

COASTAL AND MARINE ECOLOGICAL AREAS OF NEW ZEALAND

A Preliminary Classification for
Conservation Purposes

K J King*
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FOREWORD

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This approach has worked well on land. Using the IUCN concepts, the Department of Lands and Survey in association with the National Parks and Reserves Authority and with co-operation from the scientific community, acted as a catalyst in achieving agreement on a biogeographical subdivision of terrestrial environments in New Zealand, as a basis for ensuring full ecological representation within a network of protected natural areas. This biogeographical framework is fundamental to the ongoing Protected Natural Areas Programme aimed at filling gaps in the existing protected area system.

Following the success of the terrestrial programme attention turned to the adoption of a similar biogeographical approach to planning marine protected areas. While the department and the authority have again taken the initiative, the exercise has been conducted co-operatively and I am particularly grateful for the assistance received from staff of the Ministry of Agriculture and Fisheries. The Ministry has recently released a draft of its national policy for marine reserves as an integrated approach to regional management of fisheries resources. I applaud this initiative and am confident that the use of biogeographical principles, such as those proposed here, will become an integral part of the planning process for marine protected areas.

The draft coastal and marine biogeographic scheme presented here is intended specifically to assist in summarising the diversity of natural environments as a guide to selection of areas meriting protection. It has been prepared by a small team of marine biologists working temporarily in the department's head office scientific unit under the direction of Chief Scientist Paul Dingwall. Time constraints have limited the scope of consultation, and it is important that the scheme now receives careful scientific scrutiny and any appropriate revision, so that it is widely acceptable to marine scientists. It must also be practical, considering its intended conservation purposes.

I believe that the authors have successfully achieved the objective of devising the framework of a biogeographic scheme appropriate for conservation planning in coastal and marine environments, and I congratulate them on their efforts. I am pleased to be able to make the results available for review by a wider audience, and commend the approach to all who are involved in the establishment of marine protected areas in New Zealand.



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July 1985

Common Name	Scientific Name	Common Name	Scientific Name
Green eyed dogfish	<i>Squalus blainvillei</i>	Black swan	<i>Cygnus atratus</i>
Grey mullet	<i>Mugil cephalus</i>	Blue heron	<i>Egretta sacra</i>
Groper	<i>Polyprion oxygeneios</i>	Brown teal	<i>Anas aucklandica chlorotis</i>
Hoki	<i>Macrurus novaezelandiae</i>	Buller's shearwater	<i>Puffinus bulleri</i>
Horse mackerel	<i>Trachurus declivis</i>	Caspian tern	<i>Hydroprogne caspia</i>
Inanga	<i>Galaxias maculatus</i>	Cook's petrel	<i>Pterodroma cooki cooki</i>
John dory	<i>Zeus japonicus</i>	Eastern bar-tailed godwit	<i>Limosa lapponica baueri</i>
Kahawai	<i>Arripis trutta</i>	Eastern knot	<i>Calidris canutus canutus</i>
Kingfish	<i>Seriola grandis</i>	Fairy tern	<i>Sterna nereis</i>
Koheru	<i>Decapterus koheru</i>	Fleshfooted shearwater	<i>Puffinus carneipes hullianus</i>
Ling	<i>Genypterus blacodes</i>	Fluttering shearwater	<i>Puffinus gavia gavia</i>
Long-finned eel	<i>Anguilla dieffenbachii</i>	Greenshank	<i>Tringa nebularia</i>
Long-tailed stingray	<i>Dasyatis thetidis</i>	Grey duck	<i>Anas superciliosa superciliosa</i>
Monkfish	<i>Kathetostoma giganteum</i>	Grey-faced petrel	<i>Pterodroma macroptera gouldi</i>
Opalfish	<i>Hemerocoetes monopterygius</i>	Grey-tailed tattler	<i>Tringa brevipes</i>
Parore	<i>Girella tricuspidata</i>	Little black shag	<i>Phalacrocorax sulcirostris</i>
Pilchard	<i>Sardinops neopilchardus</i>	Little shag	<i>Phalacrocorax melanoleucos brevirostris</i>
Piper	<i>Hyporhamphus ihi</i>	NZ dotterel	<i>Charadrius obscurus</i>
Pufferfish	<i>Contusus richiei</i>	NZ scaup	<i>Aythya novaeseelandiae</i>
Red cod	<i>Pseudophycis bacchus</i>	Northern blue penguin	<i>Eudyptula minor subsp.</i>
Red gurnard	<i>Chelidonichthys kumu</i>	Northern diving petrel	<i>Pelecanoides urinatrix urinatrix</i>
Red moki	<i>Cheilodactylus spectabilis</i>	Paradise duck	<i>Tadorna variegata</i>
Rig	<i>Mustelus lenticulatus</i>	Pied shag	<i>Phalacrocorax varius varius</i>
Rough skate	<i>Raja nasuta</i>	Pied stilt	<i>Himantopus himantopus leucocephalus</i>
Sabretooth blenny	species undetermined	Pycroft's petrel	<i>Pterodroma pycrofti</i>
Salmon	<i>Oncorhynchus</i> and <i>Salmo</i> spp.	Red-billed gull	<i>Larus novaehollandiae scopulinus</i>
Sand flounder	<i>Rhombosolea plebeia</i>	Reef heron	<i>Egretta sacra sacra</i>
School shark	<i>Galeorhinus australis</i>	Royal albatross	<i>Diomedea epomophora sanfordi</i>
Sea perch	<i>Helicolenus papillosus</i>	Royal spoonbill	<i>Platalea leucorodia regia</i>
Seven-gilled shark	<i>Notorhynchus cepedianus</i>	Sooty shearwater	<i>Puffinus griseus</i>
Sharp-nosed pufferfish	<i>Canthigaster callisternus</i>	Southern black-backed gull	<i>Larus dominicanus</i>
Short-finned eel	<i>Anguilla australis</i>	South I. pied oystercatcher	<i>Haematopus ostralegus finschi</i>
Short-tailed stingray	<i>Dasyatis brevicaudatus</i>	Spotless crane	<i>Porzana tabuensis plumbea</i>
Skipjack tuna	<i>Katsuwonus pelamis</i>	Spotted shag	<i>Stictocarro punctatus punctatus</i>
Smelt	<i>Retropinna retropinna</i>	Spur-winged plover	<i>Lobibyx novaehollandiae</i>
Snapper	<i>Chrysophrys auratus</i>	Terek sandpiper	<i>Xenus cinereus</i>
Southern bluefin tuna	<i>Thunnus maccoyii</i>	Variable oystercatcher	<i>Haematopus unicolor</i>
Spiky dogfish	<i>Squalus acanthias</i>	White-faced heron	<i>Ardea novaehollandiae</i>
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Spotted stargazer	<i>Genyagnus novaezelandiae</i>	White-fronted tern	<i>Sterna striata</i>
Spotty	<i>Pseudolabrus celidotus</i>	White heron	<i>Egretta alba modesta</i>
Tarakihi	<i>Nemadactylus macropterus</i>	Wrybill	<i>Anarhynchus frontalis</i>
Trevally	<i>Caranx georgianus</i>		
Trout	<i>Salmo</i> spp.		
Trumpeter	<i>Latris lineata</i>		
Warehou	<i>Seriola brama</i>		
Whitebait	<i>Galaxias</i> spp.		
Yellow-eyed mullet	<i>Aldrichetta forsteri</i>		
BIRDS			
American whimbrel	<i>Numenius phaeopus hudsonicus</i>	REPTILES	
Australian gannet	<i>Sula bassana serrator</i>	Tuatara	<i>Sphenodon punctatus</i>
Banded dotterel	<i>Charadrius bicinctus</i>		
Banded rail	<i>Rallus philippensis assimilis</i>	MAMMALS	
Black-fronted tern	<i>Chlidonias hybrida albostratus</i>	NZ fur seal	<i>Arctocephalus forsteri</i>
	<i>Phalacrocorax carbo novaehollandiae</i>	Hooker's sealion	<i>Phocarcots hookeri</i>

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Black shag	<i>Phalacrocorax carbo novaehollandiae</i>		

GLOSSARY OF COMMON/SCIENTIFIC NAMES

Common plant and animal names have been used in preference to scientific names in the text wherever possible.

Common Name	Scientific Name
PLANTS	
Akeake	<i>Dodonaea viscosa</i>
Bull kelp	<i>Durvillea antarctica</i>
Cabbage tree	<i>Cordyline australis</i>
Glasswort	<i>Salicornia australis</i>
Hard beech	<i>Nothofagus truncata</i>
Hinau	<i>Elaeocarpus dentatus</i>
Horses mane weed	<i>Ruppia megacarpa</i> , <i>R. polycarpa</i>
Jointed rush	<i>Juncus articulatus</i>
Jointed wire rush	<i>Leptocarpus similis</i>
Kanuka	<i>Leptospermum ericoides</i>
Kowhai	<i>Sophora microphylla</i>
Mahoe	<i>Melicytus ramiflorus</i>
Mangrove	<i>Avicennia marina</i> var. <i>resinifera</i>
Manuka	<i>Leptospermum scoparium</i>
Marram grass	<i>Ammophila arenaria</i>
Miro	<i>Prumnopitys ferruginea</i>
NZ flax	<i>Phormium tenax</i>
Ngaio	<i>Myoporum laetum</i>
Nikau	<i>Rhopalostylis sapida</i>
Northern rata	<i>Metrosideros robusta</i>
Pampas grass	<i>Cortaderia</i> spp.
Pingao	<i>Desmoschoenus spiralis</i>
Pohutukawa	<i>Metrosideros excelsa</i>
Raupo	<i>Typha orientalis</i>
Rimu	<i>Dacrydium cupressinum</i>
Scabweed	<i>Raoulia australis</i> , <i>R. hookeri</i>
Sea grass	<i>Zostera muelleri</i>
Sea lettuce	<i>Ulva lactuca</i>
Sea rush	<i>Juncus maritimus</i> var. <i>australiensis</i>
Selliera	<i>Selliera radicans</i>
Shore pimpernel	<i>Samolus repens</i>
Silvery sand grass	<i>Spinifex hirsutus</i>
Small-leaved pohuehue	<i>Muehlenbeckia complexa</i>
Taupata	<i>Coprosma repens</i>
Tree lupin	<i>Lupinus arboreus</i>
Willow	<i>Salix</i> spp.
INVERTEBRATES	
Arrow squid	<i>Nototodarus</i> spp.
Bamboo worm	<i>Axiuthella quadrimaculata</i>
Basket cockle	<i>Notocorbula zelandica</i>
Black coral	<i>Aphanipathes</i> sp.
Black mussel	<i>Modiolus areolatus</i>
Blue mussel	<i>Mytilus edulis aoteanus</i>
Brine shrimp	<i>Artemia</i> from Lake Grassmere
Cats-eye	<i>Turbo smaragdus</i>
Cockle	<i>Chione stutchburyi</i>
Comb star	<i>Astropecten polyacanthus</i>
Crayfish	<i>Jasus edwardsii</i>
Dog cockle	<i>Glycymeris laticostata</i>
Dredge oyster	<i>Ostrea lutaria</i>
Flax snail	<i>Placostylus ambagiosus</i>

Common Name	Scientific Name
Ghost shrimp	<i>Callianassa filholi</i>
Green-lipped mussel	<i>Perna canaliculus</i>
Half-crab	<i>Petrolisthes elongatus</i>
Horse mussel	<i>Atrina zelandica</i>
Kauri snail	<i>Paryphanta busbyi</i>
Kina	<i>Evechinus chloroticus</i>
Lugworm	<i>Abarenicola affinis</i>
Mantis shrimp	<i>Heterosquilla tricarinata</i>
Morning star shell	<i>Tawera spissa</i>
Mud crab	<i>Helice crassa</i>
Mud snail	<i>Amphibola crenata</i>
Mud whelk	<i>Cominella adpersa</i>
Octopus	<i>Octopus maorum</i>
Pacific oyster	<i>Crassostrea gigas</i>
Packhorse lobster	<i>Jasus verreauxi</i>
Paddle crab	<i>Ovalipes catharus</i>
Paua	<i>Haliotis iris</i>
Periwinkles	<i>Littorina unifasciata</i> , <i>L. cincta</i>
Pill-box crab	<i>Halicarcinus</i> spp.
Pipi	<i>Paphies australis</i>
Red beadlet anemone	<i>Isactinia tenebrosa</i>
Red rock crab	<i>Plagusia capensis</i>
Ribbed mussel	<i>Aulacomya maoriana</i>
Rock oyster	<i>Saccostrea glomerata</i>
Sand scarab	<i>Pericoptus humeralis</i>
Sandhopper	<i>Talorchestia quoyana</i>
Sandlouse	<i>Actaecia euchroa</i>
Sausage worm	<i>Urechis novaezealandica</i>
Scallop	<i>Pecten novaezealandiae</i>
Seacucumber	<i>Stichopus mollis</i>
Seaslater	<i>Scyphax ornatus</i>
Shore crab	<i>Hemigrapsus crenulatus</i>
Small shell borer	<i>Xymene plebeius</i>
Snapping shrimp	<i>Alpheus</i> sp.
Swimming crab	<i>Nectocarcinus antarcticus</i>
Toheroa	<i>Paphies ventricosa</i>
Tuatua	<i>Paphies subtriangulata</i>
Venus shell	<i>Dosinia anus</i>
Wedge shell	<i>Tellina liliana</i>
FISH	
Albacore tuna	<i>Thunnus alalunga</i>
Anchovy	<i>Engraulis australis</i>
Banded kokopu	<i>Galaxias fasciatus</i>
Barracouta	<i>Thyrsites atun</i>
Bass	<i>Polyprion maeone</i>
Black angelfish	<i>Parma alboscaphularis</i>
Blue cod	<i>Parapercis colias</i>
Blue maomao	<i>Scorpius violaceus</i>
Blue moki	<i>Latridopsis ciliaris</i>
Bluenose	<i>Hyperoglyphe antarctica</i>
Butterfish	<i>Odax pullus</i>
Common sole	<i>Peltorhamphus</i> <i>novaezeelandiae</i>
Conger eel	<i>Conger verreauxi</i>
Demoiselle	<i>Chromis dispilus</i>
Eagle ray	<i>Myliobatis tenuicaudatus</i>
Elephant fish	<i>Callorhynchus milii</i>
Giant kokopu	<i>Galaxias argenteus</i>
Grahams gudgeon	<i>Grahamichthys radiata</i>

CONTENTS

SECTION I BACKGROUND AND APPROACH

Introduction	1
New Zealand Terrestrial Classification	1
New Zealand Marine Classification	1
Approaches to Ecosystem Classification for Conservation purposes	1
Aims and Approach of this Study	2
Summary	3
Acknowledgements	3
References	3

SECTION II DESCRIPTION OF ECOLOGICAL AREAS

Index to District and Region Descriptions	5
Figures of Districts and Regions	7-11
District and Region Descriptions	12
Glossary of Common/Scientific Names	46

shelf consisting of predominantly medium to fine terrigenous sand. This district extends from the eastern side of Stewart Island (including the shelf in the vicinity of North and South Trap), to the Clutha River mouth in the north, east to the shelf break and south to the beginning of the biogenic sediment of the Snares SER. The boundary at Foveaux Strait is determined by the fining of sediments and change of slope at about 75 m depth. In the north the district is defined by the beginning of coarse Otago sediments.

