areas should also be designed so they can be realistically enforced. Users and surveillance staff find straight lines much easier to find and follow than lines following depth contours or distance from land or reefs. Squares are easier for users and compliance staff to find and work with than odd shapes. Boundaries should follow major latitude and longitude lines where possible. This makes it easier for users to match with charts. For coastal zones, clear sight lines on-shore or using other fixed objects are good alternatives to areas defined by coordinates.

Site Selection Guidelines

Site selection guidelines provide guidance for selecting which candidate protected area sites should be recommended for protection. They will be considered in the context of the marine classification approaches and other information. There are two categories outlined below: those that take primacy due to them being requirements of the MPA Policy, and those that are desirable to increase the value or practicality of the protected area network.

Primary considerations

- **Protect the full range of marine habitats and ecosystems** – The MPA Policy calls for the protection of "the full range of marine habitats and ecosystems" as well as those which are rare, distinctive or internationally or nationally important. Within each biogeographic region, the approach to the classification of habitats and ecosystems should be used as a pragmatic guide to the representation needed to achieve this goal.

- **Cultural use** – Consider information on traditional use, values, current economic value and Treaty settlement obligations.

- **Adverse impacts on users** – Where there are choices of several sites that would add a similar ecosystem or habitat to the protected area network if protected, the site(s) chosen should minimise adverse impacts on existing users and Treaty settlement obligations. Where there is a choice to be made among minimum impact sites, selection may also be guided by:
    - Accessibility for management and enforcement requirements; and
    - Benefits such as educational, diving and tourism opportunities.

- **Social and economic interests** – When choosing among potential sites, information related to social and economic interests should be considered to minimise adverse impacts on existing users. Such information may include: current and potential use for the purposes of extraction or exploration, or contribution to economic or intrinsic value by virtue of its protection.

Secondary considerations

- **Number of protected areas** – The number of potential habitat and ecosystem types, defined by the classification and mapped within a biogeographic region, does not equate to the number of protected areas required to protect the full range of natural marine habitats and ecosystems. Multiple habitats should be protected within each protected area.

- **Have fewer larger (versus numerous smaller) protected areas** – It is beneficial to have fewer larger protected areas representative of more than one habitat or ecosystem than a large number of small protected areas.

- **Susceptibility to degradation** – Incorporate information on the location of, for example, coastal structures, dredging or dumping sites that potentially may impact on the integrity of the site.

- **Compatibility with adjacent land-use** – It is desirable to design protected area boundaries to align with other protected areas. This includes national parks on land and other protected waters, such as fish habitat. This allows opportunities for collaborative compliance efforts between agencies.

- **Replication** – Consideration should be given to whether the site provides replication of habitats and ecosystems in a biogeographic region.

Tool selection guidelines

MPPFs will not just recommend potential sites for protected areas but also will consider which of the three classes of protected area to recommend. If MPPFs look to implement MPAs, a case by case analysis is required in order to meet the standard for that class of protection. If MPPFs are considering implementing the second class of marine protection (other MPAs), the following factors will be used to help determine whether certain fishing methods can be used whilst still meeting the MPA protection standard. Additional guidance will also be available to MPPFs by way of precedent decisions about other MPA sites.

- **The size of the MPA** – Larger MPAs will be more likely to compensate for any higher level of biological extraction when compared to smaller MPAs. As such, higher quantities of biological extraction would be acceptable in larger MPAs compared to those of smaller size.

- **The likely level of biological extraction from an MPA (from all sources)** – If the biological extraction from a potential MPA is having an adverse effect on the aquatic environment or creating a sustainability concern, then that level of extraction is not consistent with the protection objective of the MPA Policy. Method prohibitions would be put in place to increase the biomass to levels acceptable under the Fisheries Act.

- **The frequency of extraction** – A method such as recreational line fishing may not extract large quantities of species on any one occasion. However, where such a method is used frequently and/or by a large number of people, this may lead to a similar result as would large scale methods such as trawling.

- **The type of species being extracted and its ecological importance** – Because more mobile species cannot be constrained within the boundaries of MPAs, MPAs are better at protecting species that are sedentary or have limited mobility. For this reason, case by case analyses will consider those mobile species that have some seasonal affinity with the area but will focus on sedentary species or those with limited mobility.

APPENDIX ONE:

COASTAL AND DEEPWATER HABITAT AND ECOSYSTEM CLASSIFICATION: MAPPING THE MARINE ENVIRONMENT FOR IMPLEMENTATION OF THE MARINE PROTECTED AREAS POLICY

COASTAL AND DEEPWATER HABITAT AND ECOSYSTEM CLASSIFICATION: MAPPING THE MARINE ENVIRONMENT FOR IMPLEMENTATION OF THE MARINE PROTECTED AREAS POLICY

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COASTAL AND MARINE HABITAT AND ECOSYSTEM CLASSIFICATION

1. INTRODUCTION

Purpose of this Report

This report presents one of the tools that will be used to put the Marine Protected Areas Policy and Implementation Plan (MPA Policy) into practice.

It explains the classification approach that will be applied to the coastal marine environments and deepwater marine environments in New Zealand's wider exclusive economic zone (EEZ).

In brief, this classification report:

- Describes an approach to the classification of New Zealand's coastal and marine benthic and pelagic habitats and ecosystems for both the coastal and deepwater marine environments
- Describes the scale at which coastal and deepwater marine habitats and ecosystems will be classified and mapped for the purpose of protected area planning
- Provides guidance on the extent to which other biological and physical information may be used to assist classification and protected area planning

This report uses universally recognised and accepted terms for its classification descriptors. They are explained in the Glossary at the end of the report.

The protected area classification will be used in conjunction with the protection standard which sets a minimum level of protection for all protected areas.

Policy Context

The MPA Policy released in January 2006 is designed to give effect to the New Zealand Biodiversity Strategy (NZBS) which reflects the commitment by the Government, through its ratification of the international Convention on Biological Diversity, to help stem the loss of biodiversity worldwide.

The MPA Policy objective is to:

> *'Protect marine biodiversity by establishing a network of MPAs that is comprehensive and representative of New Zealand's marine habitats and ecosystems.'*

Area-based management through the use of protected areas is a central component of a wide ranging and integrated management approach designed to protect marine biodiversity and regulate use of New Zealand's Territorial Sea and EEZ. Management tools include marine protection under the Marine Reserves Act 1971, effects-based management of the coastal and marine area under the Resource Management Act 1991, managing effects of fishing under the Fisheries Act 1996, protection of marine mammals and threatened species under conservation legislation such as the Wildlife Act 1953, and management of marine incursions under the Biosecurity Act 1993.

One of the Policy's principles says that a consistent approach to classifying habitats and ecosystems is required to ensure that protected areas in the network are representative (Network Design Principle 2). It also says the approach may be reviewed if new information on the marine environment or classification systems comes to light, and that a transparent process will be used to do so.

The Policy's implementation plan describes four stages that will use the classification approaches to achieve the Policy's objectives, namely to help:

- Develop an inventory of the habitats and ecosystems that are currently represented in protected areas
- Identify any gaps in the current representation of habitats and ecosystems in protected areas
- Prioritise which habitats and ecosystems are needed to fill any gaps to ensure the protected area network is representative, and
- Identify and select appropriate new protected area sites

Why Consistent Classification is needed to establish a protected area network

New Zealand's diverse marine environment covers an area of approximately 4.1 million square kilometers. Its characteristic features include long sand beaches and exposed cliffs, bays and estuaries of varying sizes, and deep sea habitats and ecosystems. Beneath the waves is a diverse range of marine biota, such as kelp forests, sponge gardens, shellfish beds and deep water coral communities all structured by complex interactions between biological and physical processes.

Knowledge of New Zealand's marine environment is expanding rapidly – new species continue to be discovered and natural features are becoming more precisely defined. Ideally, any classification should be based on detailed knowledge of the distribution and relative importance of marine biota. However, because biological information is missing, incomplete, or not at sufficient resolution for many areas, and a full inventory of habitats and ecosystems does not exist, an alternative approach is required to help identify where to place representative protected areas. The coastal and deepwater classification approaches in this report provide this alternative.

