Near Shore Marine Classification System

Northland Conservancy,
Department of Conservation

Revised September 6, 2005 **Compiled by Vince Kerr**

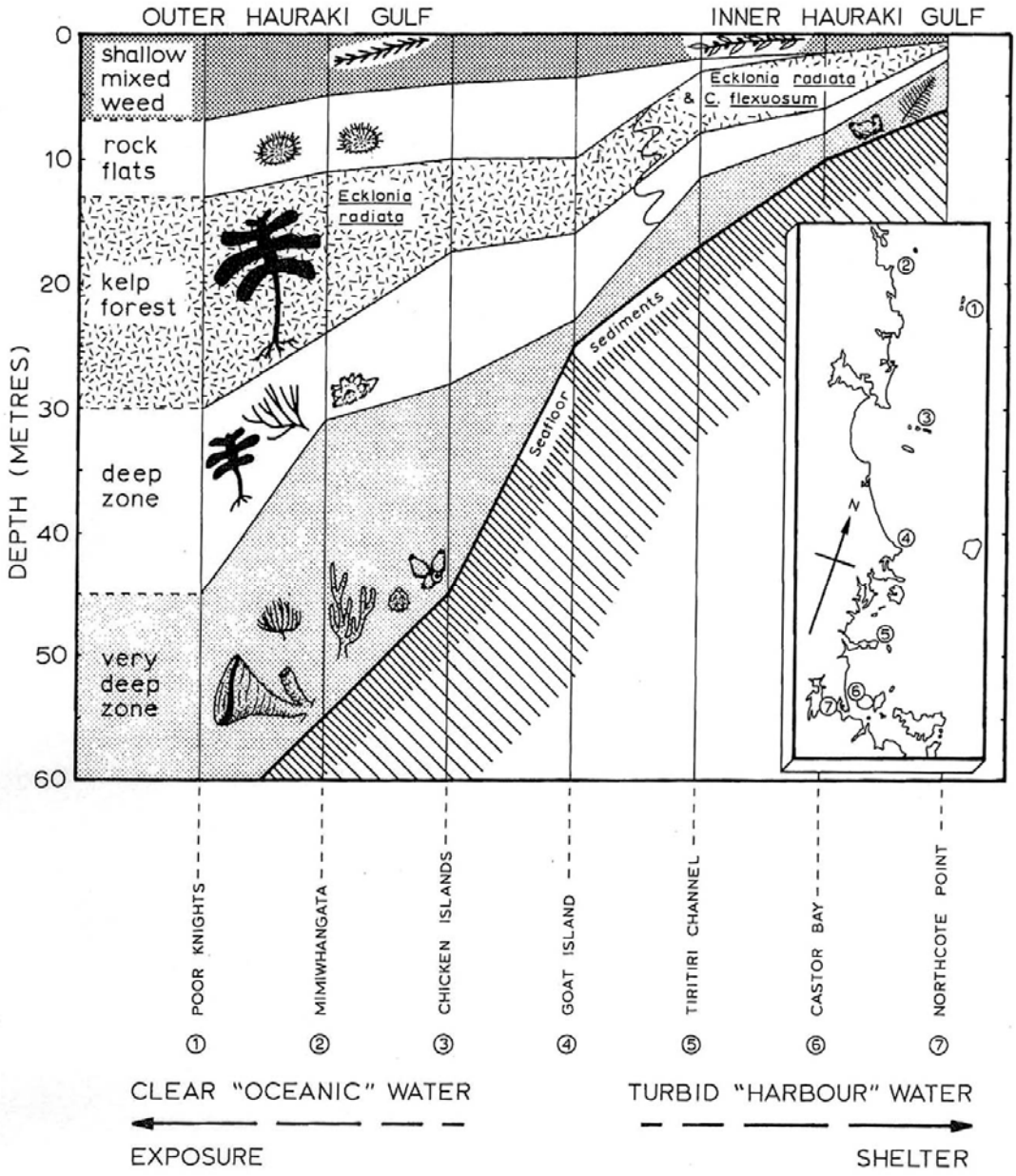

Illustration by Roger Grace

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INTRODUCTION:

This report presents a Near Shore Marine Classification System for Northland. It is part of a national nearshore classification currently being developed for the purpose of supporting work in Marine Protected Areas programs. This information system underpins the Department's efforts to provide a sound scientific basis to facilitate processes for the determinination canditate areas for marine reserve and marine protected areas in Northland. The work has been developed from objective 3.6 of the NZ Biodiversity Strategy, (DoC et.al. 2000):

"Protect a full range of natural marine habitats and ecosystems to effectively conserve marine biodiversity, using a range of appropriate mechanisms, including legal protection."

The Northland classification system is a combination of physical and ecological information and identifies nineteen "coastal units" in the Department's Northland Conservancy area. Coastal Units are smaller areas within the biogeographic regions that describe physical processes, biotic communities and habitats and other environmental influences on the scale 10-100's of kilometres. This is a scale that will be useful in the design of marine reserves and marine protected areas generally in the near coastal area. Working at this scale allows local communities to examine their

local interests and objectives in the context of physical and biological variations distinguishable at this scale. The units described in this report for Northland show broad changes in environmental conditions and biotic communities for the entire Northland coast. Each unit has a description, considering geography, oceanography and biotic communities. Special areas and species from a biodiversity perspective are identified. The initial process for defining and describing the coastal units is reported in Walls (1998), and builds on the foundation of King (1985). The development of the coastal unit information system is an ongoing process with further work planned for 2004-2006 in Northland.

A two nautical mile seaward boundary is currently used for the system as a mapping convenience. Off-shore information and classification systems will at times extend inshore of the two nautical mile line and likewise for a variety of reasons not the least being changing bathymetric profiles around the Northland coast, coastal planning process may be focused well inside this line or in some cases extend beyond the 2 nm line. It is important to note that the divisions of coastal units were done as a best fit to biological and geographical criteria. They will not necessarily be a best fit for social or cultural boundaries or other forms of planning units. Any system chosen would result in mismatches with the many boundaries that exist for many different purposes. In working with the coastal units adopted here there is no reason any group cannot consider all or part of two or several coastal units in planning exercises. For example, Iwi authorities in Northland may be concerned with several coastal units within their rohe. Or, two or more Iwi or Hapu may both have an interest or overlapping rohe boundaries in a given coastal unit. This practical reality need not be a problem for the use of the coastal unit information system.

This report aims to establish a science base which will assist the process of establishing a network of marine reserves and other marine protected areas in Northland. Generally, ‘best practice’ international models for planning marine protection emphasize that marine science derived recommendations need to be considered in a balanced way alongside social, cultural and economic considerations, (Ballantine 1998; DoC, 2002; Parks Victoria 2002; PISCO 2002;Queensland Government 2003; Taylor & Buckenham 2003; Walls 1998). Experience overseas has shown that full stakeholder involvement in the planning process achieves eventual wide support for marine protected areas and assists identification of protection options. Future work will involve enlarging the process to include a wide range of stakeholders in Northland. As this process proceeds it is important to note that due to Northland’s diversity and importance of marine habitats and marine ecosystems all coastal units as in this report will be assessed for candidate areas for marine protection.

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NORTHLAND CONSERVANCY – GENERAL DESCRIPTION

Northland Conservancy covers the far north of New Zealand including the Three Kings Islands north-west of Cape Reinga. The Conservancy is bounded in the south by a line from the base of Mangawhai Spit on the east coast through to the to the Kaipara Harbour on the west coast. Northland is an elongate, north-west-tending land mass less than 100 km at its widest point. It is bounded to the east by the Pacific Ocean and to the west by the Tasman Sea. The coastline is approximately 1700 km, of rugged cliffs, rocky shoreline, sandy beaches and sheltered harbours. There are also many offshore islands and stacks, including three major island groups, the Three Kings, Poor Knights and the Hen and Chicken Islands. Northland contains the country's largest area of relatively unmodified dunelands, some of the largest areas of mudflats, and the largest areas of mangrove forest. Northland lies within three biogeographic regions; the Three Kings/North Cape region (characterised by localised upwelling and influenced by the Tasman Current), the North-eastern region (influenced by the warm East Auckland Current), and the Central region (influenced by mixed water masses of both subtropical and subantarctic origin).

The boundary of the Three Kings North Cape Biogeographic Region with the North-Eastern Biogeographic Region is at Ohau Pt to the south of North Cape while the boundary with the Central Marine Biogeographic Region is at Scott Point at the northern end of Ninety Mile Beach. The east coast of Northland (within the north-eastern Biogeographic Region) is characterised by mangrove-lined harbours and estuaries, rocky headlands and sheltered bays, and numerous off-shore islands and rock stacks. It is more sheltered from the prevailing westerly winds, but is exposed to north-easterly gales and occasional the remnants of tropical cyclones. Many of the off-shore islands and parts of the mainland coast are influenced by the warm subtropical East Auckland Current, derived from the north-western Tasman Sea flow south-eastwards adjacent to the coast. This current brings with it a variety of Indo-Pacific larvae. The mix of these subtropical species that survive along with the many endemic species, make these areas ecologically unique.

Marine Protected Areas

Poor Knights Islands Marine Reserve - established 1981.

Island group located north-east of Whangarei. The waters surrounding the islands are internationally famous for the blend of subtropical and temperate species that can be found there. The reserve has spectacular underwater scenery, such as steep cliffs, caves and archways, and abundant schooling fish.
Area: 1,890 ha. (Statutory Regulation 1981/16).

Mimiwhangata Marine Park – established 1983.
Located north of Whangarei and south of Bay of Islands. Administered by Department of Conservation and Ministry of Fisheries. Area: 2,000 ha.

FIGURE 1: NORTHLAND COASTAL UNIT MAP:

COASTAL UNIT DESCRIPTION:

Region: Three Kings - North Cape
2.01 Three Kings Islands

General

The Three Kings Islands group is 56 km northwest of Cape Reinga and consists of one large island with an area of 407 ha (Manawa Tawhi/Great Island), three small islands ranging from 10–40 ha each (North East, South West and West Islands) and a chain of bare or scrub-covered islets and rocks (Princes Islands). The four main islands are separated from each other by depths of 50–70 metres.

The islands are remnants of a former larger island on an extensive shallow submarine plateau, the Three Kings Bank. They have been isolated for at least 10 million years since the Pliocene, separated from the mainland by an 8 km wide, 200–300 m deep submarine trough.

Hard sedimentary and volcanic rocks form steeply sloping reefs or precipitous cliffs that encircle the islands and drop down to about 25 m or more. Reefs are indented by numerous caves and archways and are typically fringed by gravel beds that extend down to 50 m. Reefs are mostly bounded by aprons of lithic cobble gravel and boulder talus. The offshore areas of this region contain areas of bare rock from volcanic outcrops, shelf terraces and escarpments. To the north-west are areas of coarse biogenic sediments while finer terrigenous sediments are located to the east and south-west.