Hydrology The north flowing Southland Current is made up of three components, subtropical, subantarctic and neritic water. In this district the major component is of subtropical origin with the subantarctic water moving to the south and east and neritic water not featuring until further north where fresh water from the Clutha dominates the inshore flow. Water temperature tends to be lower in this district than in western Foveaux.

Biology Communities of *Tawera spissa* – *Diplodonta globus* occur on sandy sediments. Commercial fish species of the Western Foveaux SED are also dominant in this district.

I-d Otago Shelf Ecological District

Marine Topography Area between the coastal strip and shelf edge from Nugget Point in the South to Karitane Township in the north. This district is delineated from the southern districts by a transition from biogenic to coarse terrigenous sediments on the outer shelf and a change to the finer sand and muds inshore. In the north the district is distinguished by a replacement of the gravel and pebble band by finer sediments of the Canterbury Bight. In this district sediments grade into pebbles and cobbles on the mid and outer shelf. At the shelf edge sediments become finer again, changing to gravels, sands and muds. A band of biogenic sediments are found on the outer shelf of the Otago

Peninsula. The shelf edge of this district is indented with the Molyneux, Taieri, Hoopers, Sanders, Papanui, Tairoa, Karitane and Canyons.

Hydrology The Southland current moving north is made up of an inshore (neritic) zone influenced by coastal runoff (particularly from the Clutha River), a central zone of subtropical water originating from the East Australian Current, and a seaward subantarctic zone. The interface of the subtropical and the subantarctic waters forms the Southland Front which corresponds to some extent with the shelf edge and the seaward limit of this district.

Biology Bryozoan and *Glycymeris laticostata* – *Venericardia purpurata* communities originate and occupy the biogenic sediments of the outer shelf off the Otago Peninsula. Commercial catches are similar to Eastern Foveaux with the addition of flounder and dredge oysters.

J SNARES SHELF ECOLOGICAL REGION (Fig 5)

J-a Snares Shelf Ecological District

Marine Topography Large region of biogenic sediment extending southwest from the outer shelf off Nugget Point to the western shelf edge near South West Cape (Stewart Island). The region's southern limit is at the shelf edge south of the Snares Islands, where the shelf drops off to the Campbell Plateau and the Solander Trough.

Hydrology The subtropical Southland Current moves across the Snares shelf and north up the Otago coast. In summer the subtropical convergence often moves north to bring subantarctic water to this region.

Biology Communities of *Glycymeris laticostata* – *Venericardia purpurata* are recorded from sand and gravelly sand sediments.

Biology Economic quantities of paua, mussel, crayfish, octopus, butterfly and blue cod. Important sea bird habitat; shag, penguin, gull, albatross, tern present. NZ fur seal haulout area.

Existing Coastal PNAs

Sandfly Bay Wildlife Refuge
Sandymount Wildlife Refuge

27-4 Inner Otago Peninsula Coastal Ecological District

Marine Topography Inundated sheltered sandy and rocky shore on Otago Peninsula including Kaikorai Stream mouth, Hoopers Inlet, Papanui Inlet, Otago Harbour, Purakarui Bay Estuary, Blueskin Bay Estuary, Waikouaiti Estuary and Hawkesbury Lagoon.

Hydrology

Biology

Existing Coastal PNAs

Mount Pleasant Scenic Reserve
Titeremoana Scenic Reserve
Burn's Park Scenic Reserve
Little Hoopers Inlet Government Purpose Reserve
Allan's Beach Government Purpose Reserve
Tomahawk Lagoon Government Purpose Reserve
Merton Tidal Arm Government Purpose Reserve
Hawkesbury Lagoon Government Purpose Reserve and Wildlife Refuge

27-5 Northern Otago Coastal Ecological District

Marine Topography Section of coast from Cape Saunders to Cape Wanbrow consisting of fine grained sandy beaches alternating with headlands of exposed rock and cliffs. Between Blueskin Estuary and Karitane is a section of eroding wave cut platforms.

Hydrology This shore is less exposed to the prevailing southerlies. The Southland Current is forced offshore by the Otago Peninsula, consequently low salinity, variable temperature neritic water often forms a south flowing counter current along this shore.

Biology Economic quantities of paua, mussel, crayfish, paddle crab, octopus, butterfly, moki, trumpeter and groper. Important habitat for seabirds including royal albatross, penguin, shag, tern and gull.

Existing Coastal PNAs

Taiaroa Head Nature Reserve
Goodwood Scenic Reserve
Heyward Point Scenic Reserve
Taiaroa Head Foreshore Wildlife Sanctuary
Kumokumowhero Bay Wildlife Refuge

SHELF ECOLOGICAL REGIONS AND DISTRICTS

I FOVEAUX SHELF ECOLOGICAL REGION (Fig 5)

Shelf region of terrigenous sediment. It begins in the west at Five Finger Peninsula (Fiordland) where the shelf expands significantly from the comparatively shelfless coast further north. In the east the limit of the region is determined by coarse Otago sediments being replaced by finer Canterbury Bight sediments just to the north of Otago Peninsula. This region terminates to the south where biogenic sediments replace the terrigenous sediments. The boundary follows a northwest-southeast direction across the Snares Shelf, beginning in the

vicinity of South West Cape (Stewart Island) and ending off the Clutha River mouth. This boundary tends to follow the 100 m contour and includes the reefs of North and South Trap. The Southland Current, seasonal movements of the subtropical convergence, and strong tidal flows have a considerable influence on this region.

I-a Western Foveaux Shelf Ecological District

Marine Topography Area delineated by the shelf edge in the west, coastal districts to the north and southwest, the boundary of cobbles and pebbles entering Foveaux Strait in the east and the beginnings of biogenic sediments to the south. The seabed is of relatively uniform medium to fine sand. To the south the district plunges into the Solander Trough and in the north the shelf merges into the Puysegur Bank (not included in this district).

Hydrology Southland Current moves east around Puysegur Point with part of the flow split by Stewart Island, some moving north into Foveaux Strait and the remaining moving south then east. Water temperatures tend to be higher than to the east of Stewart Island where subantarctic water affects the Southland Current.

Biology Communities of *Scalpomactra scalpellum* – *Macra ordinaria*, *Tawera spissa* – *Diplodonta globus* and *Glycymeris laticostata* – *Venericardia purpurata* have been reported from sand and gravel sediments. Commercial stocks of tarakihi, elephant fish, gurnard, red cod, trumpeter, monkfish, rig, spiny dogfish, warehou, groper, ling, barracouta, and mackerel.

I-b Foveaux Strait Shelf Ecological District

Marine Topography A complex area, with respect to changes in depth and sediment distribution, in the narrows of Foveaux Strait between Rugged Island and Sand Hill Point in the west and Bench Island and Waipapa Point in the east. A ridge (including aerial stacks and islands) is formed across the strait between The Neck and Waipapa Point. To the west of this ridge the strait shelves away gradually, to the east it falls steeply to approximately 75 m where the decreasing slope indicates the beginning of the Eastern Foveaux SED. This district is distinguished from those to the west and east by bands of cobbles and pebbles crossing the strait at the 'Ruapuke Ridge' and between Black Rock and Wakapatu Points. Between these coarse sediments are finer sands with patches of biogenic sediment, particularly near the northern shores of Stewart Island.

Hydrology The Southland residual and tidal currents have accelerated flows through the strait as a result of confinement over the shallow sill between South and Stewart Islands. This flow produces sediment scour which increases during storms. Near shore water close to the South Island is considerably altered by freshwater input otherwise subtropical water dominates the flow through the strait.

Biology *Tawera spissa* – *Venericardia purpurata* and *T. spissa* – *Diplodonta globus* communities have been recorded from sandy sediments. Commercial stocks of elephant fish, rig, monkfish, red cod, flounder, spiny dogfish and dredge oysters.

I-c Eastern Foveaux Shelf Ecological District

Marine Topography Eastwards sloping section of

SECTION I BACKGROUND AND APPROACH

INTRODUCTION

In response to a growing need to protect the biosphere from exploitation the International Union for Conservation of Nature and Natural Resources (IUCN) has devised The World Conservation Strategy (IUCN 1980). This strategy has three major goals:

- 1 To maintain essential ecological processes and life support systems on which human survival and development depend.
- 2 To preserve genetic diversity on which depend the functioning of many of the above processes and life support systems.
- 3 To ensure the sustainable utilisation of species and ecosystems.

One of the principal requirements for successfully achieving these goals is the establishment of a global system of ecologically representative protected natural areas (PNAs). To this end, broad biogeographical classifications of both terrestrial and marine environments have been adopted by IUCN, based on the work of Udvardy (1975) for land areas and Ray (1975) for marine environments. Ray's classification has been modified by Hayden *et al* (1984) and Salm and Clark (1984). On a national level biogeographical classifications have been used for conservation in marine and coastal environments in Australia (Rooney *et al* 1978), the United States (Cowardin *et al* 1979; Sanctuary Programs Office 1982), Britain (Nature Conservancy Council 1979) and coral reefs (Salm 1984). In this paper a classification for New Zealand is proposed.

NEW ZEALAND TERRESTRIAL CLASSIFICATION

The land area of New Zealand, which Udvardy classified as one province (with the exception of the Kermadec Islands) has in recent years been divided further into 83 Ecological Regions and 268 Ecological Districts (mapped at a scale of 1:500 000) (Simpson 1982; Biological Resources Centre (BRC) 1983). These biogeographical divisions are continually reviewed and amended at BRC. At the same time a methodology is being developed that will produce nationally comparable units (ecological classes) that are independent of the region and district framework.

New Zealand's contribution to meeting the IUCN objective of establishing a representative PNA network is therefore well underway on land. With the biogeographical framework in place, existing PNAs are being assessed and effort directed at identifying and securing areas that are poorly represented by the existing PNA system.

NEW ZEALAND MARINE CLASSIFICATION

A legal framework for the conservation of coastal and marine environments is contained within the Law of the Sea Treaty. Article 192(5) says that "States have the obligation to protect and preserve the marine environment". New Zealand as a signatory of this Treaty has established a 200 mile Exclusive Economic Zone which is divided into fisheries management areas. While there has been some progress in coastal ecological mapping

(Ballantine 1982), there is no detailed regional basis for general conservation.

Ray (1975) constructed a preliminary classification of the world's marine environment. He identified two zones in the New Zealand region, one comprising the main islands and the other the subantarctic islands (the position of the Kermadec Islands was not stated). This global classification has been refined by Hayden *et al* (1984). Within their classification mainland New Zealand is in the Eastern Temperate Coastal Realm and is divided into two provinces:

- 1 Auckland – north of Port Waikato and East Cape
- 2 Southern New Zealand – south of the Auckland Province

The offshore islands were not considered in this classification.

Knox (1975) reviewed the marine biogeography of New Zealand's benthic and shallow water faunas and recognised six provinces:

- 1 Kermadec – tropical/subtropical
- 2 Aupourian – transitional warm temperate water from northern North Island
- 3 Cookian – cold temperate mixed water from central New Zealand
- 4 Forsterian – transition between subantarctic cold temperate and the cold temperate mixed waters of southern South Island, Stewart and Snares Islands
- 5 Moriorian – subtropical convergence surrounding the Chatham Islands
- 6 Antipodean – subantarctic cold temperate water surrounding the subantarctic islands

The above biogeographical classifications of the marine areas of New Zealand are of such a large dimension that they are of limited value when considering a system of representative coastal and marine PNAs. These areas need to be divided into smaller units, as undertaken on land with the 'Ecological Districts and Regions' programme.

APPROACHES TO ECOSYSTEM CLASSIFICATION FOR CONSERVATION PURPOSES

There are major differences in structure and function between marine and terrestrial ecosystems. Consequently, a marine and coastal classification should not be approached in a manner which is identical to that on land (Hayden *et al* 1984). However in the coastal and nearshore zone many of the approaches developed for terrestrial conservation planning can be applied as a first approximation.

Salm and Clark (1984) consider classifying environments in two ways:

- 1 The genetic approach "uses biological and environmental criteria to identify discrete biogeographical units on the basis of their contained biota". Each unit has a unique set of species. This approach is essentially holistic.
- 2 The generic approach "uses geomorphological and biotic community characteristics to identify environments and to differentiate their habitats on the

basis of the community type". Habitats and environments are repeated within the unit. The approach is fragmentary and uses an hierarchical combination of criteria to produce a classification that associates geographically isolated areas.

The disadvantage of the genetic classification lies in the problem of integrating the necessary biotic data to produce a unit that is discrete and biogeomorphically unique. Boundaries tend to be less apparent with a reduction in size of the unit. Moreover, genetic classifications are usually terrestrial, boundary designation becomes increasingly difficult with distance offshore.

Generic classifications are better able to reflect environmental contrasts, particularly the more subtle changes in the sea. They do not encompass areas, but describe a central point without reference to adjacent areas hence boundaries are not an important part of the classification. However to accommodate the diversity of a unit the generic approach can become extremely complex, generating large numbers of subunits with the addition of each tier.

Both approaches tend to be hierarchical and move from a large unit which is subdivided into smaller units. An alternative method of classification is the integrated or synthetic approach (Mabbutt 1968). This requires the identification of biogeographical (ecological) entities that aggregate to successively higher orders. This is similar to the genetic approach in the sense of discrete biogeographical units ("Natural regions") but different in that it extends from a basic unit rather than subdivides.

AIMS AND APPROACH OF THIS STUDY

The aim of this study is to initiate the development of an ecological (biogeographical) framework for the purposes of planning and managing a system of representative marine and coastal PNAs. We believe that all three approaches (genetic, integrated and generic) can contribute to devising an overall system.

The genetic and integrated approaches have been adopted here to identify large administratively useful units that are discrete, ecologically distinct entities. These have been aggregated into large "natural" units to produce a national coverage of geographically ordered units of different sizes. This approach is considered important because it produces a geographical as well as ecological framework. A marine PNA system should not only contain representative habitats of New Zealand's marine environment but also the PNAs should be geographically separated to reduce the risk of localised environmental disaster. The above classification would accommodate this consideration.

This classification is not seen as the only way to plan an adequate coastal and marine representative PNA system. There is also a need for a generic classification to be developed whereby small ecological units can be identified to the level of actual PNAs yet be nationally comparable without being geographically continuous. By combining these two approaches an orderly planned system of PNAs for coastal and marine areas is conceivable.

The proposed classification has been designed to aid the development of a system of representative PNAs. However we recognise that other considerations in the

utilisation of the marine and coastal environment need to be considered (Department of Lands and Survey 1984a). These aspects, such as user group requirements, are beyond the scope of this study.

The district is the basic unit devised by this study. Its description depends on both biotic and abiotic components of the ecosystem. However, in some areas of New Zealand little data exist on the ecology of species and species relationships. Hence it has been necessary to initially examine physical features when identifying biogeographical areas. Ideally, the dynamic processes of ecosystems as well as their structure should be considered but until these data are available a classification based on physical parameters appears the most appropriate. This assumption is consistent with the global classifications of Ray (1975) and Hayden *et al* (1984). In time additional data, particularly biological, can be incorporated into this framework to refine descriptions of the ecosystems, and enable adjustment of the boundaries.

