

Methodology Report

Mapping of significant ecological areas in Northland

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1. Summary

A GIS based mapping system has been developed for the Northland Regional Council’s coastal management area for the identification of significant ecological marine areas (SEAs). Relevant mapping and survey information was assembled and reviewed on Northland’s marine ecological values, habitats and species. An expert group process was established to review the interpretation and use of the *Proposed Regional Policy Statement, (PRPS), Appendix 5* criteria for the identification of Northland’s significant ecological marine areas. Subsequently, Northland’s significant ecological marine areas were scored and mapped with a focus on i) marine values and ii) shorebird and seabird values. For each identified area a worksheet was prepared which presented a summary of ecological values and references to scientific information used in the evaluation and mapping process. Marine mammal presence and ecological importance was summarised in the marine worksheets and, where information was sufficient, was evaluated according to the PRPS Appendix 5 criteria. This process and the resulting resource has highlighted the range of very high ecological values existing in Northland’s extensive estuaries, diverse shoreline and coastal waters. Northland is home to many high quality marine habitats that support important and threatened species.

2. Introduction

This report describes the work undertaken to identify and map significant ecological areas in the Coastal Marine Area of Northland. The project has been guided by the requirements to protect significant ecological and biodiversity values set out in:

- Resource Management Act 1991 (RMA), section 6(c)
- Policy 11 of the New Zealand Coastal Policy Statement 2010 (NZCPS 2010)
- Proposed Regional Policy Statement for Northland (PRPS), policy 4.4.1

Appendix 5 to the (PRPS) (see Appendix 1) sets out criteria for selecting sites of ecological significance. Considerable consultation with the Department of Conservation (DOC) was carried out to produce the criteria. For a site to be recommended for inclusion within the proposed Regional Coastal Plan Significant Ecological Area schedule it must meet at least one of the four primary criteria:

1. representativeness,
2. rarity/distinctiveness,
3. diversity/pattern, and
4. ecological context.

Each criterion has a set of sub-criteria which made up the framework for scoring candidate areas. The following sections describe the process through which spatial information on ecological values was assembled for a group of experts to trial application of Appendix 5 criteria to identify and rank areas of significance. Following this process recommendations from the expert group were further tested in a mapping and scoring process. After review of these trials by Council staff the mapping and scoring conventions and assumptions were further refined, resulting in a set of mapped areas each with a worksheet that summarised ecological values, cited relevant references, and made comments on the values that ranked those areas as ecologically significant.

3. Methodology

3.1 Desktop study of ecological and habitat information

A GIS project was set up to support the gathering of spatial information and mapping of candidate areas for consideration as high ranking in ecological significance. Relevant scientific information and marine studies were reviewed: information sources that were used in the evaluation process are recorded in the worksheets. The Northland Marine Habitat map¹ for the East Coast and Far North proved useful in mapping boundaries of candidate areas. On the West Coast there was no existing marine habitat map available. Because the habitat maps are of prime importance to this process, it was decided to marshal all available West Coast habitat information and produce a draft habitat map for the project.²

¹ Kerr, V. 2009: Marine habitat map of Northland: Mangawhai to Ahipara vers. 1. Northland Conservancy, Department of Conservation, Whangarei p. 33

² Kerr, V., 2015. Marine habitat map of Northland's west coast, (draft). Unpublished GIS project in progress. Kerr & Associates, Whangarei, Northland. Email: vince@kerrandassociates.co.nz.

3.2 Testing the evaluation and scoring process with an expert group

Once the background information layers were assembled a group of recognised marine science experts were brought together to refine the thinking on how to apply the Appendix 5 criteria to mapping ecologically significant marine areas. As a result of logistical challenges it was decided that separate processes would be followed for seabirds/shorebirds and general marine values. The experts and their particular area of expertise are listed in Appendix 2.

A guideline was prepared along with a starting list of assumptions for applying the Appendix 5 criteria.³ Under these criteria for a site to be recommended for inclusion within the proposed Regional Coastal Plan Significant Ecological Area schedule it must meet at least one of the four primary criteria:

1. representativeness,
2. rarity/distinctiveness,
3. diversity/pattern, and
4. ecological context.