Key Points of the Classification Approach

While numerous approaches can be used to classify marine habitats and ecosystems, the approach presented in this report may best allow the objectives of the MPA Policy to be realised. The list below provides an overview of its fundamental features:

- Protected area decision-making will be guided by best available information relating to the ecological, environmental, social, cultural and economic aspects of the marine environment. 'Best available information' is that which is available without unreasonable cost, time or effort (Planning Principle 7 in the MPA Policy)
- The marine and coastal classification system provides standard terminology for maps used to identify, plan and manage protected areas
- The marine and coastal classification system describes separate methods of classification for the coastal and deepwater marine environment
- The classification of the coastal marine environment is based firstly on broad biogeographic regions that represent large-scale variation in physical and biological characteristics. Within each biogeographic region, variation in three key physical drivers will be used to describe habitats for the purposes of the MPA Policy – these are depth, substrate and exposure/energy
- Any additional biological and physical information will be incorporated into the

classification to more comprehensively describe the marine environment and inform decision-making

- In deepwater marine environments, the scale and nature of the information available necessitates a different approach to classification. Recent government decisions to close large areas of New Zealand's EEZ to bottom trawling and dredging have shifted the emphasis on protected area implementation to focus on the New Zealand Territorial Sea (12 nautical miles) until 2013. Until then, preparatory work to incorporate new research and classify the deepwater marine environment will continue
- For guidance on the scale and level of detail that may be applied to deepwater marine classification, a discussion is included of how the current Marine Environment Classification (MEC) could be used
- Because of the uncertainty and variability of available information, it is expected that the classification approach will be updated as new information and approaches become available. The public and stakeholders will be kept informed of such improvements

Factors Influencing Implementation

A number of factors will influence how the classification approaches in this report can be used to establish a protected area network. They include:

- The quantity and quality of available information will vary greatly among biogeographic regions. It is desirable to use all the available information to establish as comprehensive marine classification as is practicable
- This variability in available information will not influence the extent to which protected areas are implemented. Rather, good quality information will provide an opportunity to represent areas of greater diversity within each protected area
- The classification described in this report will be implemented only to a defined level of detail. This level of detail will define habitats for the purpose of the MPA Policy and these habitats and ecosystems will require protection within protected areas. Additional levels of detail in the classification do not have to be represented in protected areas. However, where information is available, and agreement is reached by the planning forum, further areas may be recommended for protection
- Not all habitat and ecosystem types that can be defined by the classification will necessarily be present or mapped in each biogeographic region

2. AN OVERVIEW OF DIFFERENT MARINE CLASSIFICATION APPROACHES

Classifications divide large spatial units into smaller units that have similar biological and/or environmental character. In this way, they provide spatial frameworks for systematic mapping and management.[1]

While many countries have developed marine classifications schemes to underpin protected area network identification,[2] there is still no generally accepted standardised marine classification scheme at any particular spatial scale.[3] However, it has been recognised that a hierarchical approach to marine and estuarine classification (such as the biogeographic framework discussed below), is suited to large-scale conservation planning programmes such as protected area network identification.[4]

A number of marine classification systems and biogeographic regionalisations have been developed for use in New Zealand. These include classifications based on distribution patterns of particular taxonomic groups, combinations of specified criteria and expert opinion, and quantitative analysis and modeling of different variables, such as the Marine Environment Classification (MEC).[5] Efforts have also been made to provide classification systems for New Zealand's estuaries.[6]

Ideally, any marine classification should be based on the ecology and distribution of marine flora and fauna. An important factor in New Zealand is the uneven spread and nature of such biological knowledge[7] and this frustrates attempts to apply a consistent classification system based on the biodiversity of habitats and ecosystems at a national level.

As an alternative to a biologically-driven classification, the approach to marine classification proposed here uses a mixture of biogeographical information and bio-physical properties to represent the distinctiveness between marine habitats and ecosystems. Bio-physical proxies are accepted as a reasonable surrogate for biological pattern, particularly at larger spatial scales, and can be used to provide a consistent description of the physical habitat types. Although such classifications do not yet reliably predict the biological communities associated with the physical properties of a site, they can provide a useful and cost effective method for identifying marine biodiversity over large geographic areas.[8]

Although surrogates are generally assumed to be sufficient to tell us that different areas are likely to differ in their benthic and demersal (bottom-dwelling) fauna they do not reveal in detail what those fauna are, or the pelagic communities that may be associated with particular zones or their ecology (length of life, critical habitat, adult home ranges, larval dispersal distances, trophic relationships between species, etc.) There is considerable room for research to more clearly define habitats and ecosystems and to test assumptions of surrogacy (both biological and physical surrogates) to describe the associated biological community, and further work is being undertaken.[9]

3.0 PROTECTED AREA CLASSIFICATION APPROACHES

The classification system described below has been derived from national and international literature and science advice and is structured so that it can be used in a consistent way to inform the process of establishing a protected area network in New Zealand's marine environment.

Coastal and Deepwater Classification

The MPA Policy states that the process to establish New Zealand's protected area network will differ in coastal and deepwater environments. This decision was made for three main reasons: (i) because of the different composition of stakeholders for coastal and deepwater areas; (ii) the nature of the information available to guide the implementation process; and (iii) the regulatory tools available for establishing protected areas.

Because of the difference in scale and availability of information between coastal and deepwater environments, two technical workshops held in March and December 2005 confirmed the decision to develop a separate coastal and deepwater approach to marine classification for marine protected area planning.

The coastal marine classification approach is described in section 4.0 of this report, and the deepwater marine classification approach is discussed in section 5.0. For the purposes of the classification the coastal marine boundary has been defined as the 200 metre depth contour (approximately the continental shelf break). The landward boundary for the coastal marine environment is the Mean High Water Spring line as defined by Regional Coastal Plans. The deep water marine environment extends seaward from the 200m depth contour to the extent of New Zealand's marine jurisdiction. This includes the limits of the Exclusive Economic Zone (EEZ) which is the area of sea and seabed that extends from 12 to 200 nautical miles offshore. Figure 1 provides a schematic illustration of the Coastal Marine and Deepwater Marine Classification.

Hierarchical Structure

The classification has been developed based on a broad hierarchical structure; this enables protected areas to be considered in a biogeographic and ecological context at regional and site scales. The classification follows a progressive scale from large spatial units in the upper levels of the hierarchy (for example, biogeographic regions and MEC Classes), to smaller units in the lower levels (for example, habitats and ecosystems).

The classification is three-dimensional, taking into account surface, water column and benthic features. The classification extends from tidal limits in the coastal zone to the deep oceans, and is applicable to all tidal and/or saline wetland, estuarine, coastal marine and oceanic systems.

Due to limitations in current knowledge, it will be rare that all habitat and ecosystem types in most areas can be immediately characterised. Mapping will be based on available information. As additional data are gathered in an area, gaps in the hierarchy will be filled and the classification will continue to grow, thus strengthening the understanding of the distribution of New Zealand's marine habitats and biodiversity.

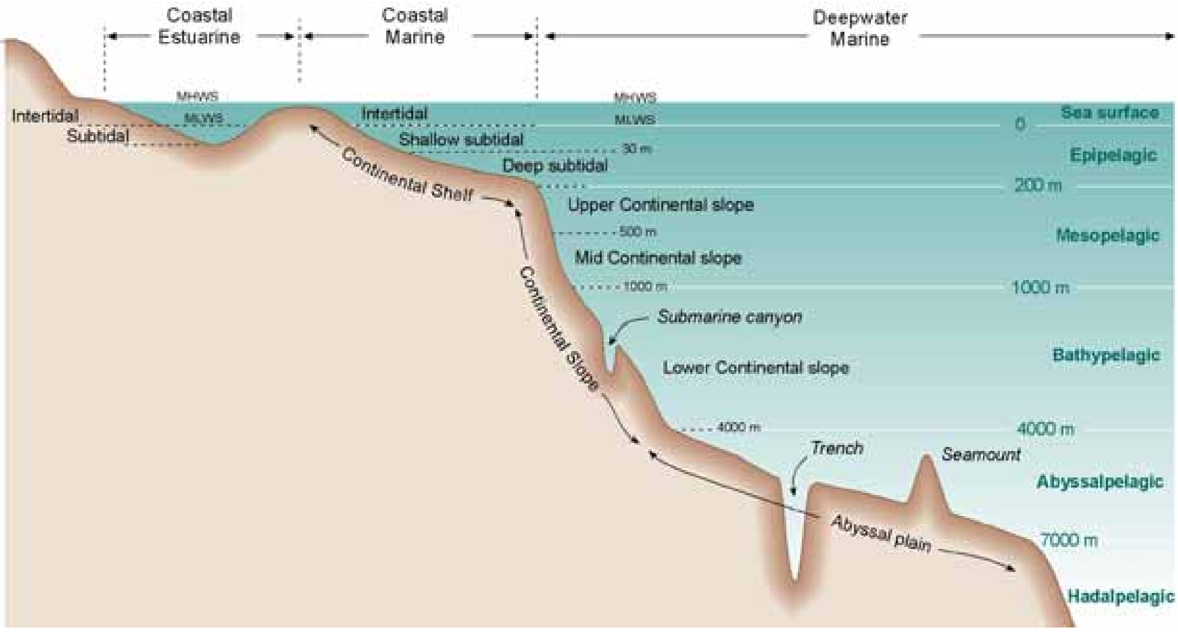

Figure 1. Schematic diagram illustrating the depth zones of the Coastal and Deepwater Classification.

4.0 COASTAL CLASSIFICATION

The coastal marine classification identifies and categorises the physical environment at different spatial scales in estuarine, coastal and marine systems.

Implementation of the classification in the coastal area will be guided by the following spatial scales:

- Biogeographic regions defined at the meso-scale (100s to 1000s of kilometres); and
- Habitats and ecosystems defined at the micro-scale (100s to 1000s of metres)

The first level – biogeographic regions – is overarching and inclusive of all coastal and marine ecological systems distinguished on the basis of biogeography. At the finer scales, the habitats and ecosystems have been defined based on physical or enduring features of the environment.