Oceanography

The Three Kings Islands are very exposed. They are subject to strong tidal currents, oceanic swell and storm waves predominantly from the south and west, but also all other directions due to the islands' isolation and small size. Low turbidity levels are a feature of the water surrounding the islands and sea surface salinities are high, about 35.5 parts per thousand, with very low levels of suspended sediment. Sea surface temperatures at the Three Kings are slightly cooler on average than along the north-eastern Northland coast, ranging from 14–21˚C.

The Three Kings Islands are subjected to contrasting influences of the north-eastward flowing subtropical water mass known as the Tasman Front and the unpredictable south and north flows of the West Auckland and Westland Currents respectively. During summer and early autumn, mixing of subsurface waters is common causing localised upwelling of cold water, reducing salinity and increasing nutrient concentration and phytoplankton productivity.

Biota

The marine biota is composed of a mixture of warm temperate, subtropical and cooler central and southern species. There are affiliations with the south-west Pacific, the North Cape of New Zealand, and central-southern New Zealand. This coexistence of subtropical and cool temperate taxa, generally attributed to the influence of upwelling, is unique to the Three Kings. These islands are the northernmost distributional boundary for many New Zealand species. Of significance is that the biota has a high number of locally occurring endemic species of algae, corals, molluscs, urchins and fish. The concentration of endemic species at depths shallower than 50 m is far higher than anywhere else in New Zealand. In addition there is a notable absence of a number of algal, molluscan and fish species from the Three Kings area that are common on rocky reefs elsewhere in north-eastern New Zealand. Examples include: the girdled wrasse *(Notolabrus cinctus),* a cool temperate labrid, occurs at the Three Kings despite its northern distributional limit being in southern

North Island; and, the Cook Strait limpet *Cellana denticulata* is abundant while the mainland limpet *C. ornata* is absent.

Reefs are mostly covered by large brown algae from the intertidal zone to about 45 m. Headlands and exposed coasts typically have a band of foliose coralline red algae and bull kelp (Durvillaea antarctica) in the lower intertidal zone, while more sheltered coasts have a fringe of brown alga *Xiphophora chondrophylla*. At depths of 6 m the endemic totara weed *(Sargassum johnsonii)* dominates the steep slopes, at greater depths mixed kelp forests are found with species composition varying with wave exposure. Boulder and cobble aprons extending below 18 m support rich assemblages of red algae.

The Three Kings Islands is a marine biodiversity hotspot for New Zealand. Tunnels, caves and shaded overhangs at shallow depths provide habitat for highly diverse communities of sessile invertebrates. The cup coral *Balanophyllia chnous* is only known from the Three Kings Bank and North Cape. In deeper waters large gorgonian fans appear interspersed with the branching ivory coral *(Oculina virgosa)*, endemic to northern New Zealand.

Marblefish (*Aplodactylus arctidens*) and the locally endemic blue-finned butterfish (*Odax cyanoallix*) are common on shallow reefs. Numerous wrasse species are abundant, in particular crimson cleanerfish (*Suezichthys aylingi*), banded wrasse (*Notolabrus fucicola*) and scarlet wrasse (*Pseudolabrus miles*). The presence of *S. aylingi* in such abundance here is unusual as in nearby parts of mainland New Zealand their distribution is sparse and ephemeral. Planktivorous fishes, such as butterfly perch (*Caesioperca lepidoptera*), demoiselles (*Chromis dispilus*), trevally (*Pseudocaranx dentex*), pink maomao (*Capradon longimanus*)and blue maomao (*Scorpis violaceus*) form large, mobile schools. Black spotted grouper (*Epinephelus daemelii*), some of which reach lengths greater than 1 m, are relatively common and hapuku (*Polyprion oxygeneios*) are also present, though the abundance of this species has declined significantly in recent decades. The spotty (*Notolabrus celidotus*), which is widespread and abundant throughout mainland New Zealand is notably absent here.

Numerous species of seabirds use the islands as breeding grounds including the largest Australasian gannet (*Morus serrator*) colony in New Zealand. Others include the northern Buller's mollymawk (*Diomedia bulleri*), grey-faced petrel (*Pterodroma macroptera*), black-winged petrel (*P. nigripennis*), sooty shearwater (*Puffinus griseus*), common diving petrel (*Pelecanoides urinatrix*) and fluttering shearwater (*P. gavia*). New Zealand fur seals (*Arctocephalus forsteri*) haul out during winter.

Region: Three Kings to North Cape
2.02 North Cape (Scott Point to Ohao Point)

General
This unit comprises the area between Scott Point on the west coast and Ohao Point on the east coast at the tip of the North Island and includes Motuopao Island. It consists of a repeating sequence of rocky headland and sandy beach; two large north-facing embayments dominate the coastline. The beaches are often backed by large areas of wetlands and Holocene dunes. Most of the headlands are of volcanic origin with steep cliffs and rocky platforms at their bases. Reefs on this coast are typically gradual sloping and inundated with sand at depths less than 10 m. Offshore calcareous gravel sands and terrigenous sediments occur.

Oceanography
The east coast is a low wave energy environment but is subjected intermittently to episodes of high energy. Comparatively, the west coast is a high wave energy environment dominated by westerly and southerly swells and storm waves. The oceanic current pattern is dominated by subtropical water of the east to north-eastward flowing Tasman Front, which flows south-east to form the subtropical East Auckland Current. The warm, saline waters of the Westland Current influence the western area of the unit.

Sea surface temperatures follow a cyclical pattern leading to influx events during warm years interspersed with cooler years during which few tropical species are observed. Subsurface waters mix periodically, causing localised upwelling of cold water, reducing salinity and increasing nutrient concentration and phytoplankton productivity. Salinities are over 35 parts per thousand, temperatures are slightly warmer towards the east than in the west and at offshore islands and range from 15-21^{o}C. Strong inshore tidal currents move around the top of the peninsula. The maximum tidal range is 2.1 m.

Biota
The biota of this unit is made up of a diverse array of tropical and subtropical fish species, from large, highly mobile pelagic species that are seasonally abundant to small, rare reef fishes. Many are ephemeral immigrants that arrive in New Zealand during warm summers then retreat north or die with the onset of winter and generally don't successfully breed here.

The reef communities in this region are generally dominated by a few species of large brown algae and have a distinct bimodal algal distribution with depth. Bull kelp *(Durvillaea antarctica)* occurs from Cape Maria van Diemen to Spirits Bay. The sea wracks *Carpophyllum angustifolium* and *C. plumosum* do not extend past North Cape. Monospecific stands of *C. maschalocarpum* dominate the immediate subtidal at Cape Reinga, in place of *C. angustifolium* present in most other exposed north-eastern shores. Large brown algae including leathery kelp (*Lessonia variegata*) and *Landsburgia quercifolia* form lush mixed algal stands on bedrock and boulders. Common kelp (*Ecklonia radiata*) is present here but unusual in that it does not show it's typical canopy-forming morphology in most areas and is interspersed along with patches of red foliose algae and coralline turf among large brown algae.

Sea urchins (or kina, *Evechinus chloroticus*) are common in the area but don't form urchin barrens. Water off North Cape is considered a nursery area for the packhorse lobster (*Sagmariasus verreauxi*).

Species diversity of sponges and bryozoans present offshore between North Cape and Cape Reinga, is exceptionally high and there is a high rate of local endemism amongst benthic species. Sponges grow in dense, diverse assemblages and are dominated by large conspicuous species.There are approximately 300 species of bryozoans found in Spirits Bay, a diversity unmatched elsewhere in New Zealand. Furthermore, at least 45 of these species are endemic to Spirits Bay. Also of note are two gorgonian and two coral species collected in deep water between 65 and 100 m as well as black coral collected from 54 m.

New Zealand dotterel (*Charadrius obscurus*) and variable oystercatcher (*Haematopus unicolor*) breed on the beaches; fernbird (*Bowdleria punctata*) are common in coastal scrub and wetlands; Australasian bittern (*Botaurus poiciloptilus*), banded rail (*Rallus philippensis*), spotless crake

(*Porzana tabuensis*) and various waterfowl are present in coastal wetlands. Motuopao Island is an important nesting area for seabirds, grey-faced petrel (*Pterodroma macroptera*), black-winged petrel (*P. nigripennis*), sooty shearwater (*Puffinus griseus*), common diving petrel (*Pelecanoides urinatrix*), and blue penguin (*Eudyptula minor*).

Region: Northeastern
3.01 Great Exhibition Bay and Rangaunu Bay (Ohao Point to Karikari Bay/Cape Karikari)

General
This unit extends from Ohao Point to Karikari Bay/Cape Karikari, including Great Exhibition Bay and Rangaunu Bay. The unit is bordered to the south and north by the rocky and precipitous coastlines of Cape Karikari and Ohao Point respectively. The coast is predominantly a soft shore with open, white sand beaches backed by extensive Pleistocene and Holocene dunefields and wetlands. This is broken by a number of minor rocky outcrops and indented by three extensive estuarine systems – Parengarenga, Houhora and Rangaunu Harbour (treated as separate units). At Paxton Point, to the north of Henderson Bay, there is a low rocky headland with an associated intertidal reef.

Offshore there are areas of coarse shell banks, sand and mud, with areas of sand and sandy mud on the mid to outer shelf areas.

Oceanography
The prevailing wind is from the west resulting in a low energy shore occasionally exposed to storm surges from the east and north. The region is influenced by subtropical water of the East Auckland Current derived from the Tasman Sea and has a maximum tidal range of 2 m.

Biota
The vast sandy shores are characterised by beds of the bivalves tuatua (*Paphies subtriangulata*), surf clam species and in deeper water, scallops (*Pecten novaezelandiae*). Offshore communities of *Tawera spissa – Venericardia purpurata* and *Nemocardium pulchellum – V. purpurata* are found on sandy substrates.

The coastal dunes support marram grass (*Ammophila arenaria*) and pingao (*Desmoschoenus spiralis*). Parts of Great Exhibition Bay are important nesting sites for New Zealand dotterel (*Charadrius obscurus*) and variable oystercatcher (*Haematopus unicolor*). Bittern (*Botaurus poiciloptilus*), North Island fernbird (*Bowdleria punctata*) and scaup (*Aythya novaeseelandiae*) are found in some interdune wetlands.

Simmonds Island, located approximately northwest of Point Camel, has several nesting seabirds including grey-faced petrel (*Pterodroma macroptera*), Buller's shearwater (*Puffinis bulleri*), fluttering shearwater (*P. gavia*) and blue penguin (*Eudyptula minor*).