The classification needs to recognise diverse, unique and representative areas and thus a flexible approach has been required. Ideally the district complex should approximate an ecological unit that can be adequately represented by a small number, if not one, PNA. Criteria for district assignment has included uniform, or repetitive patterns of, topographical features, geomorphic processes, floral and faunal composition and abundance, and ecological function of organisms. This information has been obtained to an extent from general references such as Carter (1980), Carter and Heath (1975), Heath (1973, 1976), McKnight (1969), McLay (1976), Morton and Miller (1973), Tortell (1981), Coastal Chart Series (bathymetry and sediments), and more regionally oriented scientific literature.

In Section II all districts have been described as fully as possible on the basis of readily available data. It is hoped that these descriptions will help to explain district assignment and be sufficient to stimulate comment to improve the classification.

Identification of distinctive boundaries has proven difficult, especially in areas where little physical and biological information is available, or where gradual changes occur over large distances. Where possible the zone of change that separates areas has been described, otherwise, "the ecological character" that differentiates one area from another has been recorded without clearly delineating the boundary.

The format for each district follows a three-tier approach:

- 1 *Marine topography* – data on bathymetry and sediments from the benthic zone, and wave exposure and shore type for the littoral zone, have been used to formulate primary divisions.
- 2 *Hydrology* – these primary divisions are then refined by additional information on oceanographic features such as temperature, salinity and current pattern.
- 3 *Biology* – biological data are then integrated into this physical classification and the final ecological units defined.

Existing terrestrial PNAs that occur in the coastal strip have been included within the district descriptions (Department of Lands and Survey 1984b). Mimiwhangata and Tawharanui Marine Parks are also mentioned although their establishment post-dates the above report.

Existing Coastal PNAs Snares Islands Nature Reserve

26-9 Oreti Coastal Ecological District

Marine Topography Extending from Howells Point to Omaui Island this district consists of an embayment with flat, fine grained sandy beaches. The Aparima and Oreti Rivers enter this bay from the west and north, respectively.

Hydrology

Biology Beach contains commercial quantities of paddle crabs and toheroa.

Existing Coastal PNAs Waimatuku River Mouth Wildlife Refuge McDonald J F & C J Open Space Covenant

26-10 Toetoes Bay Coastal Ecological District

Marine Topography Section of gravel, cobble and boulder beaches from Stirling to Waipapa Points. The Maitara River enters the bay in the east over an extensive low coastal plain.

Hydrology

Biology

Existing Coastal PNAs Waituna Wetlands Scientific Reserve Awarua Bay Wildlife Refuge

26-11 Southland Wetlands Coastal Ecological District

Marine Topography Disjoint district containing the following bar built sheltered shores and coastal wetlands (from west to east): Jacobs River Estuary (125 ha), New River Estuary and Mokomoko Inlet (781 ha), Bluff Harbour and Awarua Bay (1,094 ha), Waituna Lagoon (281 ha) and Toetoes Harbour (281 ha).

Hydrology

Biology Unique moorlike vegetation characterised by herbs and shrubs adapted to cold peaty conditions usually found in montane or subalpine areas. Important area for migratory and local waders and waterfowl. Long and short-finned eels and inanga are present in the brackish water.

Existing Coastal PNAs Waituna Wetlands Scientific Reserve Joey's Island Scenic Reserve Otataru South Scenic Reserve Awarua Bay Wildlife Refuge

26-12 Catlins Coastal Ecological District

Marine Topography Repeating sequence of steep medium to coarse grained sandy beaches, exposed rock and cliff, and small sand and mud river estuaries from Waipapa Point to Kaka Point. This section of coast is made up of high resistant rock forming medium height coastal hills and cliffs.

Hydrology

Biology Economic stocks of crayfish, paua, octopus, blue cod and groper.

Existing Coastal PNA's Curio Bay Scientific Reserve Willsher Bay Scenic Reserve

Tunnel Rocks Scenic Reserve
Tuhawaiki Island Scenic Reserve
Purakanui Bay Scenic Reserve
Helena Falls Scenic Reserve
Tautuku Bay Scenic Reserve
Tahakopa Bay Scenic Reserve
Waikawa Harbour Scenic Reserve
Long Beach Scenic Reserve
Waipati Beach Scenic Reserve
Manuka Point Scenic Reserve
Catlins State Forest Park
Cosgrove Island and Rainbow Isles Wildlife Refuge

27 OTAGO COASTAL ECOLOGICAL REGION (Fig 5)

Repeating sequence of exposed rocky headlands protecting soft lee shores from the predominantly south, southeast wind. Notable exposed shores are Nugget Point (part of Catlins CED); Quoin Point; Otago Peninsula; Cornish Head; Shag, Moeraki, Aorere Points; and Cape Wanbrow. This region contains five districts – Clutha, Quoin Point, Taieri, Inner Otago Peninsula and Northern Otago.

27-1 Clutha Coastal Ecological District

Marine Topography Fine grained sandy beaches in the lee of Nugget Point extending from Kaka Point to Chrystalls Beach. Clutha and Tokomairi Rivers enter this district in the south and north, respectively.

Hydrology District influenced by freshwater and sediment inputs from the Clutha and Tokomairi Rivers. The Southland Current moving north is deflected away from this district by Nugget Point and local low salinity, variable temperature neritic water often moves south as a counter current depending on wind direction and strength.

Biology

Existing Coastal PNAs Nil

27-2 Quoin Point Coastal Ecological District

Marine Topography Section of high resistant exposed rocky shore from Chrystalls Beach to south of Taieri River mouth including Taieri Island. District is backed by medium height coastal hills and cliffs.

Hydrology Influenced by low salinity coastal water.

Biology Economic quantities of paua, mussel, blue cod and groper occur in this district.

Existing Coastal PNAs Bull Creek Scenic Reserve Taieri Island Scenic Reserve

27-3 Taieri Coastal Ecological District

Marine Topography Section of medium height coastal hills (cliffed) with steep medium to coarse grained sandy beaches interspersed with rocky outcrops extending from south of the Taieri River to Cape Saunders. This district includes the White and Green Islands. The frequency of rocky shore increases northwards toward the Otago Peninsula. The shore is exposed to the prevailing southerly winds.

Hydrology The Southland Current is forced close to the coast due to constriction of the shelf at Otago Peninsula. Neritic water is subsequently compressed against the shore.

Foveaux Strait. Exposed coastal cliffs on all sides of the islands but particularly exposed to westerly gales.

Hydrology

Biology Pristine vegetation including three threatened plants. Large breeding colony of NZ fur seal and breeding grounds for many sea birds. Groper, blue cod and crayfish occupy the rocky habitat near the islands.

Existing Coastal PNAs

Solander Island National Park Specially Protected Area

26-3 *Te Waewae Bay Coastal Ecological District*

Marine Topography Large embayment of low resistant material extending from Port Craig to Monkey Island. Te Waewae Bay contains a wide range of soft shore types from gravel, cobble and boulder beaches north of Port Craig and adjacent to the Waiau River. Between this shore type the beaches are flat and fine grained. East of the river gravel beaches tend to be mixed with sand until they become steep and medium to coarse grained at Monkey Island.

Hydrology

Biology In the northwestern corner of the bay cockles, toheroas and paddle crabs are economically important.

Existing Coastal PNAs

Pahia Scenic Reserve
Orepuke Dredge Holes Government Purpose Reserve

26-4 *Foveaux Coastal Ecological District*

Marine Topography Disjoint district of exposed rock and cliff from: Monkey Island to Howells Point (excluding Colac and Kawakaputu Bays); Omaui Island to Stirling Point; islands of Foveaux Strait; northern Stewart Island from Rugged Island to The Neck.

Hydrology District influenced by strong tidal currents, the Southland Current and the predominant westerly wind.

Biology Commercial stocks of crayfish, kina, paua, octopus, butterfish, moki, blue cod, groper, tarakihi, trumpeter. Haulout sites for NZ fur seal. Gulls, petrels and penguins present.

Existing Coastal PNAs

Whero Island Nature Reserve
Bench Island Nature Reserve
Bluff Scenic Reserve
Mores Scenic Reserve
Pig Island Scenic Reserve
Omaui Scenic Reserve
Christmas Village Scenic Reserve
Golden Bay Scenic Reserve
Maori Beach Scenic Reserve
Garden Mound Scenic Reserve
Little River Scenic Reserve
Baker Park Scenic Reserve
Ackers Point Scenic Reserve
East Cape Scenic Reserve
Lords River Islands Scenic Reserve

26-5 *Inner Stewart Island Coastal Ecological District*

Marine Topography Disjoint district containing the inundated, sheltered, rocky shores and protected estuaries and tidal flats of Paterson Inlet, Port Adventure and Port Pegasus.

Hydrology

Biology Important habitat for waders and oyster-catchers. Paterson Inlet contains quantities of paua, scallop, kina, mussel, cockle and pipi.

Existing Coastal PNAs

Paterson Inlet Islands Scenic Reserve
Kaipipi Scenic Reserve
Raroa Scenic Reserve
Deep Bay Scenic Reserve
Native Island Scenic Reserve
Ulva Scenic Reserve
Rakeahua Scenic Reserve
Glory Cove Scenic Reserve
Pegasus Scenic Reserve
Port Pegasus Islands Scenic Reserve
South Cape Scenic Reserve
Port Adventure Islands Scenic Reserve

26-6 *Western Stewart Island Coastal Ecological District*

Marine Topography High resistant western coastline of Stewart Island from Rugged Island to Southwest Cape including offshore islands. District contains exposed rock and cliff of the west coast and steep medium to coarse grained beaches of Mason and Doughboy Bays. Offshore islands, notably Codfish, Rugged, Ernest, Big Moggy and the Muttonbird Islands provide some protection to the lee shores.

Hydrology District is exposed to the prevailing westerly winds and splits the Southland current, moving it north through Foveaux Strait and south around South Cape.

Biology Economic stocks of crayfish, paua, mussel, octopus, butterfish, blue cod, tarakihi, moki and trumpeter.

Existing Coastal PNAs

Pegasus Nature Reserve
Codfish Island Scenic Reserve
South Cape Scenic Reserve

26-7 *Eastern Stewart Island Coastal Ecological District*

Marine Topography Coastline of high resistant rock from The Neck to Southwest Cape including North and South Trap. Exposed to the south and east but sheltered from the predominant westerly storms.

Hydrology District in the lee of the Southland Current.

Biology Major stocks of paua, crayfish, octopus, moki, butterfish, tarakihi, groper, trumpeter, and blue cod. Gulls, petrels and penguins are common.

Existing Coastal PNAs

Pegasus Nature Reserve
South Cape Scenic Reserve

26-8 *Snares Islands Coastal Ecological District*

Marine Topography Exposed island group at the southern limit of this region. Main island consists of high coastal cliffs of resistant granite.

Hydrology

Biology Islands are occupied by NZ fur seal and Hooker's sealion. Breeding grounds for 23 species of birds (3 endemic). Littoral inhabitants have a strong affinity to the southern South Island but also contain species of subantarctic origin.

The area investigated in this study is from the coastal zone to the shelf break. It is subdivided into two major areas – coastal and shelf. The continental slope, rise and offshore island platforms within the EEZ are excluded and it would be desirable to extend the classification beyond the shelf edge in the future.

- 1 **Coastal** – extending from the sublittoral zone to merge, where possible, with the terrestrial ecological regions and districts. The inland limit may reach the terrestrial extent of marine influence including such habitats as dune and wetland systems, and lowland forest. The seaward limit may extend beyond the sublittoral zone on occasions to marked bathymetric or sediment changes down to 60 m where the affect of wave surge is still evident on exposed coasts (Carter and Heath 1975). In most cases coastal districts are geographically distinct but on occasion disjoint districts were created where areas of similar ecological character are separated by shelf or dissimilar coastline.
- 2 **Shelf** – extending from the coastal zone to the shelf break defined as the change in slope at approximately 130-200m. To some extent the seaward limit is arbitrary but tends to correspond with the maximum depth of the euphotic zone and the affect of seasonal changes (Marshall 1979). Benthic changes are more marked than changes in the water column at the shelf break, however the transition from neritic to oceanic water is usually complete beyond the shelf. On two occasions districts extended beyond the shelf (Cook Strait and Northern Northland) where hydrology and proximity of mainland shelf override the bathymetric criteria of the shelf break.

To allow adequate description and classification of a range of ecological and geographical features in the marine environment, particularly in coastal areas, districts have been aggregated to **regions** which in turn combine to form **territories**. Large areas that are ecologically distinctive can be given both district and region status. Shelf and coastal districts and regions are treated independently but are combined in the largest unit, the neritic territory.

SUMMARY

- 1 This is a preliminary classification intended to stimulate discussion on improving the methodology and ultimately the ecological framework that can be used by planners and managers to develop a system of representative PNAs.
- 2 The area covered is the coast and continental shelf. The approach is essentially integrative, with the smallest unit, the district, aggregating into the successively larger region and territory.
- 3 Each district has been delineated by its position in the coastal or shelf zone and defined by information readily accessible on topography, hydrology and biology.

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transition zone between cold temperate mixed and sub-antarctic cold temperate waters.

COASTAL ECOLOGICAL REGIONS AND DISTRICTS

25 FIORD COASTAL ECOLOGICAL REGION (Fig 5)

Area extending from Stripe to Puysegur Points and seaward to the 200 m contour. This region consists of high resistance gneiss indented by glacier cut fiords. The height of the fiords decreases towards the south. Each fiord typically has sheltered, steep sided basins (up to 200 m) separated from the exposed coast by moraine or rock sills. These obstructions at the entrances of the fiords may extend beyond the exposed coastline to form offshore terraces that are indented by canyons. No significant area of shelf is found in this region, the continental slope descending rapidly from the shore to 4500 m. This region contains two districts – Inner Fiord and Outer Fiord.

25-1 Inner Fiord Coastal Ecological District

Marine Topography This district contains 13 fiords: Milford, Bligh, George, Caswell, Charles, Nancy, Thompson, Doubtful, Dagg, Breaksea, Dusky Sounds and Chalky and Preservation Inlets. The district is delineated seawards by the beginning of the sheltered shores at the entrance to the fiords and the inner slopes of the entrance sills. The sheer walls extend to considerable depths with limited development of beaches, estuaries, shore platforms or other littoral biotopes. Low rates of sediment deposition occur within the fiord system due to the well vegetated catchment.

Hydrology Large freshwater input forms a low salinity layer moving seawards. This is darkened with forest tannin after heavy rainfall. Forest detritus is often suspended at the discontinuity layer. The deeper basin water is similar to that of the outer coastal terrace, possibly renewing from over the entrance sill during sea surface minimum temperatures and maximum salinities. At times during the year basin water may be isolated and become anaerobic in character. The reduced light, steep rock walls and low current regimes combine to produce a cave like environment.