Coastal Biogeographic Regions

New Zealand has been divided into 14 coastal biogeographic regions (Figure 2). This approach is based on the premise that similar physical habitats and ecosystems, if separated by enough space (100s to 1000s of kms), will contain different biological communities due to a combination of broad-scale factors. Such factors may include oceanography, current dynamics, large-scale latitudinal gradients, climate or barriers to dispersal. Because the biogeographic regions have been determined with imperfect data and information, there is a degree of uncertainty with regard to the location of their boundaries; they are considered to reflect major coastal biological patterns. Table 1 provides a description of the 14 biogeographic regions.

Table 1: Description of New Zealand's coastal biogeographic regions

	Biogeographic region	Boundary	Description
1	Kermadec Islands Coastal Biogeographic region	Kermadec Islands	This region is a unique marine environment. It comprises the submerged volcanic pinnacles of the Kermadec volcanic arc and lies between the South Fiji Basin (west) and the Kermadec Trench (east). Mainly influenced by the subtropical Tasman Front. Reef communities characterised by mix of endemic, tropical, subtropical and temperate elements. Areas of special interest include: sea caves.
2	Three Kings Islands Coastal Biogeographic region	Three Kings Islands	This region has a high level of endemism in sessile species. Three Kings Islands geology comprises hard sedimentary and volcanic rocks. Influenced by subtropical Tasman Front and localised up-welling of cooler subsurface waters during summer and autumn. Strong diurnal tidal flow around the islands. High degree of endemism (molluscs, algae, fish, and echinoderms), presence of some Australian and Southwest Pacific taxa not recorded elsewhere in New Zealand, noticeable absences of some genera common to mainland. Some taxa common to Three Kings and North Cape - molluscan records show locally restricted endemics. High diversity of sponges, bryozoans and other invertebrates offshore between Cape Reinga and North Cape. Areas of special interest include: sea caves, lava tubes.
3	Northeastern Coastal Biogeographic region	Ahipara around the tip of North Island and down to East Cape	This region is a warm temperate region influenced by the warm subtropical East Auckland Current, particularly around island groups of Cavalli, Poor Knights, Mokohinau, Rakitu (east coast Great Barrier Island), Alderman, Mayor, Volkner and White, and also some headlands, including Cape Karikari, Cape Brett and Cape Runaway. Region characterised by endemic algae, molluscs, echinoids, antipatharians; assemblages of sponges, ascidians, molluscs, fish, echinoids. Southern boundary is the confluence of the warm East Cape current that moves south and the cool Wairarapa Current that flows north. Areas of special interest include: high tidal flows areas of North Cape. Areas of special interest include: hydrothermal vents.
4	Eastern North Island Coastal Biogeographic region	East Cape to Cape Turnagain	This region is influenced by mixed water masses of subtropical and subantarctic origins - warm East Cape Current and northward flowing cooler Wairarapa Coastal Current. Local effects of silt-laden river inflows into coastal areas. Northeastern and Cook Strait marine biogeographic regions faunal elements exist, for example, decreasing northern reef fish species diversity. Algal and molluscan assemblages change at Cape Turnagain, and the Wairarapa Eddy moves offshore at this point. It is also the north eastern limit of "southern" seaweeds such as *Durvillaea willana*.
5	Western North Island Coastal Biogeographic region	Ahipara to Cape Egmont	This region is influenced by the northward flowing Westland Current and the southward flowing West Auckland Current, both of subtropical origin. Coastline is characterised by open, exposed sandy beaches interspersed by stretches of rocky platforms, bluffs and outcrops. Includes Hokianga, Whangape and Herekino, Kaipara, Manukau, Raglan, Aotea and Kawhia Harbours. Gravel sands and ironsands occur offshore. The fauna has affinities with both warm-temperate and cool-temperate/sub-antarctic faunas. Areas of special interest include: offshore islands – for example, Sugar Loaf Islands and Gannet Island.
6	North Cook Strait Coastal Biogeographic region	Cape Egmont on the west coast to Cape Turnagain on the east coast of North Island	This region lies in a transition area between northern and southern flora and faunas and has a high diversity of species. The tidal regimes each side of the strait are different and the water temperature is also very different. The northern side is greatly influenced by the easterly-flowing warm, saline D'Urville Current and the cooler Southland Current that travels northward through Cook Strait. This results in the presence of some sub tropical species on the west coast, compared to the east coast. Strong currents can exceed 10 knots along the eastern side of this section of the North Island. Palliser Bay is in the mixing zone of the warm D'Urville and East Cape currents and the cooler Southland Current. The Durville Current also flows up the west coast and is deflected offshore by the Mt Taranaki ringplain, resulting in very different biota further north of Cape Egmont. Includes Wellington Harbour, Plimmerton, Pauatahanui and Porirua inlets. Areas of special interest include: high tidal flows areas of Cook Strait, cold and freshwater seeps especially off the Wairarapa coast.
7	South Cook Strait Coastal Biogeographic region	Kahurangi Point on the west coast Strait and the Marlborough Sounds to Cape Campbell on the east coast of South Island	This region lies in a transition area between northern and southern flora and faunas although the tidal regimes each side of the strait are different and the water temperature is also very different. Cold water upwelling occurs off Farewell Spit in the region from Kahurangi Point. The current influences around Kahurangi Point result in a change in species assemblages. Includes Golden and Tasman bays, Clifford Bay and the Marlbourgh Sounds, D'Urville Island. Areas of special interest include: high tidal flows areas of Cook Strait and Sounds, Kahurangi Shoals.

	Biogeographic region	Boundary	Description
8	East Coast South Island Coastal Biogeographic region	Cape Campbell to Timaru	This biogeographic region is influenced by the northward extension of the cold Southland Current. There is a change in molluscan assemblages at Cape Campbell from those of Cook Strait. The gyre in the Canterbury Bight is noted as having an influence on species distribution in this region. Includes Banks Peninsula and Kaikoura Peninsula. Areas of special interest include: Banks Peninsula and Kaikoura Peninsula.
9	West Coast South Island Coastal Biogeographic region	Awarua Point north to Kahurangi Point	This region is influenced by the Westland Current fed mostly by warmer water derived from the Tasman Current. The origins of the Southland Current begins in the vicinity of Westland/northern Fiordland, forming from southern subtropical water of the Tasman Sea the waters diverge from the north-flowing Westland Current and flow south. Current patterns on the West Coast are complex due to coastally trapped waves influencing current flow within 50–100 kilometres of the coast, however, over most of the region, the mean flow moves weakly northward towards Cook Strait and Taranaki. The inflow of freshwater from several large rivers and resulting high sediment loading and detritus are key physical factors influencing the marine environment and biota.
10	Fiordland	Awarua Point south to Sand Hill Point, includes Fiords	This biogeographic region is influenced by the Southland Current from the Tasman Sea which flows around the south of the South Island and through Foveaux Strait and around Stewart Island northwards. This region. Being exposed to strong westerly winds from the Southern Ocean and the Tasman Sea year round, this coast is a high energy wave environment receiving some of the most significant coastal wave heights for mainland New Zealand. The continental shelf along much of the coast in this unit is very narrow and most of the fiord entrances drop away steeply into the Tasman Sea to several thousand metres depth. The edge of the shelf is less than 2 km from the coast over much of the region, widening to the south. Geologically, the area is predominantly gneiss, schist and marble with some diorite south of Nancy Sound. There is a noticeable change in composition and an increase in the diversity of marine flora from the West Coast southwards. Areas of special interest include the Fiords.
11	Southern Coastal Biogeographic region	Sand Hill Point around to Timaru on the east coast, includes Stewart Island/ Rakiura.	This region is influenced by cooler subantarctic water which combines with the Southland Current and flows in an anti-clockwise direction around the bottom of South Island and Stewart islands, and along the Canterbury–Otago coast to Banks Peninsula, before flowing eastward along the Chatham Rise. Freshwater input from large snow-fed rivers influences biota along the east coast of this biogeographic region. Centres of marine algae diversity occur around Stewart Island and along the Otago coast. Distinctive southern South Island molluscan fauna. Also subantarctic elements in the flora and sponge and ascidian assemblages of the southern part of South Island and Stewart Island. Areas of special interest include: high tidal flows areas of Foveaux Strait, brozoan beds off Otago,
12	Chatham Islands Coastal Biogeographic region	Chatham Islands/Rekohu	This region is a unique marine environment. Influenced by Subtropical Front. Marine algae assemblages comprise northern and southern elements of mainland species, including endemic species. Noticeable absence of some species common to the mainland (for example, *Ecklonia radiata*). Fish fauna has affinities with widespread species and central region, low species diversity compared with mainland New Zealand; mobile invertebrates have affinities with central and southern regions; encrusting invertebrates (such as, sponges and ascidians) show high levels of endemism. Areas of special interest include: sea caves, overhangs.
13	Snares Coastal Biogeographic region	Snares/Tini Heke	This region contains a unique mix of remnant mainland species. Influenced and surrounded by the Subtropical Front. Molluscan and fish fauna and flora have affinities with Southern Region. The region is also the southern distributional limit for some species of algae. Areas of special interest include: sea caves.
14	Subantarctic Islands Coastal Biogeographic region	Subantarctic Islands (Auckland/Motu Maha, Bounty, Antipodes and Campbell/Motu Ihupuku Islands)	This region is a unique marine environment and each island has distinctive assemblages of flora and fauna. Islands lie atop Campbell Plateau and Bounty Plateau. Influenced by Subtropical Front and colder Subantarctic Front. Fish, ascidians, sponges and flora have affinities with southern New Zealand; diverse range of endemic bryozoan species, limited molluscan fauna, low diversity of fish species. Areas of special interest include: sea caves, overhangs, inlets and harbours, rock stacks.