Each of the four primary criteria above has a set of sub-criteria. Each sub-criterion has a description that serves as a guide to assessing the sub-criterion as a high, moderate, or low-ranked site. Within each primary criterion the list of sub-criteria are all connected with an **or** which means that a site only has to achieve a high ranking in one sub-criterion to be considered as high ranking for that main criterion. The guideline provides an explanation of each criterion and gives practical scoring examples of localities in Northland.

The guideline suggests how information would be used in the process along with expert opinion: in most cases it is impossible to measure all biodiversity at a single site, nor is it possible to identify every significant ecological site or all of the functional ecological roles in a region. In the context of the Northland coastal environment it is important to protect the potential to further identify and protect outstanding ecological sites for the future. Surrogates such as habitat classifications, bathymetry, and other available abiotic information can be used to facilitate the assessments. Where specific spatial information is lacking a judgement can be made that there is a high probability of significant species assemblies or habitats occurring and a high ranking awarded. Notes summarising the grounds for such judgements are provided.

In the assessment worksheet there are two columns for inputs describing the category of information and a ranking for reliability of the information used.

The categories of information are:

³ Kerr, V.C., 2015. Identification and Mapping of Significant Ecological Marine Areas in Northland: Project Brief and Guide to Assessment. Prepared for the Northland Regional Council. Kerr and Associates, Whangarei.

- Quantitative report
- Qualitative report
- Habitat map and/or classification
- Expert opinion
- Personal communication
- Anecdotal information
- Visit and observation

The ranking system for reliability of the information is expressed as a scale of confidence ranging from high confidence (+++) to low confidence (---).

Some site assessment worksheets have brief explanatory notes on the extent and quality of the information considered. References are noted where possible.

The guideline was circulated to members of the expert group and they were asked to comment on usefulness and practicalities of applying Appendix 5 criteria to select significant ecological areas in Northland.

The general marine group met on 21 August 2015 in Whangarei for a one-day workshop. The workshop was divided into three sessions. In the introductory session each expert was asked to comment on the process outlined and the guidelines for identification and scoring of significant ecological areas. This was followed by a session on the open coasts - both west and east coasts - with experts discussing significant areas and information sources available. The third session was focused on estuaries, which followed a similar course. Minutes from this meeting were recorded and a mapbook was produced with annotations relating to areas the experts thought should be considered for high ranking as significant ecological areas.⁴

In addition to the meeting with the general marine expert group, a series of meetings were conducted remotely via internet conferencing with the shorebird and seabird expert Dr Ray Pierce. Dr Pierce was tasked with looking at how the Appendix 5 criteria could be applied to assessing significant ecological areas from the perspective of marine habitats that support threatened bird species in particular and bird species generally.

Following input from the expert group meeting, the scoring and mapping work was applied to all areas in Northland, resulting in a draft map set of significant ecological areas accompanied by worksheets. Worksheets summarise important ecological information, references and scoring notes for each area. A Council staff group reviewed these first draft maps and, where necessary, further comments were sought from members of the expert group. The review process and feedback provided resolution of any scoring and identification issues, thus allowing the mapping to be further refined. A second round of mapping and scoring was undertaken, which produced a final assessment of areas to be ranked high in ecological significance under the Appendix 5 criteria.

⁴ Kerr, V.C., 2015. [Expert Group Workshop: Northland's Significant Ecological Marine Areas. Prepared for the Northland Regional Council. Kerr and Associates, Whangarei.](#)

4. Results

Following the first stages of the project and trialling of the guidelines and use of Appendix 5 criteria there were some key observations made by the experts and Council staff involved in the project. Considerations of these observations assisted the final mapping and scoring process; they are included here in a summarised form as a result because they clarify how the mapping process was carried out. Also these observations are useful to understand some of the issues involved in attempting this process with a generalised ecological criteria system applied to Northland, with its very high ecological values and diverse coastal environment.

4.1 Key observations arising – challenges applying this process to marine environments

Biological information in the coastal area is limited in many environments and is often based on specific survey sites, as opposed to being spatially comprehensive. This is a challenge for a spatially-based process, thus requiring the application of expert judgement based on best possible knowledge.

We are only at the beginning of understanding the full ecological significance of the wide diversity of marine communities and ecosystems that are found in Northland. As a result this mapping process should be viewed as a starting point of our understanding and appreciation of marine ecosystems, rather than a final view.