Region: Northeastern
3.02 Parengarenga Harbour

General

Parengarenga Harbour is a drowned valley system with many meandering branches that were flooded 6,500–7,000 years ago after last glaciation. This estuarine harbour is sheltered from the Pacific Ocean by a large silica sand spit (Kokota Spit). Situated on the east coast just south of North Cape, this is the most northerly harbour in mainland New Zealand. It has an area of 6,300 ha, 90% of which consists of intertidal flats of sand/mud, mangrove, eelgrass and saltmarsh. Subtidal reefs are also present but have a highly restricted distribution. The harbour is shallow and has an array of tidal mangrove-lined inlets that radiate inland from the entrance and terminate in numerous swamp-backed channels. The creeks and streams that enter the harbour do not contribute a substantial freshwater flow.

All the subtidal areas of Parengarenga Harbour are channels, ranging in depth from 0–4 m to 3–7 m towards the harbour entrance. The deepest part of the harbour is a 25 m deep current-scoured hole in the harbour entrance channel. Subtidal areas cover less than 25% of the harbour, but support nearly 50% of the harbour's faunal diversity.

Oceanography

The harbour habitat is unusual in New Zealand, being bathed in clear, warm water and periodically influenced by subtropical water from the East Auckland Current. The maximum tidal range is about 3 m.

Biota

Eel grass (*Zostera capricorni*) covers 50% of the harbour area on extensive sand flats and mangroves (*Avicennia marina* var. *resinifera*) and saltmarsh occupy another 10–20%. This large expanse of intertidal eel grass flats has a high infaunal biomass providing important feeding grounds for bird and fish populations. Much of the coastal vegetation on Kokota Spit is undisturbed and consists of pingao (*Desmoschoenus spiralis*) and toetoe (*Arundo conspicua*).

The harbour contains extensive shellfish beds comprising pipi *(Paphies australis),* Pacific oyster *(Crasostrea gigas)* and cockle *(Austrovenus stutchburyi)*.

Subtidal reefs occur at Ngatehe Point, Paua Wharf, Tiawhakangari Point and Te Hapua and support rich encrusting invertebrate assemblages, dominated by sponges, hydroids and ascidians with associated topshells and nudibranchs. Ngatehe Point has a diverse assemblage of intertidal and shallow subtidal algal species, also.

The harbour supports the highest fish species diversity of all the Far North harbours, reflecting the biological richness of this site, though diversity of many other phyla is low. Main fish species include trevally *(Pseudocaranx dentex),* snapper *(Pagrus auratus),* kahawai *(Arripis trutta),* kingfish *(Seriola lalandi),* grey mullet *(Mugil cephalus),* yellow-eyed mullet *(Aldrichetta forsteri),* eagle ray *(Myliobatis tenuicaudatus),* and school shark *(Galeorhinus australis).*

There are distinct lower and upper harbour faunal associations, with a near-barren zone between these associations in the two northern arms of the harbour. The lower harbour assemblage is characterised by morning star shell *(Tawera spissa), Felaniella zelandica, Paguristes pilosus, Myadora striata,* sunset shell *(Gari stangeri),* venus shell *(Dosinia subrosea)* and saucer limpet

(Zegalerus tenuis). In contrast, the upper harbour assemblage is characterised by nutshell *(Nucula hartvigiana), A. stutchburyi), P. australis*, the false spider crab *(Halicarcinus varius),* and the scavenging whelks *(Cominella glandiformis* and *Cominella adspersa).* Two subspecies of the gastropods *Maurea punctulata* and *Cominella virgata* are locally endemic.

A number of subtropical species are found in the harbour including some gastropods, seldom seen intertidally or on sand elsewhere in the country, such as large trumpet shells (e.g. *Charonia lampas*), *Natica migratoria,* bubble shells (*Hydatina physis*) and the bivalve *Myochama tasmanica* (also found at the Three Kings Islands, Matai Bay and the Bay of Islands). Reefs adjacent to the sandy areas support juveniles of subtropical fish species such as spotted black grouper *(Epinephelus daemelii),* and mado *(Atypichthys latus*).

Compared with other northern estuaries, there are a number of unusual aspects of the harbour's faunal assemblage, including relatively common subtidal populations of lancelets (*Epigonichthys benhami* and *E. hector*), sand divers (or tommy fish, *Limichthys polyactis*) and short-finned worm eels (*Muraenicthys australis*), high diversities of phoxocephalid amphipods and nudibranchs (*Chromodoris aureomarginata*, *Dendrodoris citrina*, *Ceratosoma amoena*, *Phidiana milleri*, *Aeolidia* sp., *Trapania rudmani*, *Rostanga muscula* and *Plocamophorus imperialis*).

Parengarenga Harbour is of outstanding value as a wildlife habitat (especially for migratory wading birds), at times supporting up to 20,000 birds of 80 species. It is the final resting/feeding point for birds migrating to the Northern Hemisphere. New Zealand dotterel (*Charadrius aquilonius*), variable oystercatcher (*Haematopus unicolor*) fernbird (*Bowdleria punctata vealeae*) and banded rail (*Rallus philippensis*) breed around the harbour. Banded dotterel (*C. bicinctus*) over-winter here in the highest numbers of any New Zealand harbour. Rare visitors include the whimbrel (*Numenius phaeopus*), greenshank (*Tringa nebularia*), Siberian tattler (*Tringa brevipes*) and terek sandpiper (*Tringa terek*).

Region: Northeastern
3.03 Houhora Harbour

General
Houhora Harbour (1,500 ha) is a largely estuarine shallow harbour, 8.5 km long, with extensive sandy mud flats with small areas of mangrove *(Avicennia marina* var. *resinifera),* saltmarsh and eel grass *(Zostera capricorni)* beds near the head of the harbour. Mangroves are most dense in the upper reaches, where trees attain a height of 7 m. The extensive saltmarsh on the eastern shore grades to freshwater swamps and shrublands and has high habitat value. A narrow channel over 4 m deep extends about 3 km upstream. Mount Camel, a 235 m high volcanic outcrop, forms the north head of the entrance. Apart from this, the surrounding land consists of relatively flat dune sand.

Oceanography
The harbour is periodically influenced by subtropical water from the East Auckland Current. The maximum tidal range for this area is about 3 m.

Biota
On intertidal flats molluscs include the mud whelks *(Zeacumantus lutulentus, Z. subcarinatus, Zediloma subrostrata),* nutshell *(Nucula hartvigiana),* wedge shell (*Macomona liliana*) and beds of cockles (Austrovenus stutchburyi), pipi (*Paphies australis*) and Pacific oyster (*Crassostrea gigas*).

The molluscan fauna includes a strong subtropical component, e.g. necklace shell *(Natica migratoria)*, *Bursa bus*, *Conus kermadecensis*, and bubble shells *(Hydatina physis)*.

Crustaceans are relatively scarce but are represented by the snapping shrimp (*Alpheus richardsoni*), mantis shrimp *(Suilla armata)* and pill-box crabs (*Halicarcinus* sp.).

Fish species found in the harbour include parore *(Girella tricuspidata)*, snapper *(Pagrus auratus)*, spotty *(Notolabrus celidotus)*, John dory *(Zeus faber)*, flounder, kingfish (*Seriola lalandi*) and stingrays (*Dasyatis* sp.*)*. There is a significant area of oyster farms in this harbour.

This area is considered an 'excellent' habitat for wading birds. It lies between Parengarenga and Rangaunu Harbours and forms an important link in a chain of nationally important estuaries. International migratory birds include turnstone (*Arenaria interpres*), knot (*Calidris canutus*) and godwit, as well as nationally resident species such as New Zealand dotterel (*Charadrius obscurus*), wrybill (*Anarhynchus frontalis*), reef heron (*Egretta sacra*), and occasionally black stilt (*Himantopus novaezelandiae*).

Region: Northeastern
3.04 Rangaunu Harbour

General
Rangaunu Harbour is a large circular harbour (11,488 ha) with a narrow entrance and a maximum harbour channel depth of about 10 m. Fifty-three percent of the harbour area is exposed as mud, eel grass *(Zostera capricorni*) (19%), saltmarsh, brackish swamp and mangrove *(Avicennia marina* var. *resinifera)* (27%) flats at low tide. The mangrove area amounts to 3,100 ha, the largest mangrove forest in New Zealand, and as such represents 15% of the New Zealand stock. Inside the harbour, the entrance channel divides into many branches, the main branch being the centrally flowing Awanui Channel originating from the Awanui River. Rangaunu Harbour arose from the formation of the Aupouri and Karikari peninsulas which joined a number of former islands with the mainland.

Oceanography
Tidal flows dominate water movement in the harbour with a range of about 3 m. Maximum depths at the harbour entrance are 16 m. At high tide, a strong temperature and salinity gradient develops near the mouth of the Awanui River, which is the dominant feature of the harbour. This gradient extends at low tide to the middle of the harbour. In the harbour proper, salinities approach 35.3 parts per thousand, and 35.7 parts per thousand at the entrance. The catchment area is 20,000 ha, with a small freshwater runoff mostly through the Awanui River. Soft sediments dominate the harbour and can be divided into regions based on sedimentary characteristics (nearshore shelf, ebb tide, delta and channels and the lower harbour). At high water spring tide there is more than 2 m of water over most of the intertidal banks.

Biota
The mangrove community occupies 50% of the intertidal area and the remaining flats support extensive dense meadows of eelgrass. Common inhabitants include snapping shrimp (*Alpheus richardsoni*), tubeworm, venus shell *(Dosinia subrosea)*, cockle *(Austrovenus stutchburyi)*, mud crab (*Helice crassa*) and mud whelk (*Cominella* sp.). Among the mangroves occur pipi *(Paphies*

australis), mud snails, barnacles and occasional rock oysters on the pneumatophores of the trees. A characteristic of the soft bottom fauna is the presence of dense assemblages of the snail *Zethalia zelandica*.

Rocky reefs around the entrance to the harbour consist of shallow broken rock, common kelp (*Ecklonia radiata*) forest and sand. The rocky subtidal here is considered to have an extremely rich flora and fauna with large sponges and ascidians dominating in shallow depths.

The harbour is an important feeding and nursery ground for a large number of fish species (28 species recorded) including kingfish *(Seriola lalandi)*, parore *(Girella tricuspidata)*, snapper *(Pagrus auratus)*, john dory *(Zeus faber)*, eagle rays (*Myliobatis tenuicaudatus*) and flatfish. During summer, juvenile *P auratus* live amongst the *Z. capricorni* beds. Several subtropical species of mollusc occur in the harbour including *Natica migratoria*, *Bursa bus*, *Conus kermadecensis*, and bubble shells (*Hydatina physis*).