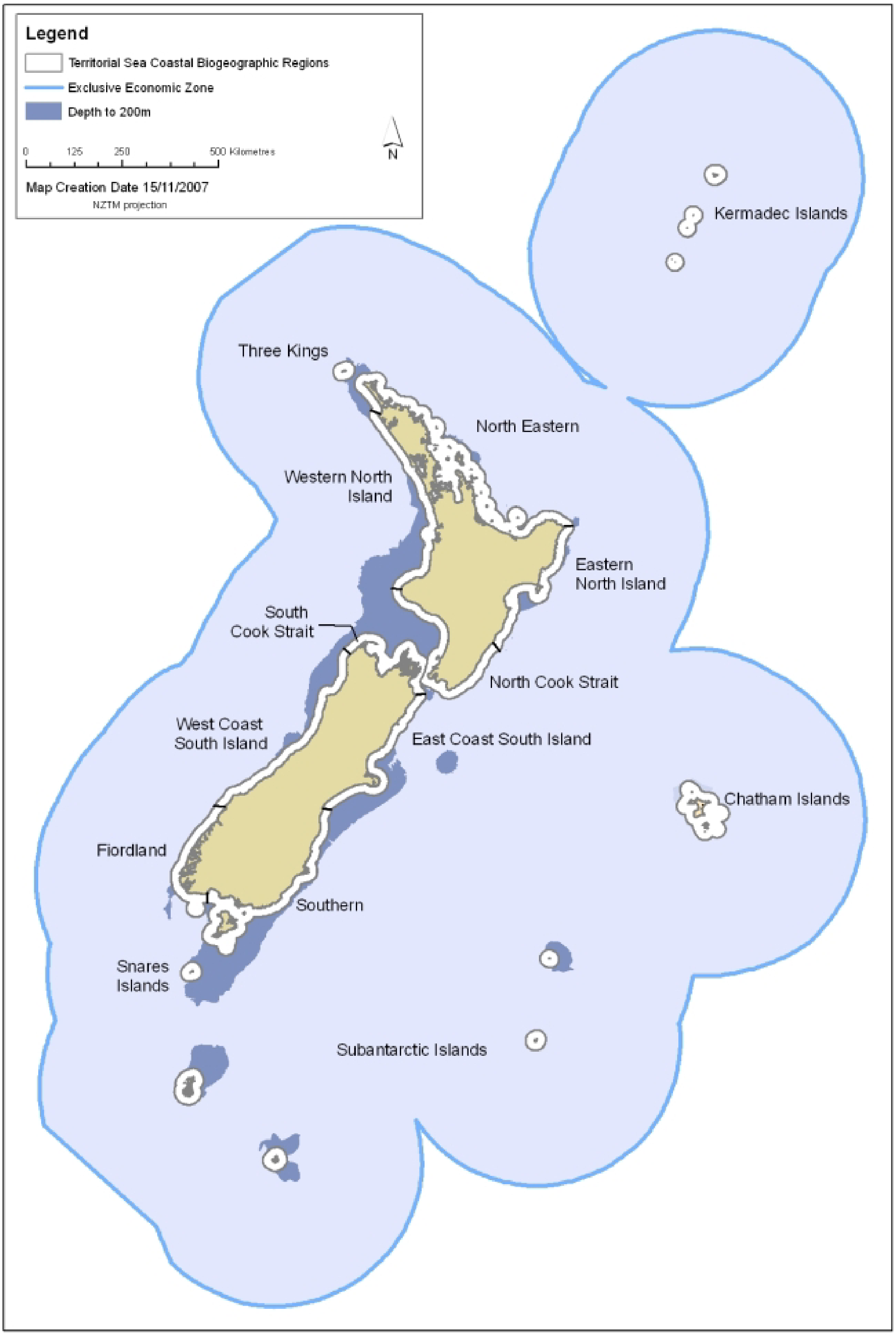

Figure 2: New Zealand's coastal biogeographic regions.

Defining coastal habitats and ecosystems

Nested within the 14 biogeographic regions, the hierarchical classification scheme is divided into two major environment types:

- **Estuarine environments** are large coastal water regions that have geographic continuity, are bounded landward by a stretch of coastline with fresh-water input, and are bounded seaward by a salinity front
- **Marine environments** include the saline waters of the open sea, the seabed and water column of open sea coasts

The main environmental factors which influence community structure (international and national literature) are considered to be depth, substrate, and exposure (wave action, tidal action and currents). These three key physical variables that influence coastal biodiversity will be used to identify habitat and ecosystems within each coastal biogeographic region.

Depth: There are three depth categories (intertidal, shallow subtidal to 30 metres, and deeper subtidal – between the 30 and 200 metre depth contours). This broadly reflects the role of light and physical disturbance in the coastal marine environment.

Substrate: There are eight substrate categories (mud, sand, gravel, cobble, boulders, bedrock, biogenic structures and artificial). These have been defined based on their role in structuring ecological communities. The 'artificial' category has been included to aid mapping for the purpose of protected area planning. Substrates are more fully explained in the Glossary.

Exposure: There are three exposure categories (low, medium and high). These have been defined based on their role in structuring intertidal and shallow subtidal communities. Exposure is more fully explained in the Glossary.

Table 2 shows how the environment types and the primary environmental drivers (depth, substrate and exposure) fit together in a hierarchy to classify coastal habitats.

Using additional physical and biological information

In all biogeographic regions, additional data will be available along with the depth and substrate categories. These data will result in a more comprehensive description of the marine environment and a more detailed classification. However, while the additional information results in a more detailed and comprehensive description of the coastal marine environment, it is not required to be represented in protected areas.

Additional biological and physical data* will allow more informed decisions to be made about the biodiversity value of specific sites. This can then be weighed against other considerations, such as minimising impact on existing users, when making recommendations for potential protected areas.

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* Examples include seagrass and horse mussel beds, kelp forests, nursery areas, threatened species distributions, breeding sites, salinity gradients, wave exposure or current flow.

Table 2: Coastal classification and mapping scheme (Mean High Water Spring – 200 metre depth).

Level 1	Biogeographic region (14)									
Level 2	Environment type	Estuarine		Marine						
Level 3	Depth	Intertidal	Subtidal	Intertidal (MHWS – MLWS)			Shallow Subtidal (MLWS – 30m)			Deep Subtidal (30m – 200m)
Level 4	Exposure	low	low	low	med	high	low	med	high	low
Level 5	Habitat type	Mud flat	Mud flat	Mud flat	Sandy beach	Sandy beach	Shallow mud	Shallow sand	Shallow sand	Deep mud
		Sand beach	Sand flat		Gravel beach	Gravel beach		Shallow gravel field	Shallow gravel field	Deep sand
		Gravel beach	Gravel field		Cobble beach	Cobble beach		Shallow cobble field	Shallow cobble field	Deep gravel field
		Cobble beach	Cobble field		Boulder beach	Boulder beach		Shallow boulder reef	Shallow boulder reef	Deep cobble field
		Boulder beach	Boulder reef		Rocky platform	Rocky platform		Shallow Rocky reef	Shallow Rocky reef	Deep boulder field
		Rocky platform	Rocky reef					Shallow Biogenic reef	Shallow Biogenic reef	Deep rocky reef
			Biogenic reef							Deep Biogenic reef

Notes:

- Terms above are defined in the Glossary
- Biogenic reefs include habitats such as bryozoan beds, rodolith beds, tube worm mounds and sponge gardens
- Artificial substrate such as marine farms and marinas has not been included in the classification as it is not considered important for representation in the network of protected areas, however, it should be considered for the purposes of mapping all features present in a biogeographic region
- This list presents the proxies for habitat types. Each listed category may not occur in every bioregion. Marine habitats do not typically function independently and these habitat types frequently occur in combination
- A proportion of all habitats identified in Table 2 that occur in a given Biogeographic Region are required to be protected in at least one marine reserve and at least one other form of marine protection

5.0 DEEP WATER MARINE CLASSIFICATION

Implementation of the classification in deep water will be guided by the following spatial scales:

- Broad scale variation at the meso-scale (100s to 1000s of kilometres); and
- Habitats and ecosystems at the local-scale (10s to 100s of kilometres)

Significant recent work on classifying New Zealand's marine environment includes, most notably, the Marine Environment Classification 2005 (MEC) which was developed for the Government by the National Institute of Water and Atmospheric Research (NIWA). The Ministry of Fisheries has commissioned a revision of the MEC to further contribute to understanding of New Zealand's deepwater marine habitats and ecosystems.