Biology Podocarp/beechn forest forms the catchment for the district. Euryhaline species adapted to rapid changes in salinity with tidal fall and periods of heavy rain characterise the littoral flora and fauna. With increasing depth coelenterates (notably black coral), brachiopods, and serpulid polychaetes form the dominant fauna. At the bottom of the fiord basins conditions tend to become anaerobic and highly organic. *Echinocardium*, *Amphiura rosea* – *Dosinia greyi*, *A. rosea* – *Gari lineolata*, *Neilo australis* – *Brassopsis oldhami*, *Scalpomactra scalpellum* – *Mactra ordinaria*, *Glycymeris laticostata* – *Venericardia purpurata* and *Nemocardium pulchellum* – *D. lambata* communities occupy much of this soft bottom environment.

In addition to changes of species with depth a transition of littoral species occurs from the head to the entrance of the fiords. The transition is associated with greater exposure to light and, nearer the entrance, wave action.

The fish found in the fiord environment include giant and banded kokopu in streams feeding the fiords; sea run trout; spotties, spiky dogfish and sea perch near the fiord

head; and blue cod, red cod, rough skate, conger eels, seven gill sharks, rig, kingfish, school shark, tarakihi and some crayfish near the entrance. Scallops are found in the central to outer areas of the fiords.

Existing Coastal PNAs

Fiordland National Park

Secretary Island National Park Specially Protected Area

25-2 Outer Fiord Coastal Ecological District

Marine Topography Area of high coastal hills and mountains (cliffed) with exposed rock and rock platforms extending into the fiords as far as the sill edge. This district reaches out to the continental slope including the terraces of the fiord entrances and shelf furrows but excludes the heads of the shelf canyons. In the absence of any appreciable shelf the district is delineated by the 200 m contour.

Hydrology The coastal environment is influenced by the exchange of saltwater and freshwater from the fiords. The Southland Current moves south along this coast before moving east off Puysegur Point and into Foveaux Strait.

Biology Exposed shore of *Littorina cincta*, *Bostrychia arbuscula*, *Chamaesipho columna* and *Durvillea antarctica* with communities of *Nemocardium pulchellum* – *Venericardia purpurata* at the fiord entrances. Important commercial grounds for crayfish. Also present are groper, bass, blue cod, bluenose, tarakihi, butterfish, moki, scallop, kina, paua and mussel. Marine birds are abundant in the area including gull, tern, petrel, penguin and shag. NZ fur seal haulout areas are found along this coast.

Existing Coastal PNAs

Fiordland National Park

Secretary Island National Park Specially Protected Area

26 SOUTHLAND COASTAL ECOLOGICAL REGION (Fig 5)

Region extending from Puysegur to Kaka Point including the offshore islands south to the Snares. This region is characterised by a repeating sequence of hard and soft exposed shores. It contains 12 districts – Long Point, Solander, Te Waewae Bay, Foveaux, Inner Stewart Island, Western Stewart Island, Eastern Stewart Island, Snares Islands, Oreti, Toetoes Bay, Southland Wetlands, and Catlins.

26-1 Long Point Coastal Ecological District

Marine Topography Area between Puysegur Point and Port Craig. Predominantly exposed high resistant rock and cliffed shore in the west grading into less resistant, lower relief coastline in the east. A section of mixed sand and gravel beach occurs to the west of Sand Hill Point.

Hydrology

Biology Economic stocks of paua, kina, crayfish and octopus.

Existing Coastal PNAs

Fiordland National Park

26-2 Solander Island Coastal Ecological District

Marine Topography Two islands (Solander and Little Solander) and outlying islets in the western entrance to

Turnagain Banks north to a boundary east of Cape Kidnappers where a band of sandy mud and the Lachlan Banks indicate the Poverty Bay SED. This boundary occurs where the shelf broadens both offshore and into Hawkes Bay. The shelf is smooth and gradually sloping with fine sands inshore and muds on the outer shelf. A notable indentation of the shelf lies to the north of the Turnagain Banks where sandy mud extends across the shelf to the Madden Depression.

Hydrology The inner and middle sections of shelf experience storm surges. The boundary of the East Cape and Southland Currents lies to the south while to the north, neritic water from Hawke Bay enters the district, moving mud and low salinity water south.

Biology Communities of *Scalpomactra scalpellum* – *Maetra ordinaria* are recorded from this district on sand to mud substrate. The district also contains commercial quantities of snapper, trevally, tarakihi, gurnard, warehou, rig, groper, monkfish, albacore tuna and ling.

H-c Hawke Bay Shelf Ecological District

Marine Topograhy This district is semi-exposed, sheltered to the north by Mahia Peninsula and by Cape Kidnappers in the south. It is separated from the southern district by the narrowing of the shelf. The northern and eastern boundary of this district is the complex topography of the Lachlan Ridge and Banks and the shoals off Portland Island in the Poverty Bay SED. The bay floor is a featureless plain gently sloping seawards and represents the largest and least exposed shelf area in this region. It consists of a central zone of pebbles and muddy sand surrounded by a mud belt. Near the coast sand encircles the bay, with zones of gravel off the Mohaka and Tukituki Rivers. The district is affected by storm surges with sediments tending to move to the north (coarser fractions) during winter and muds south in summer.

Hydrology This district has distinct low saline, cool neritic water near shore in winter. Warm oceanic water enters the bay at the centre and branches to the north and south, leaving at Portland Island and Cape Kidnappers respectively. The neritic water of Hawke Bay tends to be more productive than outer shelf water and has a distinctive coastal planktonic fauna. Tidal currents move to the north during the flood and south in the ebb.

Biology *Monamphiura aster* – *Nucula nitidula* communities on muddy sands and muds and *Tawera spissa* – *Venericardia purpurata*, *Glycymeris laticostata* – *V. purpurata* and *Nemocardium pulchellum* - *V. purpurata* communities on sands and gravels. In addition snapper, trevally, tarakihi, gurnard, flatfish, albacore and skipjack tuna are caught in commercial quantities.

SOUTHERN NERITIC TERRITORY (Fig 1; Fig 5)

This territory is enclosed by the coastal zone between Stripe Point (Fiordland) and Cape Wanbrow (North Otago) and the shelf edge south of Snares Island. The western limit is where the shelf widens at Five Finger Peninsula. To the east the shelf is delineated by the limit of coarse gravels and sands north of Otago Peninsula. The shoreward side of the boundary to some extent follows the “drowned spit” northwards from Karitane

H-d Poverty Bay Shelf Ecological District

Marine Topography Extending from the Lachlan Ridge north to Tolaga Bay the complex shelf topography of this district distinguishes it from the more uniform shelf to the south and north. It contains banks and ridges notably the Lachlan and Ariel Banks. The shelf edge is highly indented, the largest being the Poverty Bay Canyon. This district contains a greater fraction of sand and gravel on the outer shelf than adjacent SEDs. It includes shelf where bare mudstone is exposed, areas of limited terrigenous sedimentation and areas of volcanic and authogenic sediments.

Hydrology The East Cape Current moves south through the district. The inner shelf is exposed to storm surge.

Biology Communities of *Scalpomactra scalpellum* – *Maetra ordinaria* occur on sand to mud substrates. Commercial catches of trevally, rig, ling, groper, bluenose, mackerel, snapper, tarakihi, crayfish, albacore and skipjack tuna occur here.

H-e Tokomaru Bay Shelf Ecological District

Marine Topography District of smooth shelf topography with sands grading to muds at the shelf edge. To the south and north sediments become coarser and the shelf more complex. This district ends in the north where sandy muds cross the shelf off the Waiapu River Mouth to begin the East Cape SED.

Hydrology The southward flowing East Cape Current and storm surges influence the district.

Biology Commercial catches of snapper, trevally, tarakihi, gurnard, groper, bass, bluenose and albacore tuna.

H-f East Cape Shelf Ecological District

Marine Topography The East Cape SED is the most northern district of the Central Neritic Territory and consists of coarse sands, muds and shell banks around East Cape. The southern boundary lies off the Waiapu River mouth while the northern border occurs with the widening of shelf at Matakaoa Point. The Ranfurly Saddle and Banks are prominent features of the district.

Hydrology District is exposed to storms from the north, east and south. The East Auckland Current diverges in the north with a portion flowing south as the East Cape Current.

Biology *Nemocardium pulchellum* – *Venericardium purpurata* communities are recorded on gravelly sand to mud substrates. Crayfish, snapper, trevally, tarakihi, gurnard, kingfish, groper, bass, bluenose and ling are caught in commercial quantities.

township. The boundary then extends east to the Karitane Canyon.

The Southern Neritic Territory approximates the Fosterian Province. It is influenced at times by cold sub-antarctic water and at others by warmer mixed water of the Southland Current. This territory has floral and faunal affinities with the Subantarctic and forms a

SECTION II DESCRIPTION OF ECOLOGICAL AREAS

INDEX TO DISTRICT AND REGION DESCRIPTIONS

In this index each district and region is coded with numbers or letters depending on whether it is coastal or shelf. As an example, the Cape Runaway Coastal Ecological Region (CER) is coded ‘1’ and the Cape Runaway Coastal Ecological District (CED) ‘1-1’. Similarly the Eastern Auckland Shelf Ecological Region (SER) is ‘A’ and the Bay of Plenty Shelf Ecological District (SED) is ‘A-a’. This code is used in the main text and operates as the key to the following figures

Rather than moving in a north-south direction we have decided to describe the districts and regions as they lie within their respective territories. Thus the Northern Neritic Territory begins with the Cape Runaway CER, moves north along the east coast of Northland and south down the west coast to end with the Waikato CER. The Central Neritic Territory continues from this point, moving south along the west coasts of the North and South Islands to the western boundary with the Southern Neritic Territory and then north along the east coasts to East Cape CER. The southern Neritic Territory begins in the west with Fiord CER and ends in the east with Otago CER. The relevant shelf areas are described after the coastal constituents of each territory.

NORTHERN NERITIC TERRITORY (Fig 1; Fig 2)

Coastal Ecological Regions	Coastal Ecological Districts	Code
Cape Runaway	Cape Runaway	1-1
Bay of Plenty	Tauranga	2-1
	Ohiwa Harbour	2-2
	Tauranga Harbour	2-3
	White Island	2-4
	Motiti	2-5
Eastern Coromandel	Tairua	3-1
	Coromandel Islands	3-2
Inner Hauraki Gulf	Colville	4-1
	Outer Thames	4-2
	Inner Thames	4-3
	Tamaki	4-4
	Outer Waiheke	4-5
	Rangitoto	4-6
	Waitemata Harbour	4-7
	Whangaparaoa	4-8
Outer Hauraki Gulf	Great Barrier	5-1
	Outer Gulf Islands	5-2
	Bream	5-3
Eastern Northland	Whangarei Harbour	6-1
	Whangarei	6-2
	Bay of Islands	6-3
	Cavalli	6-4
	Whangaroa Harbour	6-5
	Doubtless Bay	6-6
Eastern Aupouri	Great Exhibition Bay	7-1
	Rangaunu Harbour	7-2
	Houhora Harbour	7-3
	Parengarenga Harbour	7-4
Te Pahi	Te Pahi	8-1
Three Kings Islands	Three Kings Islands	9-1
Western Northland	Ninety Mile Beach	10-1
	Hokianga	10-2
	Hokianga Harbours	10-3
	Kaipara	10-4
	Kaipara Harbour	10-5
Waikato	Western Auckland	11-1
	Manukau Harbour	11-2
	Waikato River Mouth	11-3
	Kawhia Harbours	11-4
	Ngarupupu	11-5
Eastern Auckland	Bay of Plenty	A-a
	Outer Hauraki Gulf	A-b
	Inner Hauraki Gulf	A-c
	Eastern Northland	A-d
Northern Northland	Northern Northland	B-a
Western Auckland	Western Northland	C-a
	Kaipara	C-b
	Waikato	C-c
	Northern Taranaki Bight	C-d

CENTRAL NERITIC TERRITORY (Fig 1; Fig 3; Fig 4)

Coastal Ecological Regions	Coastal Ecological Districts	Code
Taranaki	Tongaporutu	12-1
	Egmont	12-2
	Patea	12-3
Manawatu	Manawatu	13-1
Sounds	Queen Charlotte	14-1
	Pelorus	14-2
	Outer Sounds	14-3
Nelson Bays	Boulder Bank	15-1
	Tasman Bay	15-2
	Separation Point	15-3
	Golden Bay	15-4
	Farewell Spit	15-5
Buller	Northwestern Nelson	16-1
	Whanganui Inlet	16-2
	Heaphy	16-3
	Karamea	16-4
	Mokihinui	16-5
	Foulwind	16-6
	Punakaiki	16-7
Western South Island	Hokitika	17-1
	Okarito	17-2
	Paringa	17-3
	Haast	17-4
	Cascade	17-5
Canterbury Bight	Canterbury Bight	18-1
Banks	Inner Banks	19-1
	Ellesmere	19-2
	Outer Banks	19-3
Pegasus Bay	Pegasus Bay	20-1
Marlborough	Motunau	21-1
	Cheviot	21-2
	Kaikoura	21-3
	Kekerengu	21-4
	Cloudy Bay	21-5
	Cloudy Bay Wetlands	21-6
Wellington	Kapiti	22-1
	Porirua Harbour	22-2
	Southern Wellington	22-3
	Wellington Harbour	22-4
	Palliser Bay	22-5
	Eastern Wairarapa	22-6
	Southern Hawkes Bay	22-7
Hawke Bay	Hawke Bay	23-1
East Cape	East Cape	24-1
Cook	Egmont	D-a
	Farewell	D-b
	Southern Taranaki Bight	D-c

Shelf Ecological Regions	Shelf Ecological Districts	Code	Coastal Ecological Regions	Coastal Ecological Districts	Code
Buller	Manawatu	D-d	Southland	Long Point	26-1
	Cook Strait	D-e		Solander	26-2
	Tasman Bay	D-f		Te Waewae Bay	26-3
	Separation Coral	D-g		Foveaux	26-4
	Golden Bay	D-h		Inner Stewart Island	26-5
				Western Stewart Island	26-6
	Karamea	E-a		Eastern Stewart Island	26-7
	Kahurangi	E-b		Snares Islands	26-8
				Oreti	26-9
				Toetoes Bay	26-10
Western South Island	Hokitika	F-a	Otago	Southland Wetlands	26-11
	Cascade	F-b		Catlins	26-12
Canterbury	Canterbury Bight	G-a		Clutha	27-1
	Pegasus	G-b		Quoin Point	27-2
	Kaikoura	G-c		Taieri	27-3
Eastern North Island				Inner Otago Peninsula	27-4
	Eastern Wairarapa	H-a		Northern Otago	27-5
	Southern Hawke's Bay	H-b			
	Hawke Bay	H-c			
	Poverty Bay	H-d			
	Tokomaru Bay	H-e			
	East Cape	H-f			
SOUTHERN NERITIC TERRITORY (Fig 1; Fig 5)					
Coastal Ecological Regions	Coastal Ecological Districts	Code	Shelf Ecological Regions	Shelf Ecological Districts	Code
Fiord	Inner Fiord	25-1	Foveaux	Western Foveaux	I-a
	Outer Fiord	25-2		Foveaux Strait	I-b
			Snares	Eastern Foveaux	I-c
				Otago	I-d
				Snares	J-a

Hydrology This district is influenced by the north flowing Southland Current with its inshore neritic, central subtropical and shelf edge subantarctic waters.