Rangaunu is one of New Zealand's major wading bird harbours attracting many thousands of international wading birds. International species include godwits (*Limosa* sp.), knots (*Calidris* sp.) and turnstone (*Arenaria interpres*). Banded rail (*Rallus philippensis*), North Island fernbird (*Bowdleria punctata*), Australasian bittern (*Botaurus poiciloptilus*), reef heron (*Egretta sacra*), New Zealand and banded (Charadrius obscurus and *C. bicinctus*) dotterel and variable oystercatcher (*Haematopus unicolor*) all breed around the harbour. Gulls, white fronted terns (*Sterna striata*) and several species of shag (black, *Phalacrocorax carbo*; pied, *P. varius* and little, *P. melanoleucos*) are also found in the harbour. The Rangiputa shellbank supports a breeding colony of red-billed gulls (*Larus novaehollandiae*) and Caspian terns (*Sterna caspia*). White herons (*Egretta alba*) frequent the area around the Okatakata Islands.

Region: Northeastern
3.05 Doubtless Bay (Knuckle Point, Karikari Peninsula to Berghan Point)

General
Doubtless Bay is a large bay bounded by Knuckle Point on the Karikari Peninsula and Berghan Point, the southern headland to the bay. The bay consists of exposed rocky cliff headlands and intertidal reefs, with intervening sandy, shelly and locally gravely beaches broken by occasional rocky outcrops. Major beaches include Coopers Beach, Cable Bay, Taipa, Tokerau Beach and Whatuwhiwhi. There is a small estuarine harbour (Mangonui Harbour) in the south-eastern corner of the bay, 94% of which is made up of mudflats. Smaller estuaries are the Awapoko and Taipa estuaries.

Oceanography
The bay is little influenced by the East Auckland Current as this is commonly deflected eastwards offshore from Karikari Peninsula. The tidal range is 2.1 m.

Biota
The fish fauna of Doubtless Bay is predominantly composed of warm temperate and widespread species. Typical species found include snapper *(Pagrus auratus)*, goatfish *(Upeneichthys lineatus)*, blue maomao *(Scorpis violaceus)*, parore *(Girella tricuspidata)*, red moki *(Cheilodactylus spectabilis)*, spotty *(Notolabrus celidotus)*, banded wrasse *(N. fucicola)* and butterfish *(*or green bone, *Odax pullus)*.

There are also a number of records of subtropical species from within the bay, most of which are from the headland around Knuckle Point. These include eels *(Gymnothorax nubilus* and *Conger wilsoni),* single-spot demoiselle *(Chromis hypsilepis),* black angelfish *(Parma alboscapularis),* red pigfish *(Bodianus unimaculatus),* several wrasse species *(Coris sandageri, N. inscriptus* and *Pseudolabrus luculentus)* and rainbowfish *(Suezichthys arquatus).*

Mangrove (*Avicennia marina* var. *resinifera*) forests and saltmarshes occur in Mangonui Harbour and the Taipa River estuary. Tokerau Beach has three swamps along it, one of which contains the rare ferns *Cyclosorus interruptus* and *Thelypteris confluens*.

Reef heron *(Egretta sacra)* and white-faced heron *(Ardea novaehollandiae)* are recorded from the Mangonui Harbour. Awapoko estuary supports populations of spotless crake (*Porzana tabuensis*), banded rail (*Rallus philippensis*), bittern (*Botaurus poiciloptilus*) and *E. sacra*.

Region: Northeastern
3.06 Whangaroa Harbour

General
This harbour is an 8 km long estuarine embayment of 2,635 ha, of which 26% is intertidal mudflat. Basement greywacke and argillite rocks 250–150 million years old underlie the major surface rocks and andesite breccia forms the distinctive high cliffs around the entrance and other places around the harbour.

The deep harbour entrance is formed by rock headlands and cliffs with subtidal reefs to a depth of 15 m. The harbour is a deepwater anchorage with a channel which extends nearly 5 km.

Terrigeous muds and sands in the inner harbour are fluvially derived. The head of the inner harbour comprises a series of deltas, mantled with fine grained sediments associated with the three main contributing streams. The sands and gravels in the outer harbour are derived from shells from within the harbour itself.

Oceanography
The harbour has a large catchment of 26,000 ha. Over 65% is drained through the catchments of the Kaeo and Pupuke Rivers. The quantity of freshwater that enters the harbour is minor compared with the seawater exchange – about 0.2% of the total harbour volume; most of the freshwater enters the inner harbour, affecting sedimentation rates. The tidal range is 2 m. The narrow entrance means that tidal motion dominates the current system, and because of the small amount of fresh water the estuary is considered to be well-mixed.

The harbour can be considered in two parts: the outer deep water harbour, 9 m deep at low tide with a marine dominated regime; and an estuarine inner harbour consisting of both marine and fluvial inputs of water and sediments.

Biota
Much of the harbour shore consists of mangrove forest *(Avicennia marina* var. *resinifera),* covering an area of over 4 km^2 and small areas of saltmarsh (the main breeding areas for endemic birds) occur in association with mangroves. Eel grass (*Zostera capricorni*) beds also occur in a few places.

Pacific oysters (*Crassostrea gigas*, on oyster farm structures) and scallops (*Pecten novaezelandiae*), are found in the harbour. In the mid to outer harbour other dominant benthic communities include bivalves– fan scallops (*Chlamys zealandiae*), *Tawera spissa*, *Myadora striata* and gastropods (*Penion adusta*, *Struthiolaria paulosa* and *Trochus tiaratus*). Fish species include flatfishes and snapper (*Pagrus auratus*)

Thirty-eight bird species, including 12 endemic species, are known from the harbour including the New Zealand dotterel (*Charadrius obscurus*), banded rail (*Rallus philippensis*), North Island fernbird (*Bowdleria punctata*) and low numbers of brown teal (*Anas aucklandica*). Australasian bittern (*Botaurus poiciloptilus*) also occur in the swamps on the edges of the harbour.

Region: Northeastern
3.07 Cavalli (Karikari Bay/Cape Karikari to Cape Wiwiki).

General
This unit extends from Cape Karikari to Cape Wiwiki and includes the Moturoa Islands to the north-west of Cape Karikari, Stephenson Island just off Whangaroa Bay, and the Cavalli Islands off Matauri Bay. Cape Karikari is a 5 km wide, 13 km long tombolo comprising dunes, swamps, lagoons and lakes. The predominantly rocky headland coast is indented with small bays and estuaries. Subtidally, the reefs are of moderate to steep slope and comprise boulders and bedrock. In deeper waters, the sediments comprise sands and muddy sands.

The Moturoa Islands comprise three small islands (4.3–13 ha) and a number of adjacent rocks and stacks. The Cavalli Islands consist of 28 islands with 82 associated rocks, plus 25 stacks, within an area of approximately 29 km^2. The outer fringe of this group is situated 1.5 km off the coast. The largest of these islands is Motukawanui (350 ha). Motukawati Island is also relatively large at 47 ha, but the remainder of the islands are small in area. Twenty-three kilometres to the west of this island group is Stephenson Island, a highly modified area of 112.5 ha.

Oceanography
The coast is exposed to the Pacific Ocean, however, the prevailing wind is offshore. The waters are influenced by the subtropical East Auckland Current and the tidal range is 1.7 m.

Biota

The subtidal algal communities are typical for the north-eastern area of New Zealand, comprising species from the *Carpophyllum* genus at less than 2 m depth, low algal biomass at intermediate depths (4–6 m) where the grazing urchin, or kina (*Evenchinus chloroticus*) is dominant, and stands of common kelp (*Ecklonia radiata*) dominating at greater depths. There is, however, considerable variation in the depth and extent of urchin-grazed reef in relation to the degree of wave exposure at particular locations. Leathery kelp (*Lessonia variegata*), characteristic of exposed locations, occurs at Cape Karikari. At more sheltered sites the dominant kelp is *Carpophyllum flexuosum* forest.

The fish fauna in the vicinity of Cape Karikari and at the Cavalli Islands show affinities with widespread (e.g. red moki, *Cheilodactylus spectabilis*), warm temperate (e.g. porae, *Nemadactylus douglasii*) and subtropical/tropical (e.g. bluefish, *Girella cyanea*) New Zealand species.

Four associations of macrobenthos occur in the soft sediments around the Cavalli group. *Myadora boltoni* and *Pectinaria australis* inhabit fine sand; *Tawera spissa* characterises a shelly to coarse sand habitat at 10 m; very fine sand below 30 m contains a *Nemocardium pulchellum* association and the fourth association consists of *Zeacolpus pagoda, Zegalerus tenuis* and *Tawera spissa* in fine sand to fine shell gravel.

Estuaries at Tauranga and Mahinepua bays have areas of mangrove *(Avicenna marina* var. *resinifera)* and saltmarsh and support banded rail *(Rallus philippensis),* New Zealand dotterel *(Charadrius obscurus)* and brown teal *(Anas aucklandica chlorotis).* Variable oystercatchers *(Haematopus unicolor)* nest on some sandy beaches along this stretch of coast.

A diverse bird fauna is present including the blue penguin (*Eudyptula minor*), grey-faced petrel (*Pterodroma macroptera*), fluttering shearwater (*Puffinus gavia*), common diving petrel (*Pelacanoides urinatrix*), pied shag (*Phalocrocorax varius*) and black-backed gull (*Larus dominicanus*). Motukawanui Island in the Cavalli group is an important area for seabirds. Similarly, the Moturoa group supports a large petrel and shearwater population.

Region: Northeastern
3.08 Bay of Islands

General
The Bay of Islands is an open embayment of about 240,000 ha, containing several large estuaries and about 200 islands up to 220 ha in size in the western and south-eastern parts of the bay. It is bordered to the north and south by the precipitous headlands of Cape Wiwiki and Cape Brett respectively. The area has a deeply indented coastline of about 400 km length and contains a number of habitat types, from estuaries with mangroves and saltmarsh in the upper reaches, through sheltered rocky coasts with pocket beaches, to steep exposed rocky coasts in the outer bay.

Subtidal reefs on greywacke coasts are mostly moderately to steeply sloping, and generally have highly irregular topography with ridges, channels, gutters and overhangs, and caves. The deepest reefs extend to at least 30 m and are located around Cape Brett peninsula. Motukokako Island is unique for it's near vertical limestone cliffs.

Approximately 4% of the total area (800 ha) is exposed mudflat at low tide. The bay is up to 65 m deep, but reaches 85 m at the seaward limit. Much of the terrain surrounding outer areas of the bay is steep and gullied while inner areas are more moderately rolling. There are extensive areas of sheltered rock in the mid section of the bay and three large inlets in the north-western (Te Puna and Kerikeri) and southern (Waikare) sections of the bay. The subtidal topography of the Bay of Islands gradually moves from estuarine to oceanic conditions within the harbour.