Marine ecosystems are hard to characterise in terms of spatial boundaries with the proposed criteria system. They are made up of many overlapping ecosystems, functions and connections working across a full range of spatial scales. A small estuary has benthic communities and algal communities that work on scales of 10-1000 m² and at the same time can be of prime importance to a range of coastal fish and marine mammals which are part of an ecosystem that is 1000s km². The Orca who frequent visit our Northland estuaries on feeding forays travel the entire New Zealand coast, and thus connect our estuaries to all of New Zealand's coastal waters from an ecological perspective.

The current task of the SEA process is to recognise the key habitats that support the important communities, using the best ecological information available, and to apply this to our current marine habitat maps via use of expert interpretation.

Estuaries present a special challenge for the significant ecological area process. Due to the nature of estuaries as the natural interface or ecological edge environment between freshwater catchments and coastal waters they tend to score highly in ecological function criteria generally. That said, a number of Northland estuaries are degraded ecologically from accelerated sedimentation related to forest clearance and intensive agriculture. This general change to a more 'muddy' state results in a decrease in biodiversity and simplification of marine communities and shifts in species assemblies. These dynamic changes affect different estuaries in different ways and have varying effects across the diversity of Northland estuaries. Large estuaries with major oceanic influence and strong currents transport sediments offshore from the lower parts of the estuarine system. Shallow upper areas of

estuaries with many embayments may have far less flushing of catchment-sourced fine sediments and less mixing of oceanic water masses. All these factors have to be accounted for and, in some cases a line has to be drawn to reflect areas within an estuary that can be described via the criteria scoring as having high ecological significance. This requires a judgement informed by diversity measures of benthic invertebrate communities, substrate condition and studies on the estuaries importance as breeding and nurseries for estuarine and coastal fish species, and presence of known high value habitats, such as seagrass *Zostera muelleri* beds.

4.2 Assessing shorebird and seabird values

In parallel with the marine values assessment of the estuaries, a separate process assembled information on waders and shorebirds supported by Northland's estuaries. Matching this information with the marine information to create a 'combined' scoring of the criteria was problematic for several reasons. The most significant difference came when applying criteria 2 (b) below to estuarine bird species.

“2. Rarity / distinctiveness (b) Indigenous vegetation or habitat of indigenous fauna that supports one or more indigenous taxa that are threatened, at risk, data deficient or uncommon, either nationally or at the relevant ecological scale.”

The New Zealand Threat Classification System⁵ for birds, unlike for marine organisms, is sophisticated. Northland estuarine environments have some of the highest numbers of threatened bird species in the country. These species can be described in functional groups of birds that use the estuaries, nearby beaches and shallow coastal waters in different ways. Collectively there are very few areas in Northland estuaries that do not support threatened shorebirds. This includes many areas that would be considered degraded in terms of marine biodiversity values. To resolve this difference in evaluation based on bird values a decision was made to create separate maps, scoring evaluations and worksheets for birds and marine values. When the process moved to the coastal areas a similar situation arose where significant shorebirds and seabird values were supported by all Northland's open coastline when assessed against criteria 2 (b). As a result for the open coasts and offshore islands birds values and marine values were evaluated separately.

4.3 Estuarine areas scoring a high ranking for marine ecological significance

At the conclusion of the scoring and mapping process there were 32 ecologically significant estuarine areas mapped for marine values in 16 of Northland's estuaries. Estuaries that had high quality habitats throughout with known significant biological diversity and connectivity with high value indigenous riparian habitats were scored high for the entire estuarine system.

⁵ Hugh A. Robertson, John E. Dowding, Graeme P. Elliot, Rodney A. Hitchmough, Colin M. Miskelly, Colin F.J. O'Donnell, Ralph G. Powlesland, Paul M. Sagar, R. Paul Scofield, Graeme A. Taylor, 2012. Conservation status of NZ birds. Department of Conservation New Zealand Threat Classification Series 4.

Other estuaries had some areas of high quality habitat but with varying degrees of degradation from accelerated sedimentation. Commonly this was most pronounced in the upper arms of the estuaries. In the case of Whangarei Harbour there are very high values but there is also extensive commercial use of the harbour and degradation of habitats in the upper harbour due to sedimentation and some localised storm water impacts. In these estuaries specific habitats were identified and mapped within each system where the criteria were met for a high ranking score. Table 1 below lists the estuaries and harbours which were ranked high for the entire system and those estuaries and harbours which had specific areas ranked high.