The Government recently accepted a proposal from representatives of the fishing industry to establish Benthic Protection Areas (BPAs); primarily in the EEZ. As part of that proposal, the Government has agreed that implementing the MPA Policy in the EEZ will not commence until 2013.

In the interim, further preparatory work on marine classification in the deep water will continue. This work will further refine the current MEC and lead to a more comprehensive classification of deepwater marine habitats and ecosystems.

When implementing the MPA Policy in the deepwater, it will be necessary to consider what constitutes best available information. Significant input will be sought from the panel of offshore experts which will make recommendations for deepwater protected areas.

To give an indication of the level of detail considered necessary to represent habitats and ecosystems in the deepwater marine environment, the following section discusses how the current MEC (2005) could be used to plan a deepwater protected area network.

The Marine Environment Classification 2005

The MEC aims to provide a spatial framework to facilitate the conservation and management of indigenous marine biodiversity by subdividing the marine environment into units with similar environmental characteristics.10

The MEC uses predominantly physical variables (for example, depth, sea surface temperature, seabed slope and annual solar radiation) to create proxies for marine environments and groups them into broadly similar areas, called "environment classes". Each class is labelled by a number, which has no specific meaning but is associated with delineating the distinctiveness of one class from another. While the MEC currently does not predict the biota that is present in a specific area, the pattern of physical variables provides an indication of possible broad-scale environment types that are likely to influence the biota associated with a particular environmental class. An important assumption is that areas within the same environment class will be expected to have more in common with each other than with areas falling into other classes.

It is generally accepted that the MEC is a primary tool for classification in the deepwater marine environment, although it is also acknowledged that the MEC is not ideal for defining protected areas, rather, it identifies general areas that may warrant further investigation.

The 20 class level of the MEC is considered to provide a useful surrogate for ecological (biological and environmental) variation. However, given that MEC represents environmental variation only at a broad scale, it is proposed that additional information be represented within each MEC class to capture further variation at the habitat and ecosystem level (see Figure 3). Table 3 provides a hierarchical classification scheme which aims to identify habitat and ecosystem variability in the pelagic and benthic environments within the MEC at the 20 class level.

Within each MEC class, it is desirable that protected areas represent the variation in substrate that is known to have a significant influence on the associated biota at a variety of different depths.

Table 3: Deepwater marine ecosystem and habitat classification and mapping scheme (> 200 metres depth).

Large Scale **Small Scale**

Biogeographic range	Environment	Depth	Substrate	Habitat and ecosystem examples
MEC	Benthic or sea floor	Upper Continental slope (200-500 m)	Represent the biologically-significant variation in substrate type	High-relief hard-bottom or deep water reefs Hydrothermal seeps and vents Seamounts and guyots Banks Submarine canyons Trenches Marine Terraces Plains
		Mid Continental slope (500-1000 m)	Represent the biologically-significant variation in substrate type	
		Lower Continental slope (1000-4000 m)	Represent the biologically-significant variation in substrate type	
		Abyssal plain (>4,000 m)	Represent the biologically-significant variation in substrate type	
	Pelagic or water column	Sea surface (surface 0 m) Epipelagic (0 – 200 m) Mesopelagic (200-1000 m) Bathylpelagic (1000-4000 m) Abyssalpelagic (4000-7000 m) Hadalpelagic (>7000 m)	N/A	Eddies Mixed layers Upwellings Frontal boundaries Benthic boundary layers Stratified layers

Note: Not all depths identified above will exist within all MEC classes. The terms above are defined in the Glossary.

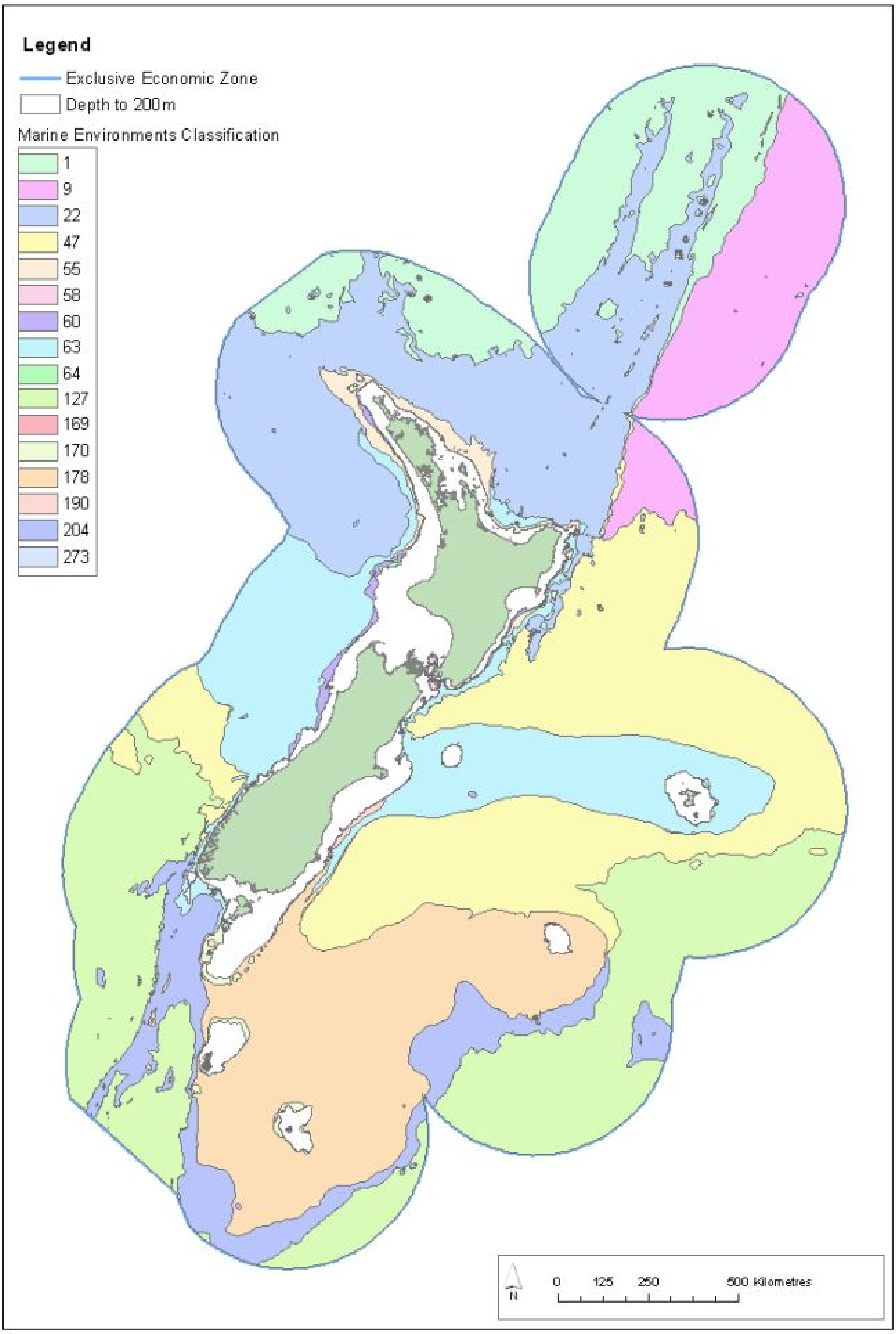

Figure 3. New Zealand's Deepwater regions. Each colour represents a different environment class and is represented by an arbitrary number.

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7. GLOSSARY

Abyssal plain: The deep ocean floor, an expanse of low relief at depths greater than 4000 metres.

Abyssopelagic zone: The ocean water column depth 4000 to 7000-metre-depth zone, seaward of the shelf-slope break. The Bathypelagic and Abyssopelagic sometimes termed the “midnight zones".

Artificial: Human-made structures that are placed in the marine environment for the purpose of human use (for example, marinas, wharfs, marine farms), habitat enhancement or recreation.

Bathypelagic zone: The 1000 to 4000-metre-depth zone seaward of the shelf-slope break. The number of species and populations decreases greatly as one proceeds into the bathypelagic zone where there is no light source other than bioluminescence. Temperature is uniformly low, and pressures are great. This overlies the abyssopelagic zone and is overlain by the mesopelagic zone.

Bedrock: Stable hard substratum, not separated into boulders or smaller sediment units. These rock exposures, typically consisting of sedimentary rock benches or platforms, may also include other rock exposures such as metamorphic or igneous outcrops. Possibly with various degrees of concealment from attached plant and animal colonisation.

Benthic: Dwelling on or associated with the seabed. Benthic organisms live on or in the seabed. Examples include burrowing clams, sea grasses, sea urchins and acorn barnacles. Deep-sea benthic fauna are zoned with depth and show marked changes in diversity and composition with topographic features, current regimes, sediments and oxygen-minimum zones (for example, Rex 1981; Grassle 1989; Etter &, Grassle 1992; Grassle & Maciolek 1992; Levin *et al* 2001; Rowden *et al.* 2002, Nodder *et al.* 2003, Stuart *et al.* 2003, Rowden *et al.* 2003, Rowden & Clark 2004, Rowden *et al.* 2004, Rowden *et al.* 2005). A great variety of chemosynthetic communities also exist (for example, Rex *et al.* 1997; Levin *et al.* 2001; Stuart *et al.* 2003). It is clear that many deep-sea soft-sediment, hard-substrate and chemosynthetic communities share some proportion of their faunas. However, the extent to which this is true and the importance of dispersal among habitats in the persistence of species remain unclear.