Oceanography
The bay is on a low energy lee shore that is sheltered from the predominantly southwesterly and westerly swell and storm waves. Predominant approach direction of waves is thus from the north through east. Inlets are largely sheltered from the effects of oceanic swells. The estuarine areas with tidal waters extend inland as far as Kerikeri and Kawakawa, the main freshwater inflows being the Kerikeri, Waitangi, Kawakawa and Waikare Rivers. Sea surface temperatures of the bay range from 15 to 23^{o}C (ranges of 9^{o}C and 6.5^{o}C recorded for inner and outer Bay of Islands respectively).

Salinities in the main basin and towards the open coast are about 35.5 parts per thousand and are lower in the upper harbours and inlets. The tidal range is 2 m.

Water circulates in an anti-clockwise movement within the bay induced by the north-west moving current. Circulation is modified by the prevailing wind. The hydrology for the most part of this unit (excluding the estuarine areas) is fairly homogeneous and well-mixed. Gradients do exist however, such as from the outer to inner bay there is a decrease in turbulence and an increase in turbidity. The open coastal water is affected by the south-eastward flowing East Auckland Current.

Biota
The inlets and estuaries of the bay provide habitat for mangrove *(Avicenna marina* var. *resinifera)*, saltmarsh and eel grass (*Zostera capricorni*). Waikare Inlet supports three quarters (214 ha) of the bay's saltmarsh habitat. Mangrove also extends over wide areas of the inlet. The eel grass beds within Rawhiti Inlet support scallop (*Pecten novezealandiae*) and juvenile snapper *(Pagrus auratus)*. The inlets of the Bay of Islands are important for the farming of rock oysters and Pacific oysters

Five shallow subtidal benthic zone types characterise the bay. *Carpophyllum* spp. are the dominant kelps with leathery kelp (*Lessonia variegata*) locally dominant in exposed sites such as Cape Brett. In most of the bay there is an algal turf and paint zone with sparse kelps below this and then a kelp forest zone consisting of extensive stands of common kelp (*Ecklonia radiata*). On deeper reefs below the kelp zone is a deep kelp zone with sparse *E. radiata*. Lower depth limits and species compositions vary from outer to inner bay.

A total of 98 species of coastal fish have been recorded. Many of these species are widespread and locally common on shallow reefs throughout New Zealand. There have also been four species with predominantly southern distributions found on deep reefs near low temperature subsurface water masses. The majority, however, are warm temperate-subtropical species including 29 subtropical indicator species (i.e. lavender lizardfish (*Synodus similes*), blue knifefish (*Labracoglossa nitida*), and clown toado *(Canthigaster callisterna)*, many of which form self-maintaining populations in the bay. Subtropical species are concentrated in the south-eastern part of the bay around Cape Brett. There is also a high diversity of subtropical invertebrate species found here, including the gastropods *Bursa verrucosa, Phillipia lutea* and *Terebra circumcincta*. The giant heart urchin *Brissus gigas* occurs in deep water.

Mangrove (over 1,000 ha) and saltmarsh areas support fernbird (*Bowdleria punctata*), banded rail (*Rallus philippensis*), brown teal (*Anas aucklandica*) and New Zealand dotterel (*Charadrius obscurus*), variable oystercatcher (*Haematopus unicolor*), reef heron (*Egretta sacra*) and a diverse array of terns and gulls. Blue penguin *(Eudyptula minor)* also breed along the beach at Onewhero Bay.

Region: Northeastern
3.09 Cape Brett to Ocean Beach/Bream Head

General
This unit extends from Cape Brett to Ocean Beach at Bream Head. This is a complex coastline of exposed rock and cliffs interspersed by a number of medium-coarse grained sandy beaches, spits and minor estuarine harbours, including Whangaruru Harbour, Whananaki, Ngunguru, Pataua and Taiharuru. The coastline is dominated by steep cliffs of high resistance greywacke that are exposed

to the full fetch of the Pacific although the prevailing winds are offshore. Small islands and rock stacks are scattered along this coast, including a chain of very small islands on the seaward side of Taiharuru Estuary.

Whangaruru Harbour is the largest estuary and extends 7 km inland and running parallel to the coast. Whananaki is a 350 ha tidal estuary separated from the ocean by a large sandspit. Here mudflats grade through mangroves and freshwater swamps to eastern cliffs and intertidal platforms. Ngunguru is a large and very diverse wetland habitat and lies parallel to the smaller Horahora Estuary separated by 2–3 km. At the southern end of Ngunguru Bay, a long sandy beach backed by dunes, another two estuaries lie parallel to each other separated by a rocky headland.

Mimiwhangata Marine Park (1890 ha) is located approximately half way between Cape Brett and Whangarei Harbour. The area comprises a range of open coastal features including beaches, small islands, rock stacks, intertidal and subtidal reefs and subtidal soft sediments.

Oceanography
The area is influenced by the warm, saline subtropical East Auckland Current. The maximum tidal range is 2 m. Sea surface salinity is about 35.5 parts per thousand.

Biota
Common fauna of the sandy beaches include the tuatua *(Paphies subtriangulata)* and pipi *(Paphies australis)*, sandlouse and sandhopper, polychaete worms and swimming crab. The subtidal sand/gravel habitat is inhabited by the comb star *(Astropecten polyacanthus)*, morning star shell *(Tawera spissa)*, basket cockle *(Clinocardium nuttallii)* and dog cockle (*Tucetona laticostata*).

The upper 4 km of Whangaruru Harbour has an estuarine habitat of mangrove *(Avicenna marina* var. *resinifera)* and saltmarsh *(Leptocarpus* sp.*)* fringing mudflat outstanding wildlife value. Northern Ngunguru wetlands grade inland from sandy beaches, dunes and tidal sand and mudflats to large areas of mangrove and saltmarsh.

The dominant algae of the rocky shore , depending on degree of shore exposure, includes common kelp (*Ecklonia radiata*), leathery kelp (*Lessonia variegata*) and sea wrack (*Carpophyllum* sp.).

Common invertebrates of the subtidal include the sea cucumber, kina (*Evechinus chloroticus*), sea stars (*Stegnaster inflatus* and *Astrostole scabra*),the red rock crab (*Plagusia capensis*), the purple spined urchin (*Centrostephanus rodgersiii*) and the large sponges *Polymastia granulosa* and *Ancorina alata.*

Fish species commonly present along this coastline include snapper (*Pagras auratus*), blue maomao (*Scorpis violaceus*), black angelfish (*Parma alboscapularis*), red moki (*Cheilodactylus spectabilis*), demoiselle (*Chromus dispilus*), and various labrids (wrasses). At Mimiwhangata Marine Park the fish fauna comprises widespread (54%), warm temperate (27%) and subtropical–tropical (19%) species. Widespread species include: *P. auratus* and blue moki (*Latridopsis ciliaris*), warm temperate species include: parore (*Girella tricuspidata*) and porae (*Nemadactylus douglasii*), subtropical species include: spotted black grouper (*Epinephelus daemalii*) and *P. alboscapularis*; and tropical species include: black–spot goatfish (*Parupeneus spilurus*) and mimic blenny (*Plagiotremus tapeinosoma*).

Investigations at Mimiwhangata Marine Park have highlighted the presence of a number of rare species such as the ivory coral (*Oculina virgosa*), red-lined bubble shell (*Bullina lineata*) and an unidentified callianassid shrimp. Deepwater habitats for this section of coast comprise reefs stretchingfor more than 4 km offshore east of Rimariki Island, off Mimiwhangata. These reefs have high biodiversity values with numerous species of sponges, gorgonian fans (*Primnoides* sp.), soft corals (*Alcyonium aurantiacum*), bryozoans (e.g. the pencil bryozoan *Steginoporella neozelanica*), black coral (*Apanipathes* sp.) and a range of different fish species including butterfly perch (*Caesioperca lepidoptera*) and pink maomao (*Caprodon longimanus*) present.

The unit also contains a diverse bird fauna including nesting colonies of the fluttering shearwater (*Puffinus gavia*) and common diving petrel (*Pelecanoides urinatrix*) on Bream Island, and grey-faced (*Pterodroma macroptera*) and black-winged (*P. nigripennis*) petrel on Piercy Island off Cape Brett. Grey-faced petrel breed on many other islets along this coast. The endangered brown teal (*Anas aucklandica*) occur in small numbers in mangrove areas and estuarine creeks along this coast especially at Whananaki, Helena Bay and Mimiwhangata. Fernbird (*Bowdleria punctata*), banded rail (*Rallus philippensis*), and New Zealand dotterel (*Charadrius obscurus*) also occur in suitable habitat along this stretch of coast.

Region: Northeastern
3.10 Poor Knights Islands

General
The Poor Knights are a group of two large islands (Tawhiti Rahi and Aorangi) and several small islets and rock stacks (including High Peak and Sugarloaf rocks south-east of the main islands). The group is a sequence of volcanic remnants forming a chain about 10 km long. The islands total about 217 ha and are located 24 km off the mainland coast, north-east of Whangarei Heads. The marine area around the islands to 800m offshore is a 1890 ha marine reserve (Poor Knights Islands Marine Reserve). Landscapes and seascapes are steep and rugged. There are few shallow rocky reefs, with most places fringed by steeply sloping subtidal rocky reefs, which drop to depths of almost 100 m close inshore. There are numerous submerged pinnacles and many caves, tunnels and archways providing a profoundly diverse range of habitats.

Reefs are bounded seawards by sediment aprons that reach depths of 80–130m. There are also several large stretches of continuous reefs composed of large boulders, which slope gently from the intertidal zone to depths exceeding 50 m. Sediments at the Poor Knights comprise shelly medium-to-coarse sand, with fine-to-medium sand in shallow sites. The sediments are predominantly bioclastic, with only a minor lithic component and no or very little mud.

Oceanography
The islands have a strong subtropical influence. They lie in the path of the East Auckland Current (EAUC), which flows offshore of the Northland coast before turning seaward just past the Poor Knights. This brings waters that are consistently 2˚C warmer than at the mainland. Summer seawater temperatures can exceed 25˚C, and in winter the temperature rarely dips below 15˚C. The EAUC provides a major source of larvae for tropical and subtropical fish and invertebrate larvae drifting from Lord Howe and Norfolk islands that are rarely found elsewhere in New Zealand. The maximum tidal range is 2 m.

Biota

The exposed intertidal fringe has a skirt of the golden seawrack *(Carpophyllum angustifolium),* exposed outpoints are covered by the tough leathery kelp (*Lessonia variegata*), and horizontal reefs are cloaked by dense beds of common kelp (*Ecklonia radiata).* Sand pockets amid the reef forming boulders are often covered by the feathery green sea rimu (*Caulerpa brownii*). High light penetration due to high water clarity allows kelp to extend to 50 m depth.

Below the kelp beds there is an abundance of colourful invertebrates and benthic algae, many of which are endemic to this unit. Large mobile grazers are less common here than on the mainland. Large packhorse crayfish (*Sagmariasus verreauxi*) and Spanish lobsters (*Arctides antipodarum*) are occasionally seen. Many of the common mobile invertebrate species are rare on the nearby mainland and have their origins in southeast Australia, such as the nudibranchs *Tambja verconis* and *T. morosa*.