Biology Communities of *Amphiura rosea* – *Gari lineolata*, *Tawera spissa* – *Venericardia purpurata*, *T. spissa* – *Diplodonta globus* and *Glycymeris laticostata* – *V. purpurata* are recorded on a variety of substrates from gravel to mud. Important areas for harvesting of elephant fish, flatfish, ling, trevally, rig, school shark, spiky dogfish, red cod, groper, tarakihi, gurnard, barracouta, warehou, arrow squid and paddle crab.

G-b Pegasus Shelf Ecological District

Marine Topography District delineated in the south by the coarse sediments of Canterbury Bight SED and to the north by the narrowing of shelf at the Kaikoura Canyon. The shelf is of smooth topography with muds in Pegasus Bay and coarse sands and gravels at the shelf edge and either side of the Waiau River mouth.

Hydrology In this district subantarctic water is the inshore component of the north flowing Southland Current. A small anti-clockwise gyre in Pegasus Bay reinforces the districts unity.

Biology *Neilo australis* – *Brissopsis oldhami* communities are recorded on mud substrates. Commercial fishing for trevally, elephant fish, gurnard, red cod, spiky dogfish, rig, barracouta, ling, flatfish and arrow squid occur here.

G-c Kaikoura Shelf Ecological District

Marine Topography This district has been determined by the sequence of sands and silts grading to fine muds at the mid and outer shelf. It is delineated by the constriction of the shelf at Goose Bay in the south. The Flaxbourne Depression (offshore from the Flaxbourne and Waima Rivers) is the northern boundary of the district. Here sands, gravels and cobbles are the first indication of the influence of the strong tidal flows and storm surges of Cook Strait. The outer limit of this district is the steep shelf break into the Hikurangi Trench.

Hydrology The northwards flowing Southland Current branches east at the southern limit of this district and at Cape Campbell in the north where part of the flow moves into Cook Strait and the remainder moves northeast to the North Island. Off Cape Turnagain the East Cape Current turns to the northeast and forms a permanent anticyclonic eddie at this position. Smaller eddies are shed off from this and move southwest through the district bringing periodic high salinity and temperature water to the Kaikoura Coast. These eddies interfere with the northwards passage of the cooler low saline Southland Current.

Biology Communities of *Neilo australis* – *Brissopsis oldhami*, *Scalpomactra scalpellum* – *Mactra ordinaria* and *Nemocardium pulchellum* – *Dosinia lambata* are found on mud to sand substrates. Commercially important fish species include barracouta, red cod, flatfish, groper, warehou and gurnard.

H EASTERN NORTH ISLAND SHELF ECOLOGICAL REGION (Fig 3)

This region extends from Cape Palliser in the south to Matakaoa Point in the north. The southern limit is at the

band of gravel, gravelly sand and shell bank at Cape Palliser in the Cook SER. The northern limit of this region (and territory) is at the narrowing of shelf at Matakaoa Point. To the east of this boundary the shelf is narrow and of coarse terrigenous and biogenic sediment while to the west in the Bay of Plenty SER the shelf widens and finer sandy silts feature along the outer portion.

The shelf is exposed to the south and east. It is narrow but tends to widen slightly towards the north with the largest areas of shelf off Hawke Bay. It has a highly indented shelf break at the seaward limit of the region. The section of slope from Wairarapa to Hawke Bay is highly modified by ridges, basins and troughs.

The shelf is covered by medium to fine sand grading into mud at the shelf edge. This region receives large inputs of fine sediment, particularly from the poorly lithified margin of Hawke Bay. The sedimentation rate appears greater than the capacity of the hydrolic regime to remove it.

The current pattern for this region is as follows. The warm saline East Auckland Current branches at East Cape with some of the flow moving south as the East Cape Current and the remainder turning to the north. In the south, water of the Southland Current mixes with the D'Urville Current and water derived from the East Cape Current in the Cook Strait Canyon. This mixture of all three current moves east to combine with a branch of the Southland Current and moves up the Wairarapa Coast to meet the south flowing East Cape Current (usually) off Cape Turnagain. These currents then move south then east out of the region. The Southland Current may extend to Gisborne at times and tends to be inshore while the East Cape Current moves south over the shelf edge and beyond.

In this region six districts have been identified – Eastern Wairarapa, Southern Hawkes Bay, Hawke Bay, Poverty Bay, Tokomaru Bay and East Cape.

H-a Eastern Wairarapa Shelf Ecological District

Marine Topography District extends from the Cape Palliser gravels to the Turnagain Banks. The shelf is narrow in the south and expands slightly in the north. In addition to the Turnagain Banks this district contains other small banks and ridges, notably the Kaukau and Adams Banks in the south. The shelf break is pronounced in the south and indented by the Opouawe, Pahaua and Honeycomb Canyons. Sediments tend to be coarser on the narrow shelf to the south while finer muds occur on the outer shelf in the north. These sediments are affected by storm surges on the inner and mid shelf.

Hydrology Cool water dominated by the Southland Current moves north along the coast to meet the East Cape Current at the northern limit of this district, Cape Turnagain.

Biology Communities of *Amphiura rosea* – *Dosinia greyi* on muddy sands and muds and *Tawera spissa* – *Venericardia purpurata* and *Glycymeris laticostata* – *V. purpurata* on sands and gravels have been recorded. The district contains commercial stocks of snapper, trevally, tarakihi, gurnard, rig, groper, monkfish, school shark, red cod, ling and barracouta.

H-b Southern Hawkes Bay Shelf Ecological District

Marine Topography This district extends from the

wards, becoming more discernible towards Cape Farewell where part of the flow moves eastwards as the D'Urville Current into Cook Strait. Salinity and temperature maxima occur near the shelf edge. Cold water upwelling off the Kahurangi Shoals contributes to the designation of the northern boundary of the district.

Biology Communities of polychaete – *Tellinella charlottae*, *Scalpomactra scalpellum* – *Macra ordinaria*, and *Glycymeris laticostata* – *Venericardia purpurata* are recorded in this district. Sand flounder, red cod and tarakihi are caught in commercial quantities. Albacore and southern bluefin tuna are present for part of the year.

E-b Kahurangi Shelf Ecological District

Marine Topography Area of gravelly sediment and hard bottom extending from the coastal zone offshore from Pillar and Kahurangi Points to the 70 m contour. District includes the Kahurangi Shoal (18 m) Paturau Bank (37 m) and Paturau Shoal (18 m).

Hydrology Reduction of depth concentrates the northeast flowing Westland Current.

Biology Communities of *Tawera spissa* – *Venericardia purpurata* and *Glycymeris laticostata* – *V. purpurata* are recorded on gravel and sands. Economically important area for crayfish and trevally.

F WESTERN SOUTH ISLAND SHELF ECOLOGICAL REGION (Fig 4)

Region delineated by the Hokitika Canyon in the north, the limit of the continental shelf in the west, West Coast CER in the east and the termination of major shelf area at Kaipo Bay in the south. This is a thin strip of shelf indented by submarine canyons with a high terrigenous sediment input. Region contains two districts – Hokitika and Cascade.

F-a Hokitika Shelf Ecological District

Marine Topography District extends from the Hokitika Canyon to the canyon north of the Arawata Canyon off Jackson Head. This is a thin strip of shelf indented by Hokitika, Cook, Moeraki and Haast Canyons. Sediments grade from sand to mud in the central part of the shelf then increase in coarseness towards the shelf edge. The central area of mud does not occur in appreciable quantities north of the Hokitika Canyon until the Karamea Bight. Input of terrigenous sediment is greater in this district than north of the Hokitika Canyon.

Hydrology District has an indistinct current pattern. Weak inshore moving Tasman Current (concentrating along the southern slopes of the Challenger Plateau) diverges to form the north flowing Westland Current in the vicinity of the Hokitika Canyon. Inshore moving water in this district is either driven north or south depending on wind direction and strength. The southern limit of this district tends to coincide with the origins of the south flowing Southland Current off Jacksons Head.

Biology Polychaete – *Tellinella charlottae*, *Scalpomactra scalpellum* – *Macra ordinaria*, *Tawera spissa* – *Diplodonta globus* and *Nemocardium pulchellum* – *Venericardia purpurata* communities are reported on mud to sand substrate. Commercial stocks of sand flounder, snapper, red cod, ling, bass, tarakihi, bluenose, groper, barracouta, rig, gurnard, skipjack, albacore and

southern bluefin tuna. The head of the Hokitika Canyon is an important breeding ground for hoki.

F-b Cascade Shelf Ecological District

Marine Topography Very narrow strip of shelf from the canyon north of Arawata Canyon to the termination of the shelf in the vicinity of Kaipo Bay. Shelf adjacent to an extremely steep continental slope (decending over 4 000 m to the base of the Haast Canyon) and highly indented with submarine canyons.

Hydrology South moving Southland Current forms at the northern limit of this district.

Biology

G CANTERBURY SHELF ECOLOGICAL REGION (Fig 4)

This region is delineated by the change from fine to coarse sediments offshore from Karitane in the south to the Flaxbourne Basin in the north. The outer limit lies along the shelf break which grades slowly into the slope for much of the region as a result of the Chatham Rise to the east. In the south, the shelf slopes more steeply, with the Waitaki Canyon forming a notable indentation. In the north the shelf plunges steeply into the Hikurangi Trench, with major indentations from the Kaikoura and Pegasus Canyons and the Conway Trough. Modern terrigenous sediments make up the major fraction of inshore sediments, with sands and gravels off major rivers in the south and fine muds in Pegasus Bay and north of Kaikoura. Relict sediment of medium to fine sand dominates the outer shelf and is interspersed with muds and coarse sand fractions north of Banks Peninsula.

The hydrology of this region is dominated by the north flowing Southland Current which consists of inner neritic, central subtropical and outer subantarctic water (the Southland Front). This current follows the shelf edge up to Banks Peninsula where some of the flow moves east along the Chatham Rise as part of the subtropical convergence. North of Banks Peninsula the subantarctic portion becomes the inshore part of the flow. At Kaikoura the Southland Current diverges, with one part moving to the east and the remainder moving north to diverge again at the northern limit of the region, either into Cook Strait or northeast towards the North Island.

This region contains three districts – Canterbury Bight, Pegasus and Kaikoura.

G-a Canterbury Bight Shelf Ecological District

Marine Topography Large area of smooth gently sloping shelf of medium to fine sands extending from the coarse sediments south of Karitane to a transition of finer sediments between Banks Peninsula and the Pegasus Canyon in the north. This district is characterised by the smoothness of the bottom topography sloping gently towards the Bounty Trough and Mernoo Gap. It has a symmetrical sediment distribution grading from coarse to fine both along the shore towards the centre of the district and towards the shelf break. Most of the district comprises medium to fine sands but grades from coarse gravels at the mouths of major rivers (notably off the Waitaki and between the Rangitata and Rakaia), to fine muds in the central part of the Canterbury Bight.

Figure 1 The coastal and shelf ecological regions of New Zealand

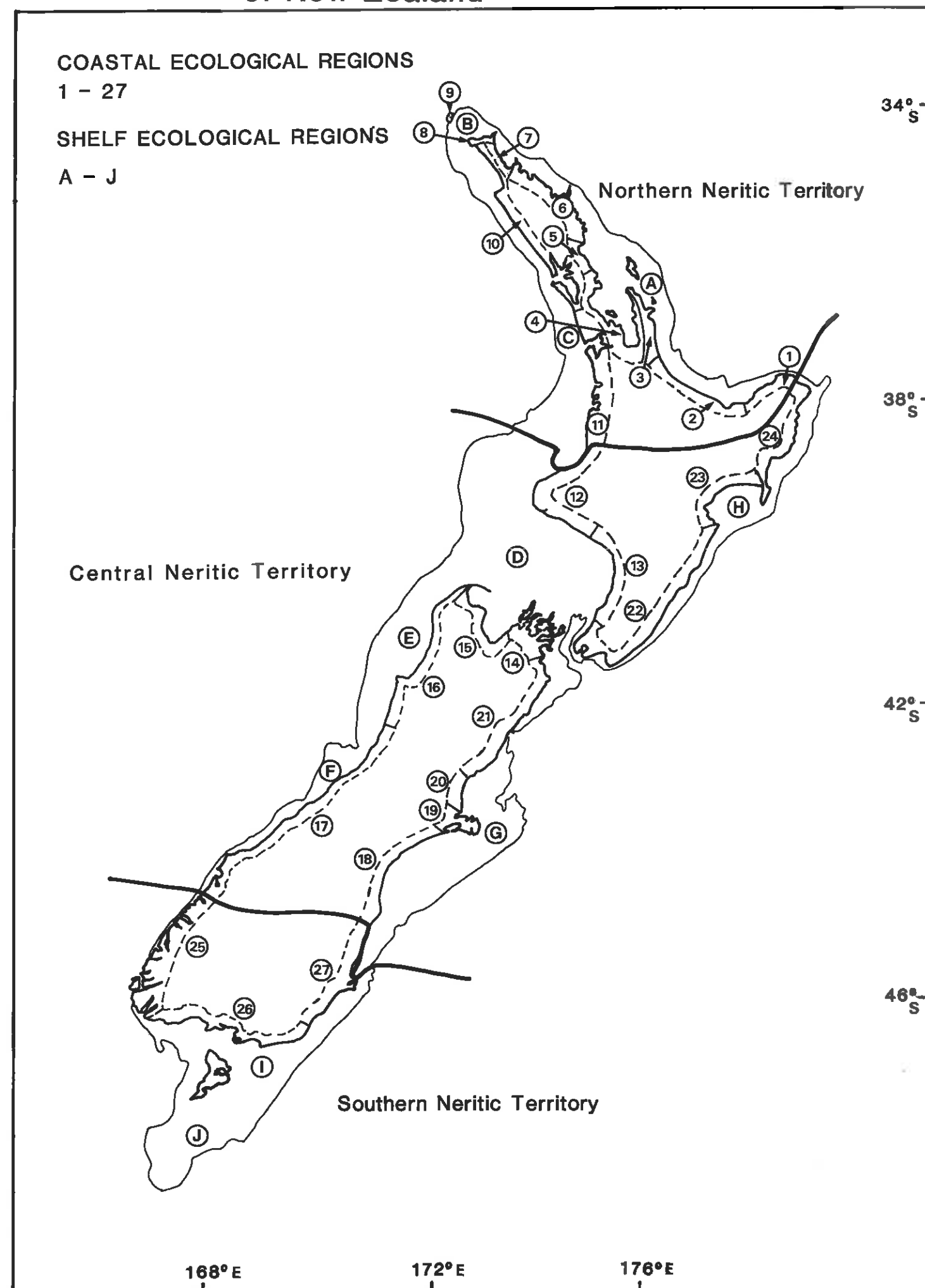
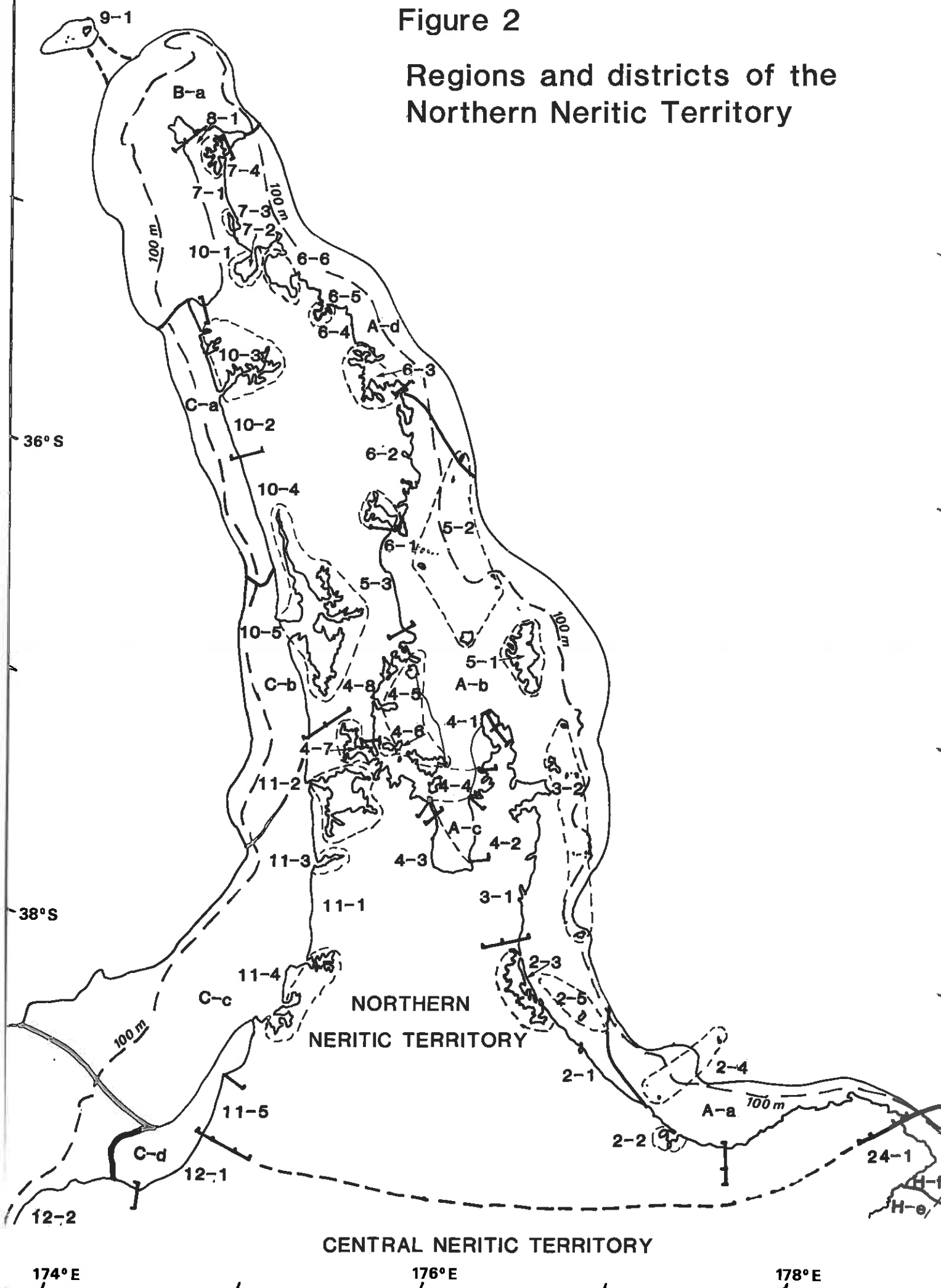