Benthic boundary layer: The dynamic environment at the interface between the deep water and the ocean floor.

Biodiversity: The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (Convention on Biological Diversity). Components include:

> ***Genetic diversity:*** The variability in the genetic make up among individuals within a single species. In more technical terms, it is the genetic differences among populations of a single species and those among individuals within a population.
> ***Species diversity:*** The variety of species – whether wild or domesticated – within a particular geographical area. A species is a group of organisms, which have evolved distinct inheritable features and occupy a unique geographic area. Species are usually unable to interbreed naturally with other species due to such factors as genetic divergence, different behaviour and biological needs, and separate geographic location.
> ***Ecological (ecosystem) diversity:*** The variety of ecosystem types (for example, forests, deserts, grasslands, streams, lakes, wetlands and oceans) and their biological communities that interact with one another and their non-living environments.
> (Source - http://www.biodiversity.govt.nz/picture/doing/nzbs/glossary.html#ecosystems)

Biogenic reefs: Biogenic reefs (elevated structures on the seabed constructed of living and dead organisms) include fragile erect bryozoans and other sessile suspension feeders. Examples are bryozoan beds, rhodolith beds, tube worm mounds, sponge gardens and cold-water corals. These communities develop in a range of habitats from exposed open coasts to estuaries, marine inlets and deeper offshore habitats, and may be found in a variety of sediment types and salinity regimes.

Biogeographic region (100s to 1000s of kilometres)**:** An area that is defined according to patterns of ecological and physical characteristics in the seascape. Biogeographic regions will form the basis of protected area coastal planning.

Boundary current: Large-scale water stream in the upper ocean that separates water masses and is driven by a combination of wind temperature, geostrophic or coriolis effects.

Coastal: For the purposes of developing a network of protected areas, the MPA Policy specifies two planning processes – one for the coastal environment and one for the deepwater marine environment. For the purpose of implementing the network of protected areas, the coastal/deepwater planning boundary is the limit of the Territorial Sea (12 nautical miles).

Coastal marine: For the purposes of this classification coastal marine refers to the estuarine and coastal marine habitats and ecosystems which include the saline waters of estuarine areas and of the open coast, the seabed and water column of open sea coasts to a depth of 200m. These coastal environments are generally subject to higher temperature and salinity fluctuations, nutrient run-off, sediment re-suspension, productivity and species' growth and reproduction than deep waters.

Chemosynthetic communities: Chemosynthetic communities include assemblages of tubeworms, clams, mussels, bacterial mats, and a variety of associated organisms. They use a carbon source independent of photosynthesis and the sun-dependent photosynthetic food chain that supports all other life on earth. Features or areas that support high-density chemosynthetic communities include cold seep hydrocarbon-charged sediments associated with anomalous mounds or knolls, whale falls, gas or oil seeps, and hydrothermal vents and seeps.

Community: An association of species which has particular species, at certain densities, in common.

Continental shelf: A broad expanse of ocean bottom sloping gently and seaward from the shoreline to the shelf-slope break. The shelf area is commonly subdivided into the inner continental shelf, mid continental shelf, and outer continental shelf. The sea floor below the continental shelf break is the continental slope. Below the slope is the continental rise, which finally merges into the deep ocean floor, the abyssal plain. The pelagic (water column) environment of the continental shelf constitutes the neritic zone. The continental shelf and the slope are part of the continental margin.

Continental shelf break: Line marking a change from the gently inclined continental shelf to the much steeper depth gradient of the continental slope. The character of the shelf changes dramatically at the shelf break, where the continental slope begins. Eade and Carter (1975) define the "shelf break" as the depth at which there is a marked change in the slope of the shelf to greater depths, generally taken as between 130–200 m. Off New Zealand the shelf width is usually 16–64 km, but ranges from 1.6 km off Fiordland to over 160 km for the Taranaki shelf.

Continental slope: A steep-sloping bottom extending seaward from the edge of the continental shelf and downward toward the rise. Continental slopes are the relatively steep inclines between the continental shelf and the surrounding ocean basins and, in New Zealand, are typically inclined at an angle of three to six degrees (Lewis et al. 2006). The slope is often cut with submarine canyons.

Deepwater: For the purposes of developing a network of protected areas the MPA Policy specifies two planning processes – one for the costal environment and one for the deepwater marine environment. For the purpose of implementing the network of protected areas, the coastal/deepwater planning boundary is the limit of the Territorial Sea (12 nautical miles).

Deepwater marine: For the purposes of this classification deepwater marine refers to the seabed and water column habitats and ecosystems of the open ocean beyond the depth of 200m.

Demersal: Occurring near the seabed. Demersal organisms live near, but not on, the seabed, and usually feed on benthic organisms.

Depth classes of the oceanic bottom: This category of depth zone (continental shelf, upper continental slope, mid continental slope, lower continental slope and abyssal plain) for the sea floor is based on the importance of the continental platforms and their associated features. On the oceanic sea floor, vertical depth zones of the bottom are defined by depth. The depths of these zones vary depending on regional geology.

Depth classes of the oceanic water column: The oceanic regime is distinguished by water depth range. In the water column, hydrographic features are identifiable water circulations, discontinuities or barriers that affect biological processes by containing, dispersing, transporting them, or concentrating food and spawning individuals. Hydrographic features in the water column include: warm core rings, cold core rings, upwelling, downwelling, major current systems, mesoscale eddies, stratified layers, frontal boundary and benthic boundary layers.

Ecosystem: An interacting system of living and non-living parts such as sunlight, air, water, minerals and nutrients. Ecosystems encompass communities and their surrounding environments and function through three basic cycles of matter and energy: extraspecific cycles (biogeochemical cycles), intraspecific cycles (life cycles and histories), and interspecific cycles (food webs). Marine ecosystems are dynamic complex three-dimensional systems. The "interconnectedness" within and among ecosystems is provided both by the physical environment (for example, currents transporting larvae from one part of the ecosystem to another) and by biological interactions (for example, kelp forests or seagrasses creating habitat or predators consuming prey). Environments covered in the marine environment include estuarine, near-shore coastal, continental shelf, seamounts, and sea trenches. Ocean ecosystems include pelagic (water column) and benthic (sea floor) communities. Coastal ecosystems include subtidal rocky reefs, subtital soft sediments, kelp forests, biogenic reefs, pelagic habitat, rocky and sandy beaches, mangrove forests, seagrass beds, estuaries and salt marshes. Ecosystems come in many sizes, often with smaller systems embedded within larger ones. For example, a kelp forest in northeastern coast of New Zealand represents a small habitat ecosystem that is nested within the larger northeastern coastal region. Individuals of a few marine species spend their entire life within a single habitat such as a kelp forest, but most have larval or juvenile stages that are transported across habitats. Some wide-ranging animals, including certain large fish and marine mammals, cross large ecosystem boundaries just as migrating birds move across large distances on land.

Epipelagic zone: The 0 to 200 metre depth zone, seaward of the shelf-slope break. The epipelagic zone extends from the surface downward as far as sunlight penetrates during the day. It is a very thin layer, up to about 200 metres deep. The endemic species of this zone either do not migrate, or perform only limited vertical migrations, although there are many animals that enter the epipelagic zone from deeper layers during the night or pass their early development stages in the photic zone. The epipelagic zone overlies the mesopelagic zone.

Estuarine: The estuarine environment includes estuaries, tidal reaches, mouths of coastal rivers and coastal lagoons. The dominant functions are the mixing of freshwater and seawater, and tidal fluctuation, both of which vary depending on degrees of direct access to the sea. Estuaries are semi-enclosed bodies of water which have a free connection with the open sea. They differ from other coastal inlets in that sea water is measurably diluted by inputs of freshwater and this, combined with tidal movement, means that salinity is permanently variable. The mixing of two very different water masses gives rise to complex sedimentary and biological processes and patterns. New Zealand has diverse examples of estuarine systems including drowned river valleys, barrier-enclosed estuaries, estuarine lagoons, river mouth estuaries, structurally influenced, technically influenced (such as the Marlborough Sounds) and fiords (Hume 2003). Six broad habitat types have been identified for New Zealand fiords, based primarily on the three physical variables above (Wing et al., 2003; 2004; 2005). The diversity of estuary types and habitats are a function of New Zealand's active margin and headland dominated coastal setting, diverse geologic past and catchment sediments, variable wave climate and rainfall. Estuaries enclose a diverse range of habitats from subtidal areas to intertidal areas. These include sheltered upper estuary mangroves, seagrass beds and marshes, highly energetic beaches on the ocean side of the estuary, rocky reefs, wave built bars in estuary mouths, deep estuarine channels where swift tidal currents flow, shallow open salt water and fresh water, river deltas, tidal pools, muddy fringing marshes, mid-estuary sand banks, intertidal flats, estuarine beaches and mangrove forests.