Sessile sponges and gorgonians dominate at depths below 30 m. Several starfish graze on the sponges and many species of suspension feeders, including worms, bryozoans, hydroids and zoanthids live amongst this deep reef-encrusting community. Steep rock walls are covered in diverse assemblages of suspension-feeding organisms including sponges, hydroids, gorgonians, zoanthids, alcyonaceans, sea anemones, bryozoans and ascidians. Clusters of jewel anemones are common on the upper 10 metres of walls.

The myriad of caves and archways provide special habitats for encrusting organisms due to the exclusion of algae resulting from low light levels. The water movement in caves is also reduced leading to reduced plankton concentration with increasing distance from the cave mouth. This unique habitat allows for the growth of species such as the small, pale green, solitary coral *Paracyathus conceptus*, previously only found at depths of 200–1,500 m. A variety of deepwater calcareous sponges also occur in these caves. Black coral trees (*Antipathes* sp.) up to several metres high can be found growing at depths around 50 m, particularly around current-swept headlands and pinnacles.

The Poor Knights island group is distinct for its high diversity of subtropical species. Tropical-subtropical molluscs include the spindle cowrie (*Primovula longirostris*) and echinoids such as the long-spined *Diadema palmeri*. Another unique feature of these islands is the lack of certain species commonly found on the nearby mainland including the common acorn barnacle (*Chamaesipho columna*), and two mussel species, *Modiolus neozelanicus* and the green-lipped *Perna canaliculus*. On soft bottoms the introduced tube-dwelling polychaete *Chaetopterus* is widespread and abundant.

This fish fauna at the Poor Knights Islands includes around 120 species, compared with 80–90 species found in nearby mainland regions. Many species such as a number of wrasses are found here but are rarely, if ever, found at the mainland. Many species have a widespread distribution, such as snapper (*Pagrus auratus*), red moki (*Cheilodactylus spectabilis*), blue cod (*Parapercis colias*) and leatherjacket (*Parika scaber*) or are warm temperate species, such as the abundant schooling planktivorous fish pink maomao (*Caprodon longimanus*) and butterfly perch (*Caesioperca lepidoptera*). However, there is also a strong presence of subtropical species, such as Lord Howe coralfish (*Amphichaetodon howensis*) and spotted black grouper (*Epinephelus daemelii*).

Some ephemeral fish include the lionfish (*Pterois volitans*) and giant grouper (*Epinephelus lanceolatus*). Large predatory hapuku (*Polyprion oxygeneios*) up to 1.6 m long and 80 kg can occasionally be found on deep reefs, though were once common here. Cartilaginous fishes frequent the area. In summer schools of large short-tailed stingrays *(Dasystis brevicaudata)* gather in

archways. A number of shark species occasionally visit, the most common being the bronze whaler (*Carcharhinus brachyurus*), which grows up to 3 m long.

Seabirds are abundant and these islands are the principal breeding site for the endemic Buller's shearwater (*Puffinis bulleri*). Others include blue penguin (*Eudyptula minor*), fairy prion (*Pachyptila turtur*) and common diving petrel (*Pelecanoides urinatrix*) and gannet (*Morus serrator*).

Region: Northeastern
3.11 Whangarei Harbour

General
Whangarei Harbour is a relatively long estuarine embayment of 9,800 ha formed from a flooded river valley, of which 60% is exposed at low tide as mud and sandflats and shellbanks. The underlying rock types are Waipapa group greywacke. The area is bounded to the north by the exposed cliffs of Busby Head/Bream Head and to the south by the sandy beach of Marsden Point. There is a small island – Limestone Island in the middle of the harbour. There are areas of rocky shore in the outer and middle reaches, extensive sandflats at the entrance, and mangrove/salt marsh beds in the sheltered bays and inner reaches.

Oceanography
Whangarei Harbour covers 5,200 ha at low spring tide. This leaves an area of 4,600 ha of intertidal mudflats. The flushing time of the upper harbour is around 11 days and the tidal range is around 2.3 m mean spring tide. Salinities and temperature vary significantly depending on tide and season in the upper harbour. Bottom sediments consist of muds and sandy muds in the upper harbour. Salinity and water temperatures in the middle of the harbour are similar to those for Marsden Point. Bottom sediments here are fine to medium sands. The lower harbour is dominated by a deep gorge channel flanked by eddy sand deposits of Mair and Calliope banks. Salinity at Marsden Point varies between 32 and 34.5 parts per thousand. Summer temperatures range from 24-25˚C and winter temperatures of 13-14.5˚C. The maximum mean spring tidal range is 2.2 m.

Biota
There are large areas of mangroves (*Avicenna marina var. resinifera*) extending up to 10 m out to sea. This is one of the most extensive mangrove systems in New Zealand. There are also areas of saltmarsh, but brackish zones are rare as most have been reclaimed. Beds of eel grass (*Zostera capricorni*) disappeared in the late 1960s. Other habitat types include rocky shores, rocky forested islands and low shell banks. Extensive beds of pipi (*Paphies australis*), and cockle (*Austrovenus stutchburyi*) are present on intertidal and adjacent subtidal sandy substrates. Scallops (*Pecten novezealandiae*) are locally common in subtidal channels.

The sheltered rocky shore is characterised by zones of barnacles (*Chamaesipho columna*), rock oysters, *Pomatoceros* tubeworms, red algae (*Corallina* sp.) and brown algae – Neptune's necklace (*Hormosira banksii*). The sublittoral fringe consists of large brown algae, notably species of *Carpophyllum* and *Cystophora.* Three categories of subtidal habitats have been found at the harbour entrance. These are gently shelving rock and sand reef habitats with a few common kelp (*Ecklonia radiata*) plants and occasional sponges on deep reefs. Mid-depth is characterised by dense *Ecklonia* forest with reefs consisting of a sloping compact array of large rocks and the upper region characterised by shallow broken relatively barren rocks.

The coastal and estuarine areas support a very diverse bird fauna, with at least 83 species being recorded, including common and rare migratory waders. Five important high tide roosts are located at Port Whangarei, Portland, Scull Creek, Takahiwai and Blacksmiths Creek. The estuary supports over 10,000 migrant waders. Endemic species breeding in the harbour include New Zealand dotterel (*Charadruis obscurus*), fernbird (*Bowdleria punctata*), and marsh crake (*Porzana pusilla*). Reef heron (*Egretta sacra*) are also present in significant numbers.

Region: Northeastern
3.12 Bream Bay (Ocean Beach/Bream Head to Pakiri/Okakari Point, including Hen and Chickens Islands, Sail Rock).

General
This unit includes Bream Head and contains the two long beaches of Bream Bay and Pakiri, intersected by rocky headlands. Bream Head forms the northern headland to Whangarei Harbour comprising a steep sided, southward facing ridge of volcanic origin. Bream Bay, from Marsden Point to Waipu consists of a long stretch of exposed open beach composed of fine grain sand. Quaternary sediments have built up a sand barrier which fronts Bream Bay from Marsden Point to Waipu, backed by Holocene and Pleistocene dunes. Two small estuaries are located in this bay at Ruakaka and Waipu.

Wave cut platforms and shelly pocket beaches of Bream Tail separate Bream Bay from Pakiri, a similarly exposed, fine-grained sandy beach about 20 km long. This vast beach is only broken in one place by the exposed volcanic rock cliffs of Te Arai Point. Mangawhai Harbour is a small sandspit enclosed, mesotidal, estuarine lagoon to the south of Bream Tail. Off-shore sediments are generally sand with calcareous gravel, through to muddy sands and calcareous gravel, and muddy sand with depth.

This unit also includes the Hen and Chickens Islands, 10–15 km east of Whangarei Heads. A northern east-west trending island chain (Marotere Islands) includes three larger islands (79.5–155 ha) and a series of smaller islands and rocks. Taranga (Hen) Island to the south is the largest island in this group covering 500 ha. Sail Rock, south of this group is 3.4 ha.

Oceanography
This unit is influenced by the subtropical East Auckland Current. The maximum tidal range is 2.2 m near Marsden Point.

Biota
Crustacea of the sandy beaches include the sea-slater (*Scyphax ornatus*), common sandhopper (*Talorchestia quoyana*), isopods of the families Sphaeromidae and Eurydicidae, paddle crab (*Ovalipes catharus*), ghost shrimp (*Callianiassa filholi*) and mantis shrimp (*Squilla sp*.). The tuatua (*Paphies subtriangulata*) is the most common bivalve on this and other east coast beaches.

The fish fauna of the mainland coastal section of this unit is predominantly composed of widespread species, such as red moki (*Cheilodactylus spectabilis*), John dory (*Zeus faber*), butterfly perch (*Caesioperca lepidoptera*), snapper (*Pagrus auratus*) and marblefish (*Aplodactylus arctidens*), and warm-temperate species, such as goatfish (*Upeneichthys lineatus*), blue maomao (*Scorpis violaceus*), parore (*Girella tricuspidata*) and silver drummer (*Kyphosus sydneyanus*).

Four macrofaunal associations are recognised for the soft bottom sediments around the Hen and Chickens Islands. These are an infaunal bivalve association of *Venericardia purpurata – Corbula zelandica – Talabrica bellula* in shallow gravel and a *Gari stangeri – Felaniella zelandica* bivalve association in deeper coarse sand (28 m). An association of the molluscs *Pupa kirki – Pleuromeris zelandica – Myadora striata* occurs at 11–45 m depth.

The fish fauna in terms of richness, composition and diversity is similar to that described for the mainland section of this unit. However, there are also a number of subtropical species present at the Hen and Chickens Islands that rarely occur around Bream Head (the nearest mainland point), such as half-banded perch (*Hypoplectodes* sp.), single-spot demoiselle (*Chromis hypsilepis*), red pigfish (*Bodianus unimaculatus*) and Sandager's wrasse (*Coris sandageri*).

Mangroves (*Avicenna marina* var. *resinfera*) occur at Waipu Cove, Ruakaka River, Mangawhai Harbour, and Pakari. They provide excellent habitat for birds, including fernbird (*Bowdleria punctata*), banded rail (*Rallus philippensis*), banded dotterel (*Charadrius bicinctus*), New Zealand dotterel (*C. obscurus*), wrybill (*Anarynchus frontalis*), and variable oystercatcher (*Haematopus unicolor*). Mangawhai Spit is one of a few regular nesting sites for fairy tern (*Sterna nereis*) in New Zealand.

The Hen and Chickens Islands are important nesting areas for seabirds including Pycrofts petrel (*Pterodroma pycrofti*), flesh-footed shearwater (*Puffinus carneipes*) and little shearwater (*P. assimilis*). Removal of kiore from the Marotere group has significantly improved breeding success of Pycrofts petrel and little shearwater.