Figure 2
Regions and districts of the Northern Neritic Territory



Biology Mud associated communities of *Nemocardium pulchellum* – *Pleuromeris zelandica* occur. There are near shore commercial quantities of snapper, trevally, tarakihi, flatfish, barracouta, kahawai and mackerel, with mackerel also being taken in deeper water.

D-e Cook Strait Shelf Ecological District

Marine Topography This district consists of the northern and southern entrances of Cook Strait and its narrows. It extends west from Kapiti Island to Stephens Island in the north and between Capes Palliser and Campbell in the south. Sands, muddy sands, sandy gravels and shell beds occur at the northern and southern entrances and gravels are found in the Strait Narrows. Due to the dominating influence of hydrology over bathymetry this district includes the Narrows Basin and Terawhiti Sill which are below the shelf break at the head of the Cook Strait Canyon.

Hydrology Very strong tidal flows occur through the Strait. In addition the D'Urville Current moves south through the Strait to meet the East Cape and Southland Currents in Cloudy Bay and off Cape Campbell. The East Cape Current may at times move through the Strait to Kapiti Island. In doing so it occupies the Cook Strait Canyon and converges with the D'Urville Current in the narrows. The funnel effect of Cook Strait also concentrates wind generated storms from the north and south. In combination these three factors affect sediment patterns, moving coarse fraction across the seabed.

Biology The following communities have been recorded from this coarse sediment, strong current habitat: *Nemocardium pulchellum* – *Dosinia lambata*, *Scalpomactra scalpellum* – *Mactra ordinaria*, *Glycymeris laticostata* – *Venericardia purpurata*, *Tawera spissa* – *V. purpurata*. There are important fisheries for snapper, blue cod, groper, spiky dogfish, school shark, warehou, kahawai, bass, rig, trevally, butterfish, moki, red cod, flatfish, barracouta and tarakihi.

D-f Tasman Bay Shelf Ecological District

Marine Topography Area defined by a graded sequence of sand and silty sands to muds in the central parts of Tasman Bay. The district is delineated by the Separation Point, Tasman Bay, Boulder Bank, Western Sounds CEDs, the bryozoan coral beds off Separation Point and the reappearance of muddy sand at the northern seaward boundary. This coarse sediment zone of the Cook Strait Platform is also part of the boundary between this district and the Golden Bay SED.

Hydrology East flowing D'Urville Current moves towards Cook Strait with part of its flow moving into Tasman Bay, either from Golden Bay or directly from off Farewell Spit.

Biology Communities associated with the sand and muddy sediments of this district include *Amphiura rosea* – *Dosinia lambata*, *A. rosea* – *Gari lineolata*, *Scalpomactra scalpellum* – *Mactra ordinaria*, *Glycymeris laticostata* – *Venericardia purpurata*, *Nemocardium pulchellum* and *Pleuromeris zelandica*. There are commercial fisheries for such demersal and pelagic species as snapper, rig, gurnard, tarakihi, red cod, trevally, kahawai, a flatfish, scallops and dredge oysters.

D-g Separation Coral Shelf Ecological District

Marine Topography 135 square kilometres of bryozoan coral to the north of Separation Point in depths ranging from 10 to 35 metres.

Hydrology

Biology Extensive area of bryozoan coral (principally *Celleporaria agglutinans* and *Hippomenella vellicata*) with an associated diverse fauna of commercially important fish species (particularly juveniles) and invertebrates. This area is protected from commercial fishing in response to trawl damage of the coral.

D-h Golden Bay Shelf Ecological District

Marine Topography District delineated on three sides by the lower limits of the Farewell Spit, Golden Bay and Separation Point CEDs. The eastern boundary adjacent to Tasman Bay is recognised by a slight ridge of coarse sediments between Bush End Point (Farewell Spit) and Separation Point. Golden Bay grades from sand and silty sand adjacent to the littoral zone to fine muds in the centre of the bay (40 m). The major sediment inputs come from the Takaka and Aorere Rivers and the load of the D'Urville current via Farewell Spit.

Hydrology Strongly influenced by tidal currents flushing the bay. In addition there is a clockwise residual current, which is strongest along the Spit Bank. Golden Bay is influenced by freshwater run off and temperature fluctuations in shallow water. A salinity front has been detected between Tasman and Golden Bays.

Biology Common macrobenthic inhabitants include the cockle, bivalves *Nemocardium pulchellum*, *Pleuromeris zelandica*, *Dosinia lambata*, *Panopea zelandica*, hermit crabs *Paguristes* spp and sausage worms. Golden Bay is an important breeding and feeding ground for many demersal and pelagic fish species notably rig and snapper. There are also commercial beds of scallops, dredge oysters and green-lipped mussels.

E BULLER SHELF ECOLOGICAL REGION (Fig 4)

Region of continental shelf west from Pillar Point to the Hokitika Canyon in the south. In contrast to this region the shelf to the south tends to receive more sediment and current patterns are less distinct. To the north the Westland Current diverges and the shelf expands into the Cook Platform. In this region two districts have been identified – Karamea and Kahurangi.

E-a Karamea Shelf Ecological District

Marine Topography District extends west from Pillar Point (excluding the hard and gravel bottom inshore between Pillar and Kahurangi Points), to the continental shelf edge, south to the Hokitika Canyon and inshore to the coastal zone. This region of shelf is adjacent to the Challenger Plateau and consequently lacks the deep canyons characteristic of regions further south. Sediments grade from sands along the coastal zone to fine muds in the Karamea Bight. The fraction of sand then increases towards the shelf edge (sand and sandy mud). The sediment load moving north in the Westland Current is appreciably less than south at the Hokitika Canyon.

Hydrology Indistinct Westland Current moves north-

as both a region and district because it contrasts with the gravel beaches of the Hawke Bay CER immediately to the south and the greywacke and volcanic rock platforms/boulder beaches of the Cape Runaway CER to the north.

Hydrology The district is influenced by the East Cape Current, which is a continuation of a portion of the sub-tropical East Auckland Current. Water temperatures vary between 13–19°C, salinities from 34.8–35.3‰ with a tidal range of 1.7 m.

Biology The wave cut platforms are scattered with broad, shallow rock pools that are typically fringed with *Carpophyllum plumosum* and *Pterocladia capillacea*, and rich coralline turf between the pools.

In the vicinity of Matakaoa point, a considerable number of northern species appear to reach their southern limit (although sparse occurrences are found to the south) eg algae *Apophloeoea sinclairii*, *Gigartina alveata*, *Vidalia colensoi* and *Carpophyllum angustifolium*. Similarly, this coastline is devoid of southern species such as *Durvillea antarctica*, *D. willana* and the ribbed, and blue mussels. There are commercial quantities of paua, kina and crayfish, with flatfishes in Poverty Bay and mussels in Tolaga Bay.

Existing Coastal PNAs

Whangaokena (East Island) Wildlife Refuge
Waipu River Mouth Wildlife Refuge
Jobson Swamp Government Purpose Reserve

SHELF ECOLOGICAL REGIONS AND DISTRICTS

D COOK SHELF ECOLOGICAL REGION (Fig 3)

This region contains a variety of sediments and bathymetric features resulting from the extensive shelf area and the constriction at Cook Strait between the North and South Islands. Sediment types range from large areas of mud off Taranaki, Manawatu, Tasman Bay and Golden Bay to coarse gravels in Cook Strait and the South Taranaki Bight. The hydrology of this area is influenced by Cook Strait with the Westland Current moving into the western entrance via Farewell Spit and Cape Egmont (D'Urville Current) and the Southland Current and the East Cape Current moving into the eastern entrance from the south and north respectively. Strong tidal currents and storm surges also influence the region particularly in Cook Strait. This region contains eight districts – Egmont, Farewell, Southern Taranaki Bight, Manawatu, Cook Strait, Tasman Bay, Separation Coral and Golden Bay.

D-a Egmont Shelf Ecological District

Marine Topography This district encloses the muds of the sheltered Egmont Depression. Sediments gradually increase in coarseness over a considerable distance from this central tongue of mud extending northeast from the shelf break. It is delineated by the sands to the north and those on the Farewell-Egmont Rise to the south. The beginning of volcanic gravels, cobbles and boulders of the Egmont CED at approximately 75 m separate this district from the shore.

Hydrology The district experiences the northerly movements of the Westland Current and storm surges on the mid and inner shelf.

Biology *Nemocardium pulchellum* – *Pleuromeris*

zealandica communities have been recorded from the muds and muddy sands. Commercial stocks of snapper, green eyed dogfish, southern bluefin, albacore, skipjack tunas and squid occur here.

D-b Farewell Shelf Ecological District

Marine Topography This district encompasses the Farewell – Egmont Rise and consists of sand with some muddy sand. In the north these sands change to muds of the Egmont Basin; in the northeast to gravels and cobbles at the Egmont CED and Southern Taranaki Bight SED; in the east and south to muds in the Cook Strait Trough and in Tasman and Golden Bays; in the southwest to gravelly sand at the northern limit of the Buller SER and in the west to sandy muds at the shelf break.

Hydrology The Westland Current moves north across the rise turning east at Farewell Spit and Cape Egmont to form the D'Urville Current which passes through Cook Strait. Part of the northward flow continues into the North Taranaki Bight. The district experiences tidal and storm surges.

Biology Benthic communities associated with sand and sandy mud include *Nemocardium pulchellum* – *Venericardia purpurata*, *Glycymeris laticostata* – *V. purpurata*, *Tawera spissa* – *V. purpurata*, *Scalpomactra scalpellum* – *Mactra ordinaria*. Commercial quantities of arrow squid are taken from this district.

D-c Southern Taranaki Bight Shelf Ecological District

Marine Topography Known as the Rolling Grounds, this district consists of boulders, gravels, sands and shell banks. It slopes to the south into the Cook Strait Trough. Numerous banks and ridges (often of black iron sand) are found, particularly off Patea. To the west the district ends at the finer sediments of Farewell SED.