Table 1 Estuaries and estuarine areas score a high ranking for ecological significance

Estuary	Number of Areas
Bay of Islands	4 areas
Hokianga Harbour	1 area
Horahora Estuary	entire estuary
Houhora Harbour	most of estuary
Mangawhai Harbour	3 areas
Matapouri Estuary	entire estuary
Ngunguru Estuary	entire estuary
North Kaipara Harbour	1 large area
Parengarenga Harbour	entire estuary
Pataua Estuary	entire estuary
Rangaungu Harbour	entire estuary
Ruakaka Estuary	2 areas
Taiharuru Estuary	entire estuary
Waipu Estuary	entire estuary
Whananaki Estuary	entire estuary
Whangarei Harbour	11 areas

4.4 Coastal and offshore island areas scoring a high ranking for marine ecological significance

Recommendations and opinion from the expert group made clear statements about the importance of shallow rocky reefs to marine biodiversity values. Rocky reefs make large contributions to coastal primary productivity (algal forests) which is the base of many food chains. They also provide shelter, nursery areas for many species and are home to a wide group of species, specifically adapted to this habitat, who live only on the reef. Several

factors emphasise the significance of Northland's reef areas: the location in relation to currents, and the geology of the coastline. The northerly position and presence of the East Auckland subtropical current means that Northland has far more subtropical species than other New Zealand regions, adding to the biodiversity values of reef fish assemblies. Secondly the varied and rugged coastline, with many pinnacles and islands, greatly add to this diversity. Northland also has large systems of deep reefs (beyond 30 m depth), and patch reefs which are beyond the depth limit of algal forests due to light not penetrating well to these depths. The communities of the deep reefs are characterised by encrusting invertebrate species that mainly are filter feeders. A whole ecosystem and food web is structured around these invertebrate communities leading up to the predator fish species, like snapper and kingfish. These deep reefs all along the northeast coast form a sequence of valuable and productive habitats with the shallow algal forest dominated habitats and the intertidal rocky shore communities. For all these values most of Northland's exposed coastal reefs were scored as high ranking for ecological significance.

4.5 Mapping the coastal reef significant ecological areas

Fortunately, unlike most other regions of New Zealand, Northland has published thematic marine habitat information for its east coast, northern most coasts and extending south down the west coast to Ahipara. This habitat map can be applied to the process of assessing significant ecological areas. After investigating various depth based mapping rules, it was decided that where reefs extend offshore beyond 30 m, they would be mapped offshore to 100m depth. This convention, firstly, was based on the need to limit the scope of the mapping work and, secondly, on the fact that not as much information is available for these deeper reef habitats.

4.6 Rocky reef soft sediment transition areas (reef edge habitats)

There was considerable discussion amongst the experts on the importance of soft sediment areas. Assessment of soft sediment communities on such a large scale as required by this assessment of significant ecological areas was limited by the lack of studies or information for all but a few specific locations in Northland. There was also discussion amongst the experts of the importance of the reef edge environments or soft sediment habitats adjoining the reef edges. Research in New Zealand has documented reef associated species commonly foraging in these 'reef edge' habitats, often on shellfish and other benthic invertebrates.^{6 7} Research in New Zealand documents ecological connections between these reef edge habitats and reef-associated species, such as snapper and rock lobster, which commonly forage in these habitats on shellfish and other benthic invertebrates. To recognise the importance of the ecological connectivity of these habitats a mapping convention was applied. Reefs scoring high for ecological significance were mapped with an additional 'edge' habitat varying in

⁶ Kelly, S. 2001: Temporal variation in the movement of the spiny lobster (*Jasus edwardsii*). New Zealand Journal of Marine and Freshwater Research 52: 323.331.

⁷ MacDiarmid A. B. and Kelly S. (2003) Movement patterns of mature spiny lobsters, *Jasus edwardsii*, from a marine reserve. NZ J of Mar Freshwater Res.

distance from the edge of the reef from 300 – 1,000 m depending on the size of the reef. This mapping rule had the effect of capturing a significant area of these reef-edge habitats, and also representative areas of a wide range of soft sediment habitats; both a specific recommendation of the expert group and supported by the Appendix 5 criteria. Summary information on the coastal offshore island significant ecological areas is presented in Table 2.