Region: Central
4.01 Ninety Mile Beach (Scott Point to Tauroa Point)

General
Ninety Mile Beach is bordered to the north and south by the rocky promontories of Scott Point and Tauroa Point, respectively. The area forms a sweeping, low-profile 90 km coastline of firm white sands. It is backed by a belt of shifting dunes up to 150 m high which, in some places, penetrates 10 km inland. The beach is interrupted by two rocky outcrops – The Bluff and Te Arai Rock – and the 50 m high, consolidated sand dome of Hukatere Hill. Matapia Island lies off the beach. This area is exposed to the west although Tauroa Point affords some shelter to the southernmost beaches in Ahipara Bay. The extensive Tauroa Point reefs extend offshore to 40 m depth.

Oceanography
The area is influenced predominantly by the Westland Current and to a lesser extent the ephemeral West Auckland Current. Surface currents are weak and strongly dependant on wind. Inshore surface salinities range from 35.3 – 35.5 parts per thousand, sea surface temperatures range from 14–21˚C and the maximum tidal range is 3.2 m.

Biota
This sandy beach supports toheroa (*Paphies ventricosa*) and tuatua (*P. subtriangulata*) populations. Toheroa are most numerous near the north end of the beach, north of Matapia Island, although juvenile *P. ventricosa* are found scattered throughout the beach's length. The beach provides feeding grounds for variable oystercatcher (*Haematopus unicolor*) and Capsian tern (*Sterna caspia*)

while Matapia Island is a nesting area for seabirds including black winged petrel. The island is also a winter haul-out for New Zealand fur seals (*Arctocephalus forsteri*).

Drift material comprising mainly algae and hydroids with green–lipped mussel (*Perna canaliculus*) spat attached periodically washes up on Ninety Mile Beach. It is the main source of spat for the mussel aquaculture industry. Most of the algae comprises subtidal red species, dominated by *Osmundaria colensoi* and *Rhodymenia dichtotoma*.

At Tauroa Point, there are beds of *P. canaliculus* attached to the intertidal and shallow subtidal rocky reefs.

Offshore communities of *Nemocardium pulchellum – Venericardia purpurata, Scalpomactra scalpellum – Mactra ordinaria* and *Tawera spissa – V. purpurata* have been recorded on sediments ranging from gravelly sands to mud.

Region: Central
4.02 Hokianga Coast (Tauroa Point to Maunganui Bluff)

General
This coastline is characterised by open, exposed sandy beaches interspersed by stretches of rocky platforms, bluffs and outcrops and three harbours (treated as a separate unit, see 4.03).
The Waipoua and Waimamaku rivers drain onto the coast. The Waimamaku River estuary is quite small and shallow at 3–3.5 km long and 30–80 m wide with a maximum depth of 4.5 m. From the South Head of the Hokianga Harbour to the Waimamaku River Miocene stratigraphy consists of the following formations: sandstones, siltstones, pebbly mudstones and minor conglomerate of the shallow-water Otaua Formation, overlain by interbedded basalt flows, breccias and sediments of the Waopoua Basalt overlain again by interlensing conglomerates, sandstones, siltstones and lignites of Pukorukoru Formation.

Oceanography
The area is influenced by the north flowing Westland Current and occasionally by the south flowing West Auckland Current. Salinities are between 35 and 35.5 parts per thousand and sea surface temperatures range between 15–22˚C.

Biota
At Mitimiti Beach there are toheroa (*Paphies ventricosa*) beds and some green–lipped mussels (*Perna canaliculus*) on the rocky reefs.

The Waimamaku River estuary has a subtidal faunal association in the upper reaches dominated by pipi (*P. australis*), Pacific oyster (*Crassostrea gigas*) and mud whelk (*Cominella glandiformis*). In the intertidal area there are abundant tunnelling mud crabs (*Helice crassa*) and clumps of sedge (*Cyperus usulatus*) and extensive sea rush (*Juncus maritimus* var. *australiensis*). Lower down the estuary, species diversity increases with cockle (*Austrovenus stutchburyi*), wedge shell (*Macomona liliana*), heart urchin (*Echinocardium cordatum*) and sand mason worm (*Pectinaria australis*) in the subtidal area. The intertidal fringe has jointed rush (*Leptocarpus similis*) interspersed with basalt boulders. Intertidal organisms just inside the mouth of the estuary that occur in abundance include truly marine species such as, the acorn barnacle (*Chamaesipho columna*), rock oyster (*Crassostrea glomerata*), *P. canaliculus* and the littorinid snail (*Litorina unifasciata antipodum*).

Some of the species inhabiting the intertidal reefs at Kawarua show the influence of northward and southward currents converging in the area (e.g. the alga *Xiphophora chondrophylla*, the black snail *Nerita melanotragus*, and smaller numbers of the topshell *Melarapha cincta* and the leathery kelp (*Lessonia variegata*). Eel grass (*Zostera capricorni*) grows in small clumps in the rock pools.

Sea wrack (*Carpophyllum maschalocarpum*) is the dominant brown alga in the less exposed subtidal areas of the coast in the vicinity of Kawarua. Other species form mixed stands and include *L. variegata*, *Landsburgia quercifolia*, common kelp (*Ecklonia radiata*) and *Sargassum sinclairii*. Bull kelp (*Durvillaea* sp.) occurs at the more exposed rocky reef areas.

The subtidal reef fish fauna outside the Hokianga Harbour is low in diversity compared with other sites in northern New Zealand. There is a predominance of widespread species and an absence of subtropical species. Species richness appears to be temperature related and species composition and richness between exposed coastal sites and sheltered harbour mouth sites is similar. Abundance varies, however, with for example banded wrasse (*Notolabrus fucicola*) more abundant at exposed sites and spotty (*N. celiodotus*) more abundant in sheltered sites.

Offshore *Scalpomactra scalpellum – Mactra ordinaria* communities occur on sandy substrates.

The Hokianga coast is important for birdlife, including the New Zealand dotterel (*Charadrius obscurus*), blue penguin (*Eudyptula minor*), black shag (*Phalacrocorax carbo*) and grey-faced petrel (*Pterodroma macroptera*). Bird species known to feed in the Waimamaku River estuary include the grey duck (*Anas superciliosa*), pied shag (*Phalacrocorax varius*), pied stilt (*Himantopus himantopus*), white-faced heron (*Ardea novaehollandiae*) and black shag.

Region: Central
4.03 Hokianga, Whangape and Herekino Harbours

General
Hokianga is the largest of the three harbours in this unit and the fourth largest in New Zealand. This drowned river valley extends well inland and has 50% of its 11,500 ha area composed of tidal mudflats with Pleistocene dunes at the entrance. Whangape (850 ha) and Herekino (630 ha) harbours are significantly smaller in area but also have tidal mudflats occupying approximately 50% of their area. Whangape is a small Y-shaped harbour which opens to the sea via a 4 km long, 150 m wide channel bordered by steep hillsides. It is formed by the confluence of two estuaries or arms of two rivers. The Herekino Harbour entrance is 200 m-wide and lies between huge dunes to the north and a prominent spur to the south. The harbour is a drowned former stream valley, approximately 6 km long that branches into two in the upper reaches. The northern shore is mainly sandy but the southern entrance consists of a relatively sheltered, rocky shore.

Oceanography
Tidal flow is the major factor influencing water circulation in the Hokianga Harbour rather than the freshwater inflows. The maximum tidal range of the three harbours is 3 m.

Hokianga Harbour comprises three major areas – the lower harbour (from the entrance to Te Karaka/Onoke) is characterised by high salinity oceanic water, soft substrates dominated by sands, numerous areas of boulder and rock, strong tidal currents, low water turbidity and relatively short

water residence times. The middle harbour (Te Karaka/Onoke to Matawhera) is characterised by soft substrates dominated by fine sand and mud and moderate to strong tidal currents in the main channels. The upper harbour (Matawhera inwards) is characterised by lower salinity estuarine water and soft substrates dominated by silt and clays, strong tidal currents in particular areas, numerous backwaters and lengthy river arms, relatively long water residence times and high water turbidity.

Whangape Harbour comprises four areas – the entrance channel (a former steep sided river gorge), a shallow central basin (between Whangape and Pawarenga) that at low tide comprises 2 – 5 m deep channels linking the estuaries with the entrance channel, and two estuaries formed from the Awaroa and Rotokakahi Rivers.

Herekino Harbour is mainly empty of water at low tide, with only a shallow subtidal entrance channel.

Biota

Hokianga harbour contains large stands of mangrove (*Avicennia marina* var. *resinifera*) and saltmarsh species (*Juncus* spp., *Leptocarpus* spp., and *Muehlenbeckia* spp). Twelve intertidal habitats and substrates have been recognised for the Hokianga Harbour, including the presence of quite large beds of introduced cord grass (*Spartina* sp.).

Both marine and estuarine species occur in the harbour. Truly marine species found as far as Onoke, some 12 km from the harbour entrance include brown algae (common kelp, *Ecklonia radiata*, and sea wracks, *Carpophyllum flexuosum* and *C. maschalocarpum*), topshells (*Melagraphia aethiops* and *Diloma subrostrata*), oyster borer (*Lepsiella scobina*) and cat's eye (*Turbo smaragdus*). Horse mussels (*Atrina zelandica*) are found subtidally in the lower harbour and provide nursery habitat for juvenile species of fish such as snapper (*Pagrus auratus*). Truly estuarine species present include the mudflat whelk (*Cominella glandiformis*), cockle (*Austrovenus stutchburyi*), mudsnail (*Amphibola crenata*), estuarine snail (*Potamopyrgus estuarinus*) and mud crab (*Helice crassa*). The introduced Pacific oyster (*Crassostrea gigas*) is also common.

Fish species in Hokianga Harbour comprise coastal and estuarine elements. In the vicinity of the harbour entrance, banded wrasse (*Notolabrus fucicola*), spotty (*N. celidotus*) and *P. auratus* are common coastal species. Estuarine species found within the harbour include yellow-eyed mullet (*Aldrichetta forsteri*) and grey mullet (*Mugil cephalus*). Rock lobsters (*Jasus edwardsii*) also occur within the harbour.

Whangape Harbour has some of the tallest mangroves (10 m) in New Zealand, however the soft sediments generally support a low diversity of biota. Sand dollars (*Fellaster zelandiae*) are numerous just inside the harbour mouth and pipis (*Paphies australis*) dominate the remaining 3 km of the entrance channel. Hermit crabs (*Paguristes pilosus* and *Pagurus novaezelandiae*) and scavenging whelks (*C. adspersa, C. glandiformis, C. maculosa*) are common. The central basin contains the most diverse fauna of the harbour. Pipis, hermit crabs and whelks dominate the medium grained sandy sediments nearest the entrance channel, while wedge shell (*Macomona liliana*), nutshell (*Nucula hartivigiana*) and cockles (*A. stutchburyi*) are common in the finer substrate of the basin. The Awaroa estuary supports rich populations of cockles while the Rotokakahi estuary is dominated by rich pipi populations. The only introduced species is the Pacific oyster, *Crassostrea gigas*.