Estuary: A partially enclosed coastal body of water which is either permanently or periodically open to the sea and within which there is a measurable variation of salinity due to the mixture of seawater and freshwater derived from land drainage (Day 1981 in Hume & Herdendorf 1988). Estuaries vary in size, with the largest in New Zealand being Kaipara Harbour (74,000 ha), while the smallest are less than 10 ha.

Exposure: Exposure is related to the prevailing energy of water movement, tidal, wave or current. Exposure level also influences the substrate type by suspending, transporting and sorting fractions of substrate particulates of smaller grain size. Exposure is an important factor that influences the kinds of animals and plants that can maintain attachment or position in a particular habitat. Wave exposure is determined by the aspect of the coast (related to direction of prevailing or strong winds), the fetch (distance to nearest land), openness (the degree of open water offshore) and profile (the depth profile of water adjacent to the coast). Energy can shape the seafloor (forming sand waves, sand ripples) and erode or accrete areas. For example high energy environments are typified by the presence of erosive features, such as beach scarps or bare rock substrates. Exposure can be measured using two components: (i) long-term wave climate - a surrogate for wave energy impacting primarily on the intertidal and subtidal fringe; (ii) orbital velocity - to indicate subtidal areas that experience significant stirring by wave action. A number of exposure scales have been developed (e.g. Ballantine 1961, Thomas 1986, Hiscock 1996). For the purposes of the protected area coastal classification three levels of relative exposure are used to identify deferent categories structuring intertidal and shallow subtidal communities.

- High – describes areas where wind/wave energy is high in areas of open coasts which face into prevailing winds and receive oceanic swell (fetch >500 kilometres e.g. ocean swell environment; current >3 knots).
- Medium – describes areas of medium wind/wave energy generally including open coasts facing away from prevailing winds and without a long fetch (fetch 50-500 kilometres e.g. open bays and straits).
- Low – describes areas where local wind/wave energy is low (fetch <50 kilometres e.g. sheltered areas; small bays and estuaries; current <3 knots).

Fetch: The distance across water over which the wind blows from a particular direction uninterrupted by land.

Guyot: A flat-topped extinct volcanic seamount.

Habitat: The place or type of area in which an organism naturally occurs. Habitat is a term that evokes debate and is often difficult to describe because there are different perspectives on its definition. Habitat is generally thought of as a place where an organism is found (Odum 1971), such as estuaries, salt marsh, seagrass, kelp forests and cobble fields that fringe our coastlines, to deep sea habitats and ecosystems, such as offshore bryozoan beds, deep sea coral reefs, extensive areas of fused manganese nodules that forms a solid 'pavement' at 5000 metres depth, vast areas of abyssal 'ooze' and the various depth zones of the water column (Baston 2003). Marine habitats include those below mean spring high tide (or below mean water level in non-tidal waters) and enclosed coastal saline or brackish waters, without a permanent surface connection to the sea but either with intermittent surface or sub-surface connections (as in lagoons) out to the to the extent of New Zealand's marine jurisdiction. Describing habitat is complicated by issues of scale and complexities in natural processes. Right whale habitat is described in terms of oceans (1000s of kilometres), while juvenile fish habitat is described by unique seafloor characteristics or microhabitats (centimetres to metres). Many marine organisms require a range of habitat types throughout their life cycle. Some species of fish and shellfish spend their early lives in estuaries or bays where food and shelter are plentiful. Later in life, these same animals move into different environments in the open ocean where they eat different types of food. In spite of how habitat is described and issues of scale, New Zealand has a rich and complex marine environment covering an area of approximately 4.1 million square kilometres.

Hadaalpelagic: Depth zone greater than 7000 metres, seaward of the shelf-slope break.

Hard bottom: Substrates defined by large particle sizes or cemented substrates, generally with organisms that live attached on the surface (for example, bedrock, boulder, deep sea manganese nodule pavements and artificial substrate).

Hydrothermal vents: Hydrothermal seeps and vents are sites in the deep ocean floor where hot, sulphur-rich water (for example, methane CH_4) is released from geothermally heated rock. Commonly found in places that are also volcanically active, where hot magma is relatively near the planet's surface. Some deep submarine hydrothermal vents (known as "black smokers") can reach temperatures of over 400° Celcius. This super-heated mineral-rich water helps support diverse communities of organisms in an otherwise species depauperate environment.

Intertidal: The area of land at the land-sea interface that is marine in character influenced periodically by the rise and fall of twice-daily tides, of bimonthly spring and neap tides, or by ebb and flow in tidal reaches of rivers.

Mangroves: A community of manawa (*Avicennia marina* subsp. *australasica*), vascular shrubs or trees which typically produce erect aerial roots. Occurs in the warm harbour and estuarine waters of the northern third of the North Island, north of about 38^o South. Fringing plant communities, such as salt marshes and mangroves, play an important role in our estuaries and coastal ecosystems. These fringing habitats are a key source of organic material and nutrients, which help to fuel the estuarine food web. Stems and leaves of salt marsh and mangrove plants provide a three-dimensional structure in which animals can hide from predators, and they create habitat for fish species and wading birds.

Marine Protected Area network: It is generally accepted that an ecologically representative network of protected areas should, by definition: capture the full range of ecological variability; ensure functioning ecosystems by encompassing the temporal and spatial scales at which ecological systems operate ;and provide for effective management of large-scale processes and patterns. It is considered that multiple reserves, or replication, reduces risk that populations or habitat are destroyed by a catastrophe. While no widely accepted definition exists, a number of definitions have been developed, including Roff (2005) who specifies the characteristics a network should embody *"multiple sites with replicates of all habitat types that are oceanographically connected; individually or in aggregate they are of sufficient size to sustain minimum viable populations of the largest species in a region (including those of seasonal migrants to the region) and their resident species can sustain their populations by recruitment from one MPA to another'".* Another definition developed by United States National Oceanic and Atmospheric Administration (NOAA) in collaboration with the World Commission on Protected Areas (WCPA)/IUCN states the and MPA network is *"A collection of individual marine protected areas operating cooperatively and synergistically, at various spatial scales, and with a range of protection levels, in order to fulfil ecological aims more effectively and comprehensively than individual sites could alone. The network will also display social and economic benefits, although the latter may only become fully developed over long time frames as ecosystems recover"* (WCPA/IUCN 2007).

Mesopelagic:. The 200 metre - 1000 metre depth zone, seaward of the shelf-slope break. Midwater or "twilight zone", where there is still faint light but not enough for photosynthesis. Bacteria, salps, shrimp, jellys, swimming (cirrate) octopods, vampire and other squids, and fish are typical; many are bioluminescent.

Neritic zone: This spans from the low-tide line to the edge of the continental shelf and extends to a depth of about 200 metres.

Network design principles: Principles that guide the design of the protected areas network (including concepts of representative, rare/unique, viable, replication, resilience, connectivity). There have been a number of papers published recently that have evaluated the effects of larval dispersal, physical oceanography, source-sink dynamics, disturbance, and climate variability for marine protected area and reserve design and focused on the development of principles and tools to design efficient reserve systems that represent as much biodiversity as possible (for example: Bohnsack 2000, Crowder *et al.* 2000, Tuck & Possingham 2000, Botsford *et al.* 2001, Roberts *et al.* 2001, Sala *et al.* 2002, Sponaugle 2002, Stevens 2002, Allison *et al.* 2003, Botsford *et al.* 2003, Gaines *et al.* 2003, Halpern 2003, Halpern & Warner 2003, Hastings & Botsford 2003, Kinlan & Gaines 2003, Lubchenco *et al.* 2003, Neigel 2003, Roberts *et al.* 2003, Palumbi 2003, Shanks *et al.* 2003, Palumbi 2004, SCBD 2004, Bell & Okamura 2005, Fernandes *et al.* 2005, Carson & Hentschel 2006, Cowen 2006, Halpern *et al.* 2006, Laurel & Bradbury 2006, Laffoley 2006, Leis 2006, Possingham *et al.* 2006, Nicholson *et al.* 2006, Parnell 2006, Salomon *et al.* 2006, Sarkar *et al.* 2006, Gladstone 2007, Baskett *et al.* 2007; Wagner *et al.* 2007; Winberg *et al.* 2007, Wood & Dragicevic 2007). A single reserve design will not be optimal for all species or in all locations. However, these studies provide general guidelines to support the identification and design of sites considered to meet biodiversity objectives. In addition, evidence suggests that there will never be a perfect surrogate or suite of surrogates that can be used to efficiently represent all elements of biodiversity. The choice of surrogate will depend on both the presumed effectiveness of the surrogates available, and the amount of time, cost and effort required to develop alternatives. Conservation planners therefore should make the best use of all available environmental and biological data to inform decision-making (Possingham *et al.* 2006).

Oceanic water column: Those waters of the ‘open ocean,’ in areas beyond the shelf break (about 200-250 metres depth) extending to the maximum ocean depths. These waters are removed from primary continental influences, and the sea bottom interacts little or not at all with the water column.

Pelagic: Associated with open water. Pelagic organisms live in the open sea, away from the seabed.