Table 2 (numeric values in hectares)

Name	Habitat	Reef area intertidal shallow and deep less than 100m deep	Reef edge soft bottom	Reef edge deep reef >100m depth
Mitimiti Beach toheroa habitat	Toheroa	515		
Ninety Mile Beach toheroa habitat	Toheroa	2,546		
Rapiro Beach toheroa habitat	Toheroa	3,565		
Ahipara Banks Reefs	Reefs	5,149	7,368	556
Berghan Point to Takou Bay reefs	Reefs	3,959	5,576	16
Black Rocks reefs	Reefs	373	808	0
Bland Bay Coast reefs	Reefs	6,106	3,842	170
Bream Head Coast reefs	Reefs	251	1,042	19
Cape Karikari to Rawarawa Beach reefs	Reefs	16,836	17,750	1,113
Cape Tauroa reefs	Reefs	1,443	3,627	0
Cavalli Islands and Coast reefs	Reefs	21,587	11,133	3,687
Doubtless Bay Complex reefs	Reefs	4,230	5,500	0
Eastern Bay of Islands - Cape Brett reefs	Reefs	9,059	11,615	1,860
Hen and Chicks Islands reefs	Reefs	1,052	5,019	0
Matapia Island reefs	Reefs	18	480	0
Mimiwhangata reefs	Reefs	5,140	3,995	748
Poor Knights Islands reefs	Reefs	490	2,351	1,350
Takaou Bay to Ninepin Coasts reef	Reefs	7,449	4,787	734
The Bluff reef	Reefs	20	344	0
Tutukaka to Taiharuru Coast reefs	Reefs	4,531	2,288	1,893
West Coast shallow Reefs	Reefs	1,412	1,749	0
Whananaki reefs	Reefs	6,958	3,945	289
Whangaroa Coast reefs	Reefs	69	216	0
Far North Special biodiversity Area	All habitats	257,186		
Eastern Bay of Islands biogenic habitats	Biogenic	1,489		
Great Exhibition Bay biogenic complex	Biogenic	7,053		

4.7 Marine Mammals

Consideration of marine mammal values in this process provided another set of unique challenges for both Northland estuaries and coastal waters. In Northland coastal areas, both inshore and offshore, there are a number of species that are listed in the New Zealand Threats

Classification listings. Data on habitat use by each species varies from spatially specific to very limited. Across the spectrum of species some spend a lot of time in shallow waters, both coastal and estuarine; Orca *Orcinus orca* and dolphin species are an example. Due to the limits of the spatial information for the marine mammals and the highly dispersed nature their use of the Northland's marine environment it was decided that a separate worksheet would be written for marine mammals which describe the values over the whole coastal area. In the evaluation of estuarine and coastal significant ecological areas, where information on specific threatened marine mammal use of habitats was available, this information was factored into the scoring of ecological significance under the Appendix 5 criteria.

5. Discussion

5.1 Using this resource

The mapping of the significant ecological areas was informed by existing habitat maps. The most effective way to use or query the map layer produced for each SEA is overlaid over the marine habitat maps. Where possible, in the worksheet for each significant ecological area a description of the ecological values identified and assessed are discussed in relation to the relevant habitats. Again, where possible, key spatially-based information used in the scoring of the areas is referenced in the worksheets. Priority was given to review publications that included summaries and citations of prior work relating to each location. This system of site-based references for prior scientific survey data and information is intended to guide the user to identify and detail known information on ecological values of the particular area or habitat in question.

5.2 Validity and uncertainty

Marine ecosystems are very complex and in many cases poorly studied. This process relied on a desktop literature review and input from a group of experts and specialist staff from Northland Regional Council. Information sources varied from published works to personal experience of the experts. For each worksheet the type of information sources used is indicated and the confidence in the assessment was ranked. As such, the results reflect best current knowledge of the habitats, the ecology and the judgement of the assembled experts. There is a significant element of subjective judgement involved in this process relating to the interpretation of the Appendix 5 criteria and its application across such a wide variety of marine environments, habitats and information sources. It is suggested that there are many improvements to the process that can be made in future. Site-based survey information will become more sophisticated and detailed. In future there will be emphasis on investigating special biogenic habitats and their ecological roles. Valuable lessons on 'what is natural' will

be learned from our marine reserves. Marine habitat maps will improve, ecosystem function models will emerge from current research programs and our interpretations of the Appendix 5 criteria will be tested in practice over coming years. In this way the process of mapping significant ecological areas in Northland will be fine-tuned and improved in future projects.