The southern rocky shore of Herekino Harbour between Owhata and the harbour entrance support zone forming species such as periwinkle (*Austrolittorina antipoda*), barnacles (*Chamaesipho*

brunnea and *C. columna*), flea mussel (*Xenostrobus pulex*), tube worm (*Spirobranchus carniferus*) and algae (*Apophlaea sinclairii, Gigartina alveata, Xiphophora chondrophylla, Corallina* turf). The medium grained sandy sediments support intertidal and subtidal populations of pipis and cockles. Other common bivalves include wedge shell, nut shell and *Theora lubrica*. The upper reaches of both arms of the harbour support mangrove forests.

The harbours are of considerable wildlife value and are important for birdlife. In the Hokianga Harbour there is a small brown teal (*Anas aucklandica*) roost in the Mangamuka arm and high numbers of banded rail (*Rallus phillippensis*) and spotless crake (*Porzana tabuensis*).

Region: Central
4.04 West Auckland (Maunganui Bluff to Waikato River Mouth)

General
This unit is characterised by long stretches of exposed ironsand beaches, intersected by a section of exposed rocky shore and cliffs between Muriwai and Karekare (unit 4.06).

Maunganui Bluff is a prominent rocky headland and marks the northern part of this unit. The area from Maunganui Bluff (and Aranga Beach) south to Muriwai Beach consists of a uniform stretch of exposed fine-grained sandy beaches backed by high foredunes, behind which a series of sand waves extend inland. Ironsands occur along much of the coast particularly south of Kaipara Harbour.

Whatipu Beach is the northern exposed tidal delta at the north head of Manukau Harbour, forming an extensive area of sand dunes 7 kilometres long and about 1 kilometre wide at the toe of the Waitakere Ranges. The beach is characterised by a number of permanent and temporary dune lakes.

The coastline from South Head at the entrance of the Manukau Harbour to Port Waikato some 35 kilometres south is mostly ironsand beach.

The offshore sediments comprise medium to fine sands in the north, changing to fine sediments (muddy sand and mud) off Kaipara and southwards.

Oceanography
This area is influenced by the Westland Current and occasionally by the West Auckland Current. Surface currents are weak and strongly dependant on local winds; the prevailing winds are south-west. Salinities range from 35 – 35.5 parts per thousand, sea surface temperatures range between 14 and 22˚C, and maximum tidal range is 2.9 m. This is a high wave energy coast with waves of 1.5 – 2.5 m on average. There is littoral sand movement longshore to the north largely driven by a Southern Ocean derived swell. Heavy storm wave action often causes beach erosion, moving sand to offshore bars.

Biota
Crustaceans of the upper beaches include seaslater, sandlouse and sandhopper with isopods of families Sphaeromidae and Eurydicidae on the mid-beach, and ghost shrimp (*Callianassa* sp.), paddle crab (*Ovalipes catharus*), mantis shrimp (*Squilla armata*) and haustoriid amphipods on the lower beach. Dominant molluscs of the lower intertidal and shallow subtidal are tuatua (*Paphies subtriangulata*), morning star (*Tawera spissa*), pipi (*Paphies australis*) and *Struthiolaria papulosa.*

Toheroa (*P. ventricosa*) beds are found in the beach sediments in the vicinity of Dargaville, and at Muriwai Beach where they occur as the only significant population in the Auckland region.

Fish species characteristic of the area include snapper (*Pagrus auratus*), trevally (*Pseudocaranx dentex*), gurnard (*Cheilodonichthys kumu*), rays and sharks. Offshore *Scalpomactra scalpellum – Mactra ordinaria* communities occur on sand to mud substrates.

The endangered Maui's dolphin (*Cephalorhynchus hectori maui*) population is centred in this area.

Among sand dunes are areas of swamps and small lakes that support waterfowl and wading birds such as the New Zealand scaup (*Aythya novaeseelandiae*), paradise shelduck (*Tadorna varigata*), grey duck (*Anas superciliosa*), pied shag (*Phalocrocorax varius*), little shag (*P. melanoleucos*) and little black shag (*P. sulcirostris*). Rangitira Beach north of Muriwai Beach has colonies of white-fronted terns (*Sterna striata*). Numerous populations of shags also inhabit the beaches along this coastline as well as blue penguin (*Eudyptula minor*).

Region: Central
4.05 Kaipara Harbour

General
Kaipara Harbour is New Zealand's largest enclosed harbour and protected estuarine area. It is 94,700 ha, with over 800 km of coastline. The harbour mouth is approximately 8 kilometres across. The harbour heads have extensive areas of sandflats, dunes, impounded wetlands and dune lakes. There is substantial sand progradation occurring at the heads. The coastline is deeply indented with sheltered rocky shores and low cliffs. Sand and mudflats are extensive at low tide (43% of the area). The harbour contains highly productive intertidal sandflats very similar to those of the Manukau Harbour. The harbour is composed of a mosaic of estuarine habitats including saltmarsh, saltmeadows and reed swamps, and about 10% is covered with mangroves.

Mud bank and mangrove environments occur mainly in the north and south, with areas of white sandy beaches and rocky promontories and shorelines in the central portion. The southernmost parts of the inlet have the most sizeable areas of mangroves and saltmarshes. The hardshore consists of grey limestone. The main inflowing rivers are the Wairoa River from the north and the Kaipara River from the south.

Oceanography
This is a sheltered estuarine harbour dominated by tides with a maximum tidal range of 3.7 m. There is a high level of freshwater input from the numerous rivers that feed into the harbour.

Biota
There are large areas of relatively unmodified sequences of habitats from tidal channels to near shore mangrove (*Avicennia marina* var. *resinifera*), saltmarsh, saltmeadow, maritime rushes with freshwater habitats and full forest habitats, with the Hoteo River being a notable example.

The harbour provides high quality habitats for many marine species and supports a high diversity of estuarine invertebrates. The rocky shore has a wide belt of Pacific oysters (*Crassostrea gigas*) below which is the tubeworm *Pomatoceros caeruleus* forming biogenic reefs and gastropods *Cominella glandiformis, Zeacumantus lutulentus* and *Zediloma subrostrata*. The mysid *Tenagomysis chiltoni* is

abundant. Cockles (*Austrovenus stutchburyi*), pipis (*Paphies australis*) and scallops (*Pecten novaezelandiae*) are abundant in the soft sediments.

At the Otamatea estuary approximately 40% of the estuary comprises very soft mud with areas of *A. marina* and *C. gigas* beds. Here, the benthic infaunal assemblages are dominated by small, deposit–feeding polychaetes, oligochaetes and bivalves (including *A. stutchburyi*) while the grazing gastropods *Z. lutulentus* and *Z. subrostrata* are the dominant epifauna.

In contrast, the sand banks off the Kakaraia Flats feature a benthic invertebrate assemblage dominated by wheel shells (*Zethalia zealandica*) and polychaete worms (*Magelona dakini*), and a dense subtidal bed of sand dollars (*Fellaster zelandiae*).

Horse mussels (*Atrina zelandica*) occur in the lower areas of harbours along the edges of the main channels providing habitat for juvenile snapper (*Pagrus auratus*).

The harbour is a significant breeding and feeding ground for fish such as snapper (*Pagrus auratus*), grey mullet (*Mugil cephalus*), sole, kahawai (*Arripis trutta*), trevally (*Pseudocaranx dentex*), red gurnard (*Cheilodonichthys kumu*), yellow-eyed mullet (*Aldrichetta forsteri*), skates, rays, sharks and white bait.

Papakanui Spit is a haul out area for New Zealand fur seals (*Arctocephalus forsteri*).

The harbour provides a rich food source for many shore birds, including large numbers of migratory species from the Northern Hemisphere, and at least three globally threatened species of bird. Waionui Inlet, which cuts into the top of South Head, is more or less permanently closed off to the sea, and is an important bird feeding area.

Thousands of Arctic and New Zealand wading birds roost here and on the sand islands at Tapora and Shelley Beach and feed on the extensive areas of intertidal mudflats. These include the New Zealand dotterel (*Charadrius obscurus*), wrybill (*Anarynchus frontalis*), variable oystercatcher (*Haematopus unicolor*) and fairy tern (*Sterna nereis*). This is also the principle nesting area for the Caspian tern (*Sterna caspia*) and white-fronted tern (*Sterna striata*). Salt marsh and mangroves are important for banded rail (*Rallus philippensis*) and fernbird (*Bowdleria punctata*). There is a breeding colony of grey-faced petrel (*Pterodroma macroptera*) on Moturemu Island.

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Grace, R.V. 1991 : Pakiri - Te Arai sand extraction. Biological investigations. McCallum Brothers	3.12	Pakiri - Te Arai, sand mining, benthos	The sand mining area on the nearshore bar contains sand dollars, wheel shells, surf clams (Dosinia spp.)

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Hilton, M.J. 1990: Processes of sedimentation on the shoreface and continental shelf and the development of facies. Pakiri, New Zealand. Ph.D. thesis, Department of Geography, University of Auckland. 300 p.	3.12	Pakiri, sediments, benthos	
Hilton, M.J.; McLean, R.F. 1986: Pakiri coastal sediment study, for marine division of Ministry of Transport. Department of Geography, University of Auckland. 51 p.	3.12	Pakiri, sediments, beach profiles, benthos	Wheel shells, sand dollars and heart urchins occur in shallow water. From 8 - 12 metres Dosinia and Tawera are present. 12-15 m hermit crabs are abundant. Greater than 25-

			30m horse mussels and scallops are found.
Hilton, M.J.; McLean, R.F. 1986: Pakiri coastal sediment study, for Marine Division of Ministry of Transport. Dept. of Geography, University of Auckland. 51 p.	3.12	Pakiri, sediments, beach profiles, benthos	Wheel shells, sand dollars and heart urchins occur in shallow water. From 8 - 12 metres Dosinia and Tawera are present. 12-15 m hermit crabs are abundant. Greater than 25-30m horse mussels and scallops are found.
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Grace, R.V. 1991: Kaipara Water Transport Ltd sand extraction site. Biological investigations. Kaipara Water Transport Ltd. 19 p.	4.05	Kaipara, Millers Bank, Okaro Bay, sand mining, benthos	Mobile sands of Millers Bank support very little life except sand dollars and wheel shells. Okaro Bay has cockles, pipis and wedge shells. Mussels and oysters occur on intertidal sandstone rocks.
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