Representativeness: Marine areas selected for inclusion in reserves should reasonably reflect the biotic diversity of the marine ecosystems from which they derive.

Salinity: The quantity of dissolved salts in water, especially of seawater or its diluted products. Salinity is recorded, by convention, as parts per thousand (‰); that is, grams of salts per litre of water. Fully saline - 30 - 40‰; variable salinity/salinity fluctuates on a regular basis - 18 - 40‰; reduced salinity -18 - 30‰; low salinity - <18‰.

Saltmarsh: A wetland in estuarine habitats of mainly mineral substrate in the intertidal zone.

Seagrass: Seagrasses are vascular marine plants with the same basic structure as terrestrial (land) plants. They have tiny flowers and strap-like leaves. They form meadows in estuaries and shallow coastal waters with sandy or muddy bottoms. Most closely related to lilies, they are quite different from seaweeds, which are algae. The leaves support an array of attached seaweeds and tiny filter-feeding animals like bryozoans, sponges, and hydroids, as well as the eggs of ascidians (sea squirts) and molluscs. They also provide food and shelter for juvenile and small fish.

Seamounts: Formations rising higher than 1000 metres from the seafloor, or formations with a vertical elevation above the surrounding base slope of 250 metres or greater.

Soft bottom: Substrate defined by small particle size and unstable bottom conditions, generally with organisms that live buried beneath the surface (for example, cobble, gravel, sand and mud bottoms).

Straits and sounds: Any relatively narrow channels linking two larger areas of sea and occurring between islands, or between islands and the mainland. Straits and sounds are often characterised by strong tidal currents.

Submarine canyon: A valley on the seafloor of the continental slope. Submarine canyons are generally found as extensions to large rivers, and have been found to extend 1 kilometre below sea level, and extend for hundreds of kilometres. The walls are generally very steep. The walls are subject to erosion by turbidity currents, bioerosion or slumping.

Substrate: The type of bottom sediments, such as sand and gravel. Substrate type and sediment grain size have a strong influence on the types of plants and animals that can inhabit a given place. Substrates and sediment sizes range from tiny mud particles, to fine sand, to coarse sand, to pebbles, to cobbles, to boulders, to solid rock outcrop. The precise mix of species inhabiting a rocky habitat is strongly affected by water depth, sunlight, wave exposure, and stability of the substrate. Species on intertidal rocky outcrops tend to be relatively large, long-lived and securely attached to the rock, while species living on wave-tossed intertidal cobbles tend to be small, mobile and short-lived. In general, stable rocks like bedrock, boulders and partially buried cobbles have greater diversity of species than rocks and finer sediments that are frequently shifted by waves (Schoch and Dethier 1996). For the purposes of this classification the substrate categories are defined where the particle size or the primary material of the substrate comprises > 50% of the substrate.

Soft substrates (generally defined by small particle size and unstable/unconsolidated seafloor substrate):

- Mud <0.07 millimetres: Muddy bottoms are areas of fine unconsolidated sediment comprised of silt, clay and fines that may be un-vegetated or patchily covered with green algae and benthic diatoms. These habitats occur in calm, sheltered, depositional environments in both the subtidal and intertidal zone. A variety of invertebrates and fish inhabit subtidal mud bottoms. Grain size can range from pure silt to mixtures containing clay and sand. The sediments of muddy habitats boast a higher proportion of nutrient-rich, organic-mineral aggregates (detritus) than the sediments in sandy habitats (Van Houte-Howes *et al.* 2004). Tidal mudflats frequently occur next to eelgrass meadows and salt marshes. Many of the invertebrates in mud bottoms live near the mud's surface because oxygen typically becomes scarce within a few centimetres of the sediment surface. In very deep, undisturbed basins, sea pens and other species may live on the muddy seabed.
- Sand 0.07-2 millimetres: Sand beaches are constantly in motion. Their shape, size, and location shift continually due to wind, waves and storms. Beaches constructed from sand tend to dominate the North Island, whereas gravel beaches are more common along the east and west coasts of the South Island, but not exclusively so (Shulmeister & Rouse 2003). Storm-generated waves and currents shape sandy bottoms into ripples and ridges in shallow subtidal sandy habitats. In deeper water, storms don't affect the bottom topography, but currents can create sand waves or the bottom can be relatively featureless. Few animals live atop the sandy seafloor. Instead, they bury themselves in the sand to avoid predators, currents and shifting grains. Can include broken shell remnants.
- Gravel 2-75 millimetres: Mixed sand and gravel beaches are common in New Zealand, particularly on the east coast of both the North and South Islands (Shulmeister & Rouse 2003). Subtidal gravel habitats host many of the same species as boulder reefs and generally occur on flat or low slope areas forming low relief habitat. Can include broken shell remnants.
- Cobble 75-260 millimetres: Intertidal cobble and pebble habitats tend to have higher species diversity than mud and sand because the rocks provide refuges for algae and small animals. Invertebrates and algae attach to cobbles or take shelter in crevices. Flat or partially buried cobbles often harbour the greatest diversity of species because these rocks are less frequently overturned by waves. In the wave-swept intertidal zone, cobble habitats are typically devoid of long-lived seaweed, but ephemeral algae, such as sea lettuce or laver, may colonise some relatively stable rocks. Rock barnacles often attach to cobbles, and the mussel byssal threads can partially anchor cobble to the underlying substrate. Many gastropod, amphipods, isopods and worm species dwell among cobbles or pebbles. Subtidal cobble and pebble habitats host many of the same species as boulder reefs. Some of the organisms that attach to cobble include anemones, tunicates, hydroids, soft corals and sponges. In places where storm waves and other disturbances are infrequent, these organisms may become abundant and cover cobble substrates. Generally occurring on flat or low slope areas forming low relief habitat.

Hard substrates (generally defined by large particle sizes or cemented substrates):

- Boulder >260 millimetres: Because they are not frequently overturned by waves due to their large size, boulders support similar species as rocky outcrops. Long-lived algae and animals can survive attached to them. In the intertidal zone, boulders provide a substrate for algae, molluscs, barnacles, hydroids and other sessile organisms. In addition, boulders provide shelter from wind, sun, rain and predators for small organisms that can take shelter underneath and beside them. Boulders are large rocks that can form high relief habitat when piled up or when their diameter exceeds 1 metre. Large underwater piles of boulders, known as boulder reefs, provide an important habitat for algae, anemones, molluscs and sponges that attach to the rock surfaces or dwell in crevices. Lobsters, crabs and many fish associate with boulder reefs.
- Rocky substrate: Rocky substrate, for the purposes of this classification, includes consolidated material and bedrock platforms of various relief and roughness, rockpools, caves and reef cliffs (e.g. High Profile Reef - consolidated substrate with a change in vertical profile >4 m over a horizontal distance of 10 m, Medium Profile Reef - consolidated substrate with a change in vertical profile greater than 1-4 m over a horizontal distance of 10 m. Low Profile Reef - consolidated substrate with a change in vertical profile <1 m over a horizontal distance of 10 m, steep rocky cliffs), and patchy mixed soft bottom and reef habitats. These 'patch reef habitats' are quite common over large areas and are defined as 15% to 60% hard reef interspersed between boulder or unconsolidated substrate. Rocky reef provides an important habitat for the kelp such as *Ecklonia radiata* and other mixed algae forests, molluscs and encrusting invertebrate groups that attach to the rock surfaces or dwell in crevices. Lobsters, crabs and many fish associate with rocky reefs.
- Biogenic reefs: Biogenic reefs (elevated structures on the seabed constructed of living and dead organisms) include fragile erect bryozoans and other sessile suspension feeders. For example, byrozoan beds, rhodolith beds, tube worm mounds and sponge gardens. These communities develop

in a range of habitats from exposed open coasts to estuaries, marine inlets and deeper offshore habitats, and may be found in a variety of sediment types and salinity regimes.

- Artificial: Artificial category includes human developed artificial structures constructed in the coastal marine area (such as artificial reefs, marinas, marine farms and drilling platforms). The artificial category has been included to aid mapping for the purposes of protected areas planning.

Subtidal: The zone of estuarine and coastal areas below the level of lowest tide; permanently inundated.

Subtidal (MLWS – 30 metres): Coastal waters where the salinity is substantially marine, that is, >30 psu throughout the year. The zone extends from below the level of lowest tide, mean low water springs (MLWS), to the 30 metre depth contour. In these waters, benthic processes can strongly influence the ecology and biology throughout the water column and the water column interacts strongly with the benthos.

Subtidal (30 metres – 200 metres): The deep coastal marine environment is the region of marine waters between the 30 metre depth contour and the continental shelf break, at approximately at 200 metres water depth. Depending on shelf morphology, waters at the 30 metre isobath can be quite distant from the mainland or they may lie quite close to land. Depth is more important ecologically than the distance from land.

Trench: Deep and sinuous depression in the ocean floor, usually seaward of a continental margin or an arcuate group of volcanic islands.

Upwelling: A process where subsurface, nutrient-rich, and usually cooler water is carried upward into the ocean's surface layers. Upwelling is caused by a complex interaction of wind, currents and the topography of the sea floor.

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