6. Acknowledgements

The experts involved in this project added greatly to the interpretation of the criteria in practical terms. Also the expert's knowledge of information sources was very helpful to the process. Council staff with specialist knowledge in planning policy, estuarine and shorebird ecology made key contributions. Dr Ray Pierce⁸ provided oversight of all the seabird and shorebird work in this project and donated considerable time in the development of the bird lists and writing and editing of the worksheets and mapping processes. Special thanks is due to Katrina Hansen (NRC) who worked on the bird lists and mapping process for the coastal areas and offshore islands. Richard Griffiths who ably supported the estuarine evaluation process via the Council estuarine monitoring program data and his field experience. Lastly a warm thankyou to all our experts involved who volunteered their valuable time and tackled some tricky questions. Their work, collectively, has contributed greatly over the years to what we know about marine ecology in Northland and provided much of the information to work with in this process.

⁸ Dr Ray Pierce is an independent ecologist and ornithologist based in QLD. Australia. Ray was formerly the Northland Conservancy Advisory Scientist for the Department of Conservation and is a leading expert in seabird and shorebird ecology in Northland and the Pacific region. Ray works from his own consultancy Eco Oceania. Email: raypierce@bigpond.com

Appendix 1 PRPS Appendix 5 criteria

Appendix 5 - Areas of significant indigenous vegetation and significant habitats of indigenous fauna in terrestrial, freshwater and marine environments

An area of indigenous vegetation or habitat(s) of indigenous fauna is significant if it meets one or more of the following criteria:

Note:

- i) *These criteria are intended to be applied by suitably qualified and experienced ecologists.*
- ii) *The meaning of underlined italicised terms are described in ' **Appendix 5***

Definitions '.

1. Representativeness

- (a) Regardless of its size, the ecological site is largely indigenous vegetation or habitat of indigenous fauna that is representative, typical or characteristic of the natural diversity at the relevant and recognised ecological classification and scale to which the ecological site belongs:
 - i. If the ecological site comprises largely indigenous vegetation types; and
 - ii. Is typical of what would have existed circa 1840; or
 - iii. Is represented by faunal assemblages in most of the guilds expected for the habitat type; or
- (b) The ecological site
 - i. Is a large example of indigenous vegetation or habitat of indigenous fauna, or
 - ii. Contains a combination of landform and indigenous vegetation and habitat of indigenous fauna, that is considered to be a good example of its type at the relevant and recognised ecological classification and scale.

2. Rarity / distinctiveness

- (a) The ecological site comprises indigenous ecosystems or indigenous vegetation types that:
 - i. Are either Acutely or Chronically Threatened[1] land environments associated with LENZ Level 4[2])
 - ii. Excluding wetlands, are now less than 20% of their original extent; or
 - iii. Excluding man made wetlands, are examples of the wetland classes[3] that either otherwise trigger Appendix 5 criteria or exceed any of the following area thresholds[4] (boundaries defined by Landcare delineation tool[5]):
 - a) Saltmarsh greater than 0.5 hectare in area; or
 - b) Shallow water (lake margins and rivers) greater than 0.5 hectare in area; or
 - c) Swamp greater than 0.4 hectare in area; or
 - d) Bog greater than 0.2 hectare in area; or
 - e) Wet Heathlands greater than 0.2 hectare in area; or

- f) Marsh; Fen; Ephemeral wetlands or Seepage / flush greater than 0.05 hectares in area.
- (b) Indigenous vegetation or habitat of indigenous fauna that supports one or more indigenous taxa that are threatened, at risk, data deficient or uncommon, either nationally or at the relevant ecological scale.
- (c) The *ecological site* contains indigenous vegetation or an indigenous taxon that is:
 - i. Endemic to the Northland-Auckland region; or
 - ii. At its distributional limit within the Northland region;
- (d) The *ecological site* contains indigenous vegetation or an association of indigenous taxa that:
 - i. Is distinctive of a restricted occurrence; or
 - ii. Is part of an *ecological unit* that occurs on an originally rare ecosystem^[6].
 - iii. Is an indigenous ecosystem and vegetation type that is naturally rare or has developed as a result of an unusual environmental factor(s) that occur or are likely to occur in Northland; or
 - iv. Is an example of nationally or regionally rare habitat as recognised in the New Zealand Marine Protected Areas Policy.