Hydrology This area experiences storm and tidal surges. At its outer part the D'Urville Current moves east towards Cook Strait. Inshore a west flowing, low salinity, neritic current originating from lower North Island rivers moves out of the Cook SER via Cape Egmont

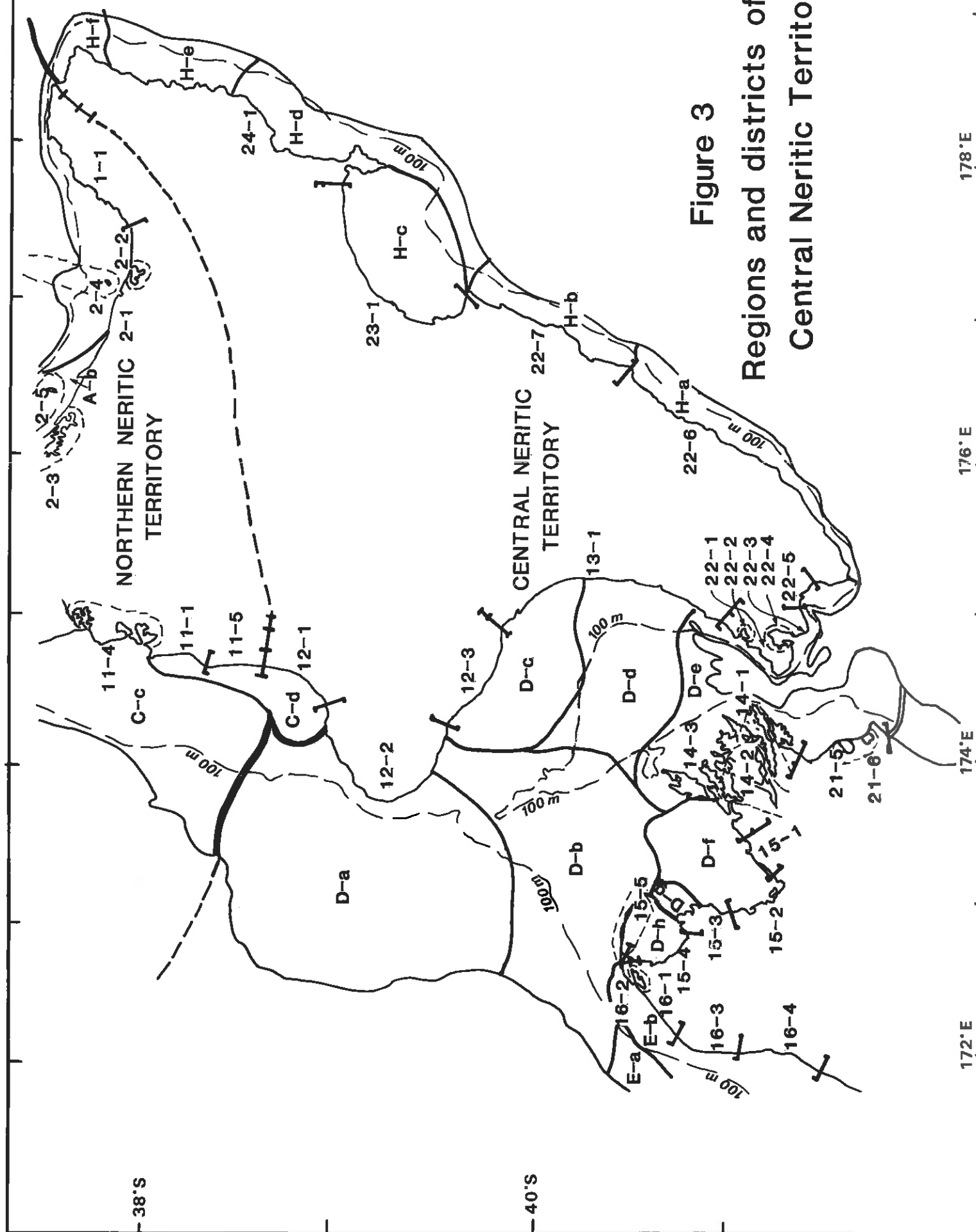
Biology Benthic communities associated with sands and gravels include *Nemocardium pulchellum* – *Venericardia purpurata*, *Glycymeris laticostata* – *V. purpurata*, *Tawera spissa* – *V. purpurata*, *Scalpomactra scalpellum* – *Mactra ordinaria*. Snapper, trevally, mackerel and barracouta occur in commercial quantities.

D-d Manawatu Shelf Ecological District

Marine Topography Area of the Cook Strait Trough consisting of concentric fining of sediments from muddy sands to mud in the centre. This area appears to act as a sink for muds emanating mainly from the nearby Wanganui, Rangitikei and Manawatu Rivers. It is adjacent to the coarse sediment districts of Southern Taranaki Bight in the north, Farewell in the west and Cook Strait in the south.

Hydrology Direct exposure to the west results in wave surge in the shallow eastern parts. Low salinity water flows north in the east of the district with the D'Urville Current moving into Cook Strait over its deeper parts.

Figure 3
Regions and districts of the
Central Neritic Territory



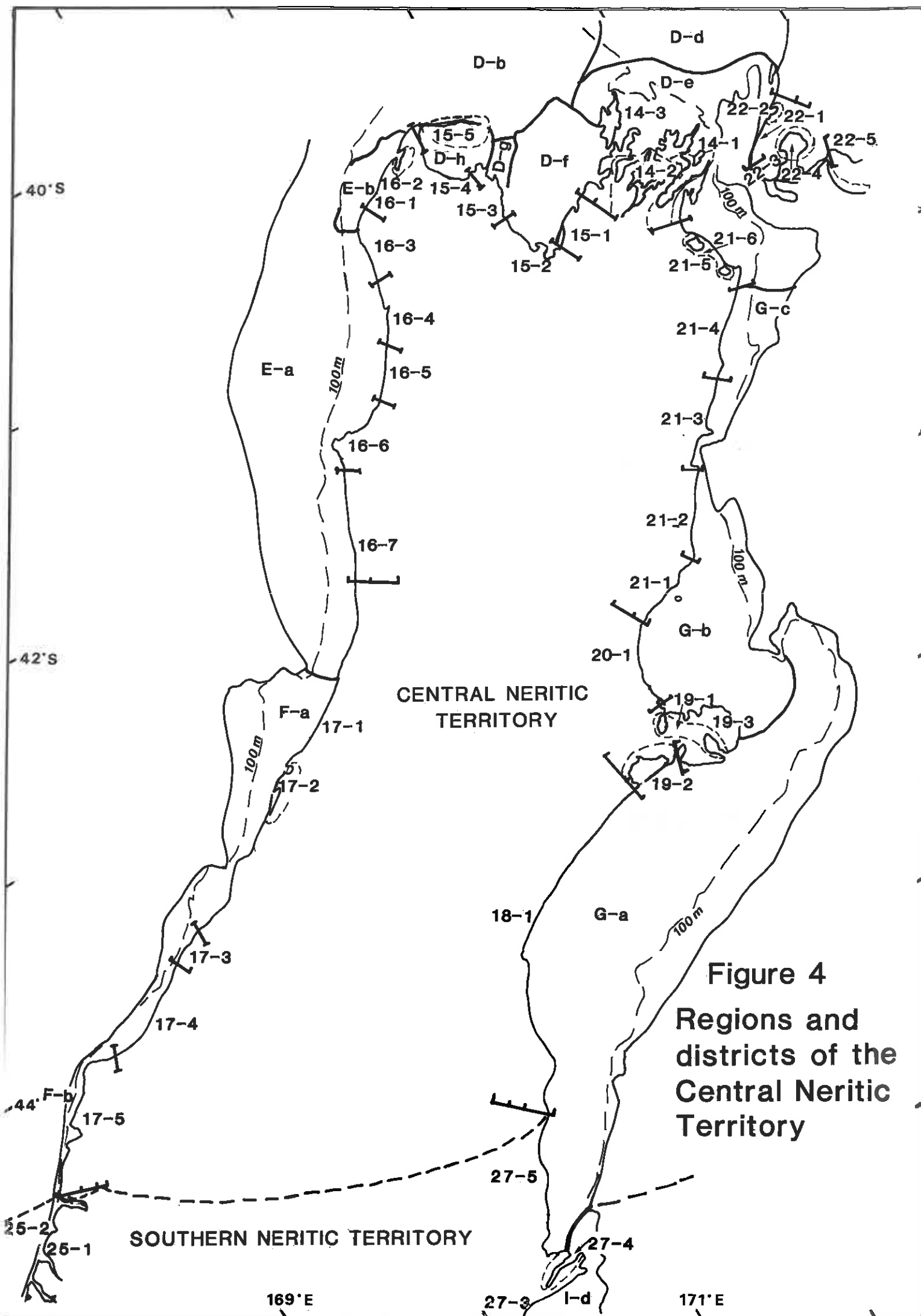


Figure 4
Regions and districts of the Central Neritic Territory

saline water of the Southland Current, although some mixing of this current occurs in the Cook Strait Narrows with the warm, more saline water of the D'Urville and East Cape Currents before it heads north. The Southland Current is deflected to the east by Cape Turnagain. Some of this cool water may flow to points north of Hawke Bay. Sea surface temperatures range between 12° and 17°C, with salinities between 34.7 and 35.2‰. The tidal range along this coast is 1.2 m.

Biology The extensive rocky platforms are scattered with broad and shallow rock pools often with sandy bottoms and typically fringed with *Carpophyllum plumosum*, dense *Pterocladia capillacea* and rich coral-lines. Between the pools extends a wide *Corallina* turf, with *Hormosira* and occasional patches of sand where seagrass may grow. The golden limpet *Cellana flava* is a typical east coast form, flourishing on the soft sedimentary rocks but replaced on fully exposed shores by *C. denticulata*. Cape Turnagain has been taken as the northern boundary of this district because it is in this vicinity that a number of southern species become rare, eg mussels *Mytilus edulis aoteanus* and *Aulacomya maoriana* and sea weeds *Durvillea antarctica*, *D. willana* and *Macrocystis pyrifera*.

The rocky coast provides ideal habitats and therefore commercial quantities of paua, crayfish and kina. The agar producing *Pterocladia* weeds are extensively harvested throughout the district. Small quantities of butterfish, tarakihi and blue cod are also taken.

There are considerable populations of gulls, oystercatchers and shags, especially around the numerous river mouths and associated tidal flats and spits. Castle Point is a nesting site for the red-billed gull, white-fronted tern, southern black-backed gull, black shag and blue heron.

Existing Coastal PNAs Nil

22-7 Southern Hawkes Bay Coastal Ecological District

Marine Topography Extending from Cape Turnagain to Cape Kidnappers, this district is characterised by medium resistance, high energy lee shores of wave cut platforms and coarse to fine grained sandy beaches. Exposed rock and cliffs occur at the two boundaries and also between Waimarama and Kairakau Beach. The coastline is formed of sandstone and siltstone with the two Capes consisting of more resistant marine sandstone. In the lee of Cape Turnagain, a long sandy beach has formed at Porangahau in association with the tidal flats of Porangahau River.

Hydrology District lies in a transition zone between the influences of the cool, less saline Southland Current and the warm, more saline East Cape Current although the latter probably exerts a greater influence. Sea surface temperatures range between 13° and 18°C, with salinities between 34.8 and 35.2‰ and a tidal range of 1.4 m.

Biology This area has a similar biota to that of the East Cape CER and as such is part of the zone of merging of the Central and Northern Neritic Territories. As already mentioned in the Eastern Wairarapa description a number of southern species are particularly rare north of Cape Turnagain. Some species are, however, common to both districts, such as limpets *Cellana flava* and *C. denticulata* depending on substrate-type, barnacle *Chamaesipho brunnea* and weed *Carpophyllum*

plumosum. The northern form *Nerita melanotragus* is occasionally seen at Kairakau but is rare south of Cape Turnagain

The rocky coast has commercial quantities of crayfish and paua. Fish species taken include snapper, tarakihi, gurnard, blue moki etc.

The Porangahau River mouth and adjacent sandy beach is an important area for New Zealand and overseas wading birds. Cape Kidnappers is a major nesting site of the Australian gannet, with over 4450 pairs present.

Existing Coastal PNAs

Cape Kidnappers Nature Reserve

23 HAWKE BAY COASTAL ECOLOGICAL REGION (Fig 3)

23-1 Hawke Bay Coastal Ecological District

Marine Topography Area of uniform gravel and cobble beaches between Cape Kidnappers and the Nuhaka River mouth. A major break occurs at Whakaari Bluff and includes the wave cut platforms to the north. The long stretches of cobble beach are, however, the distinctive feature of this district and because they are bordered to the north and south by rocky shore warrant district and region status.

Hydrology Mainly influenced by a central inflow of East Cape Current but may change depending on the disposition of the Southland Current. Seasurface temperatures and salinities decrease shorewards from typically oceanic values to pockets influenced by freshwater run off, especially off the Wairoa River mouth. Tidal currents within Hawke Bay set to the north on a rising tide and to the south on a falling tide. The tidal range is 1.4 m.

Biology The cobble beaches are almost barren of life. Barnacle *Chamaesipho brunnea*, mollusc *Littorina cincta* and weed *Carpophyllum plumosum* are present but many central and northern species are largely absent. The Napier breakwater has as typical inhabitants the following: *Littorina unifasciata*, *Notoacmea pileopsis*, *Porphyra columbina* and barnacles *Chamaesipho brunnea*, *C. columna* and *Elminius plicatus*. Coralline turf is replaced by *Laurencia heteroclada* and the low tide curtain is pure *Carpophyllum maschalocarpum*.

The estuarine areas at the many river mouths have saltmarshes of seagrass, glasswort and shore pimpernel with *Juncus - Leptocarpus* rushland on higher ground and a wide range of wading birds.

Commercial fishing occurs for paua, kina, crayfish and flatfishes.

Existing Coastal PNAs

Ahuriri and Westshore Lagoons Wildlife Refuge
Ngamotu Lagoon Government Purpose Reserve

24 EAST CAPE COASTAL ECOLOGICAL REGION (Fig 3)

24-1 East Cape Coastal Ecological District

Marine Topography This area stretches from the Nuhaka River mouth north to Matakaoa Point, including Mahia Peninsula. It consists of a series of wave-cut platforms and benches at the base of papa sandstone or soft limestone cliffs broken by bays of medium to coarse grained sand. There are extensive areas where the cliffs are directly exposed to the sea. This area is considered

Pauatahanui Inlet Government Purpose Reserve

22-3 Southern Wellington Coastal Ecological District

Marine Topography Disjoint district lying between Cape Terawhiti and the Pahaoa River mouth, encompassing an area of greywacke and argillite headlands and platforms interspersed by beaches of gravel and sand but excluding Palliser Bay because of its size, unconsolidated shore and the associated estuarine system of Lake Onoke.

The entire coast is a high energy shore directly exposed to the prevailing southerly storms of winter although the degree of exposure alters with aspect, fetch etc. Offshore stacks around Wellington city are extremely exposed because they occur in relatively deep water; headlands are exposed to a lesser degree while most rocky platforms are protected to some extent by submerged rocks and reefs. The predominant zoning pattern of algae reflects this exposure gradient.

Hydrology Much of the district is influenced by the warm saline waters of the D'Urville Current while Cape Palliser is in a zone of mixing of water types from three separate sources – D'Urville, the similarly warm East Cape Current and the cool, less saline Southland Current. Sea-surface temperatures range between 11 and 16°C while salinities range between 34.5 and 34.8‰. Tidal range is 1.6 m.

Biology Bull kelp is the dominant feature of the more exposed parts of this coast. Above the kelp are barnacles *Chamaesipho brunnea* and *Epopella plicatus*, with the former occurring in large sheets. Dominant grazers include limpets *Cellana ornata*, *C. denticulata* and *Notoacmea* spp. and periwinkle *Littorina cincta*. Seaweeds *Lessonia variegata* and *Carpophyllum maschalocarpum* are common in the sublittoral zone.

Where rock faces are sheltered from the full force of wave smash, bull kelp is largely absent and would appear to be replaced by *Xiphophora chondrophylla*. Similarly, *Chamaesipho columna* may replace *C. brunnea*.

The extensive reefs offer ideal habitats for a number of commercially important species in particular crayfish, kina and paua, and to a lesser extent butterfish, blue moki, blue cod and tarakihi.

Colonies of the New Zealand fur seal occur at Cape Terawhiti, Tongue Point, Sinclair Head/Red Rocks, Turakirae Head and Cape Palliser.

The variable oystercatcher, northern blue penguin and southern black-backed gull nest at Baring Head, and on occasion a few pairs of banded dotterel have nested along the shingle spit at the mouth of the Wainuiomata River. Southern black-backed gull also breed at Cape Terawhiti.

Existing Coastal PNAs

Sinclair Head Scientific Reserve
Red Rocks Scientific Reserve
Turakirae Head Scientific Reserve
Lowry Bay Scenic Reserve
Putangirua Pinnacles Scenic Reserve.