3. Diversity and pattern

- (a) Indigenous vegetation or habitat of indigenous fauna that contains a high diversity of:
 - i. Indigenous ecosystem or habitat types; or
 - ii. Indigenous taxa;
- (b) Changes in taxon composition reflecting the existence of diverse natural features or ecological gradients; or
- (c) Intact ecological sequences.

4. Ecological context

- (a) Indigenous vegetation or habitat of indigenous fauna is present that provides or contributes to an important ecological linkage or network, or provides an important buffering function; or
- (b) The *ecological site* plays an important hydrological, biological or ecological role in the natural functioning of riverine, lacustrine, palustrine, estuarine, plutonic (including karst), geothermal or marine system; or
- (c) The *ecological site* is an important habitat for critical life history stages of indigenous fauna including breeding / spawning, roosting, nesting, resting, feeding, moulting, refugia or migration staging point (as used seasonally, temporarily or permanently).

Appendix 5 Definitions

Ecological site: the area under assessment comprising one or more ecological units. Ecological sites are comparable with each other at relevant and recognised scales within the landscape. Current ecological classification systems include the ecological districts framework, freshwater biogeographical units and LENZ, and are expected to evolve in terrestrial, freshwater and marine environments as new information and technology develops.

Ecological unit: Any combination of indigenous vegetation types (or suite of interrelated types) plus the landform they occur on. The Ecological Unit may include exotic vegetation types where they support indigenous fauna.

Man made wetlands: These are wetlands developed deliberately by artificial means or have been constructed on sites where:

- a) Wetlands have not occurred naturally previously; and
- b) The current vegetation cover cannot be delineated as indigenous wetland; or
- c) Man made wetlands have been previously constructed legally.

Man made wetlands do not include *induced wetlands*; *reverted wetlands* or wetlands created for conservation purposes for example as a requirement of resource consent.

Examples of man made wetlands include wetlands created and subsequently maintained principally for or in connection with:

- a) Effluent treatment and disposal systems; or
- b) Stormwater management; or
- c) Water storage; or
- d) Other artificial wetlands and water bodies including or open drainage channels (that have been legally established) such as those in drainage schemes).

These may contain emergent indigenous vegetation such as mangroves, rushes and sedges.

Induced wetlands: This are wetlands that have formed naturally on ecological sites where wetlands did not previously exist, as a result of human activities such as construction of roads, railways, bunds etc. While such wetlands have not been constructed for a specific purpose, they can be considered to be artificial in many cases given they arise through physical alteration of hydrology through mechanical human modification.

However these should be assessed on their ecological merits i.e. are not excluded from any Appendix 5 significance criteria.

Reverted wetlands: Where a wetland reverts over time (e.g. stock exclusion allows a wetland to revert to a previous wetland state). In this instance, the wetland has not been purposefully constructed by mechanical change to hydrological conditions.

Indigenous wetlands of this sort should be treated as natural wetlands i.e. not excluded from any Appendix 5 significance criteria.

Appendix 2 Expert Group participants

Marine Expert Group

Facilitators: Vince Kerr (Facilitator), Catherine Langford (Note taker)

NRC: James Griffin (Policy), Richard Griffiths, Ben Lee (Policy), Justin Murfitt (Policy), Irene Middleton (Bio-security), Janelle Palmer (GIS), Katrina Hansen (Biodiversity) contributed to seabird/shorebird worksheets.

Expert Group: Clinton Duffy (DOC senior marine technical officer); Dr Roger Grace (independent marine biologist); Dr Judy Hewitt, Dr Meredith Lowe, Dr Mark Morrison and Dr Wendy Nelson (NIWA scientists); Dr Nick Shears (Researcher – Lecturer University of Auckland)

Additional experts who advised the process:

Dr Ingrid Visser, marine mammal expert

Dr Ray Pierce, ecologist and ornithologist provided oversight, peer review and contribution to the the shorebird and seabird evaluations for this project