22-4 Wellington Harbour Coastal Ecological District

Marine Topography This district is distinct in being the only large sheltered embayment on the Wellington south coast. It is defined as the enclosed body of water

north of a line drawn east from Point Dorset and coincides with a change from exposed to sheltered shores.

Wellington harbour is roughly circular with a maximum width of 11 km and a surface area of 85 km². The sea floor slopes evenly down to a maximum depth of 31 m near its centre. Bottom sediments consist largely of silty-pelite grading to sandy-pelite and sand in the shallows. The shoreline consists of coarse grained sandstone interspersed with sandy beaches.

Hydrology Sea surface temperatures range from 8-19°C. Generally the harbour waters are isothermal although a slight thermocline may develop in summer. Freshwater outflow from the Hutt River creates lowered salinities. Similarly, outflow from the Ngauranga and Korokoro streams and leakage of artesian water from the Hutt Valley aquifers lower the normal salinity range of 32.4-35.7‰. The maximum tidal range is 1.0 m.

Biology The littoral and sublittoral biota consists of species that prefer sheltered conditions, including algae *Ecklonia radiata*, *Corallina officinalis* 'turf', *Macrocystis pyrifera* and *Hormosira banksii*, blue and ribbed mussels and tubeworm *Pomatoceros caeruleus*. Common fish species include the spotty, red cod, tarakihi, flatfishes, Grahams gudgeon and opalfish. A number of sea birds breed in this district including the northern blue penguin, variable oystercatcher, southern black-backed gull, reef heron, spotted shag and white-fronted tern.

Existing Coastal PNAs

Mokopuna Island Government Purpose Reserve

22-5 Palliser Bay Coastal Ecological District

Marine Topography Area consists of a long, exposed beach of alluvial gravel and cobbles broken by the estuarine Lake Onoke. This district is enclosed to the east and west by the exposed, greywacke coast of Southern Wellington CED.

Hydrology Palliser Bay is in the zone of mixing of the D'Urville, East Cape and Southland Currents. Sea-surface temperatures and salinities range between 11-16°C and 34.5-34.8‰, respectively. Some heating by insolation may occur irregularly in the shallows. The maximum tidal range is about 1.5 m.

Biology Kina and paua are taken in the bay while flounders, eels and whitebait are harvested from Lake Onoke.

Existing Coastal PNAs

Nil

22-6 Eastern Wairarapa Coastal Ecological District

Marine Topography Area from the Pahaoa River mouth north to Cape Turnagain. This district consists primarily of wave-swept rocky platforms backed by boulder/cobble beaches or sandy beaches dotted with boulders. The district is further divided by three areas of sandstone cliffs – at Uruti Point, Castle Point and Cape Turnagain. Sandy beaches have formed in the lee of these points. Similarly, river mouths have usually formed alluvial flats that confront the sea as sandy bays with a northward facing spit. The rocks of this shore are of medium resistant sandstone, siltstone and mudstone.

Classified as a high energy lee shore, with the prevailing deep water wave being of southerly origin.

Hydrology This district is dominated by the cool, less

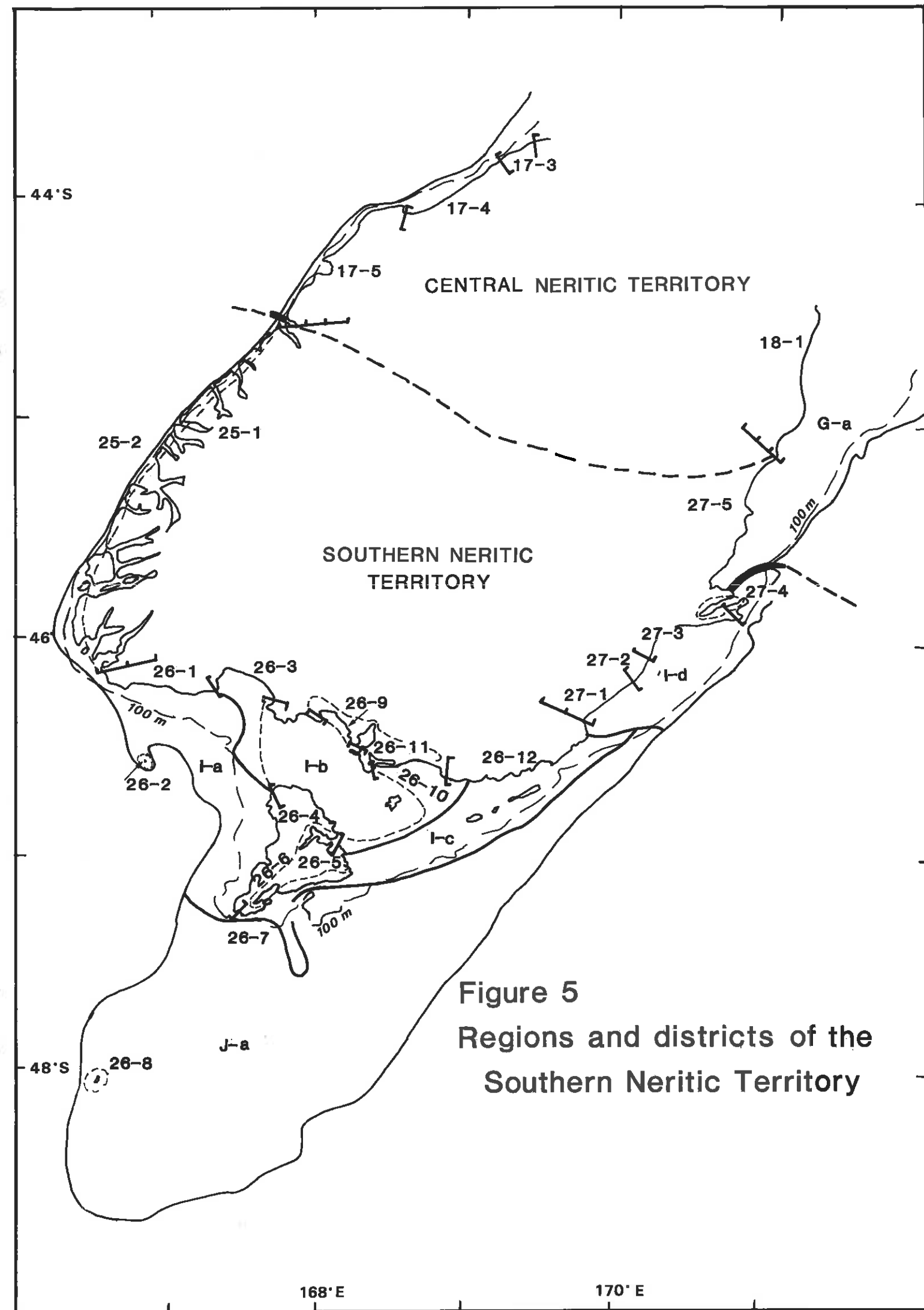


Figure 5
Regions and districts of the
Southern Neritic Territory

DISTRICT AND REGION DESCRIPTIONS

NORTHERN NERITIC TERRITORY (Fig 1; Fig 2)

Area of shelf and coast north of Matakaoa Point (East Cape) and Awakino River mouth (North Taranaki). It contains transitional warm, high salinity water originating from the East Australian Current. This territory corresponds with the northern floral and faunal elements associated with the Aupourian Province found in biogeographical literature.

COASTAL ECOLOGICAL REGIONS AND DISTRICTS

1 CAPE RUNAWAY COASTAL ECOLOGICAL REGION (Fig 2)

1-1 Cape Runaway Coastal Ecological District

Marine Topography Hard shore from Matakaoa Point to Opape consisting of wave cut platforms and exposed rock and cliffs broken by small bays with gravel and cobble beaches. The area contains rocks of both volcanic and sedimentary (greywacke) origin. To the east the district (and territory) ends at the transition to less resistant sandstone and siltstone beyond Matakaoa Point. The change from hard shore to the extensive sandy beaches of the Bay of Plenty indicates the western limit of the district.

Hydrology The district is exposed to the west. It is influenced by subtropical waters of the East Auckland Current and has an approximate tidal range of 1.5 m.

Biology The shore is characterised by such northern species as the algae *Apophloeosinclairii*, *Gigartina alveata*, *Vidalia colensoi* and *Carpophyllum angustifolium* and gastropod *Nerita melanotragus*. Other common species include the barnacle *Chamaesipho brunnea* and weed *Carpophyllum plumosum*. Area is important for crayfishing and seaweed harvesting.

Existing Coastal PNAs Nil.

2 BAY OF PLENTY COASTAL ECOLOGICAL REGION (Fig 2)

This region encloses the area between Opape and Waihi Beach, including the offshore islands (White, Moutoiki, Rurima, Takata, Whale, Motiti, Karewa and Motunau). The Bay of Plenty mainland coast consists of extensive sandy beaches divided in parts by estuarine bays and river mouths, and rocky promontories. Two largish embayments are given district status, namely Ohiwa and Tauranga Harbours. The offshore islands are of volcanic origin, with a number being presently active. There are five districts – Tauranga, Ohiwa Harbour, Tauranga Harbour, White Island and Motiti.

2-1 Tauranga Coastal Ecological District

Marine Topography Area lies from Opape to Waihi Beach enclosing a coastline of long, gently sloping sandy beaches occasionally interrupted by sandy inlets, estuaries and isolated rocky promontories. Backing much of the shore are sandy barrier progradations including tombolos, barrier spits, barrier island and

dune ridge sequences. The district includes the outer coast of Matakana Island.

This is a low energy shore with prevailing wind from the west and a nearshore wave height averaging 0.6 m.

Hydrology Influenced by the East Auckland Current flowing southeastwards along the coast, the district has sea-surface temperatures of 14–20°C, salinities of 34.5–35.2‰ and a tidal range of 1.5 m.

Biology Harvesting of tuatua along beaches and scallops offshore, mussels and whitebait in the estuaries. District gets considerable recreational use especially surfcasting for snapper, red gurnard, trevally and tarakihi.

Contains important areas for seabirds including breeding colonies of reef heron, northern blue penguin and red-billed gull.

Existing Coastal PNAs

Motuotau Island Scenic Reserve
Kohi Point Scenic Reserve
Waiotahi Spit Scenic Reserve
Matakana Island Wildlife Refuge
Waewaetutuki Wildlife Refuge
Matata Lagoon Wildlife Refuge
Ohope Spit Wildlife Refuge
Lower Kaituna Government Purpose Reserve
Waihi Estuary Government Purpose Reserve
Awaitei Government Purpose Reserve
Thornton Lagoon Government Purpose Reserve

2-2 Ohiwa Harbour Coastal Ecological District

Marine Topography Ohiwa Harbour is one of two large estuarine shores in the Bay of Plenty CER and, because of its unmodified state, is considered of national importance.

This harbour consists of a drowned river valley embayed by the Ohope Spit. It has an approximate area of 27 km² at MHW, with a maximum width and length of 8 km and 5.5 km, respectively. About 70% of the area is exposed as mud and sand flats at low tide. A number of channels divide these flats, with strong currents causing regular scouring in the entrance channels.

Hydrology Several streams enter the estuary, the largest being the Nukuhou River. However, the volume of freshwater is small, hence salinities are high. The tidal range is 1.5 m.

Biology The high tidal zone contains salt marsh of glasswort, selliera, shore pimperl etc. A small seaward area contains rushland of jointed wire rush and *Juncus* sp.

In the intertidal zone, *Juncus* forms dense swards with *Scirpus americanus*. Typical fauna include the mud snail, mud crab, cockle, wedge shell, *Mactra ovata*, mud whelk. A feature of the upper intertidal zone are the small and prostrate mangroves, at their southernmost limit on the east coast.

The subtidal zone is populated by cockles, polychaete worms, pipis, horse mussels and occasional scallops.

22 WELLINGTON COASTAL ECOLOGICAL REGION (Fig 3)

This region extends from Paekakariki (including Kapiti Island) around the Wairarapa Coast and north to Cape Kidnappers. It consists of an exposed hard shore of medium to high resistance wave cut platforms, rocky outcrops and boulder beaches. The region is bounded on the west coast by the uniform sandy beaches of the Manawatu CER and on the east coast by the gravel beaches of the Hawke Bay CER. Seven districts have been identified for this region – Kapiti, Porirua Harbour, Southern Wellington, Wellington Harbour, Palliser Bay, Southern Wairarapa and Eastern Hawkes Bay.

22-1 Kapiti Coastal Ecological District

Marine Topography This district encompasses the Wellington west coast from Paekakariki to Cape Terawhiti and includes Mana Island and its sublittoral 'bridge' and Kapiti Island and its associated rock-stacks (ie Tokomapuna, Motungarara and Tahoramahaurea Islands). The coastline is distinguished by steep greywacke and argillite cliffs and wave cut rocky platforms. Narrow boulder/cobble and/or shingle beaches commonly occur between the cliffs and platforms or in large embayments such as Makara and Titahi Bay. Porirua Harbour is excluded from this district because of its distinctive estuarine nature. The rocky platforms generally have a gently seawards sloping profile, are often wide and dotted with rock pools.

This coastline is a high energy shore open to prevailing westerly and northwesterly winds. Some degree of protection is offered to the southern part of the district by the Marlborough Sounds.

Hydrology The district is influenced by the easterly flowing indraught of warm, saline water known as the D'Urville Current. Salinities range between 34.5 and 35.3‰ but may be reduced close to freshwater outflows. Sea-surface temperatures reach a maximum of 20°C in summer and a minimum of about 12°C in winter. The tidal range is from 1–1.2 m. The flood tide usually has a north flowing component while the ebb flows to the south.

Biology The fauna and flora is characteristic of a temperate rocky shore with an exposed outlook. Zoning biota includes:

Seaweeds *Corallina officinalis* 'paint', *Xiphophora chondrophylla*, *Carpophyllum maschalocarpum* and *Lessonia variegata*,
Barnacles *Chamaesipho brunnea* and to a lesser extent *C. columna*
Molluscs *Turbo smaragda*, *Zediloma* spp, *Haliotis* spp, *Xenostrobus pulex*.

The rocky nature of the coast provides suitable habitats for several species of recreational and commercial importance. These include crayfish, paua, mussels and kina. Also a number of locally important fish species, such as butterfish, red cod and blue moki.

Winter haulout colonies of the NZ fur seal occur at Cape Terawhiti and Black Point. Breeding colonies of sea birds occur on Kapiti Island and its associated stacks, Mana Island and on a number of mainland localities. These include the southern black-backed gull, red-billed gull, reef heron, northern blue penguin, banded dotterel, sooty shearwater and black shag.

Existing Coastal PNAs Kapiti Island Nature Reserve

22-2 Porirua Harbour Coastal Ecological District

Marine Topography Porirua Harbour has an area of 15 km² and consists of two inlets with common access to the sea via a narrow entrance opening to the north. This area is distinct because it contains the only extensive tidal mud flat and estuarine shore along an otherwise exposed rocky coastline.

Pauatahanui Inlet lies in an east-west direction, has a mean area of 4.5 km² a tidal mudflat area of 1.1 km² and is approximately 3.5 km long by 2 km wide. Porirua Inlet is 4 km long by 1.3 km wide, lies in a southwest-northeast direction and has a tidal flat of about half its overall area. Porirua Inlet has not been studied to the extent of Pauatahanui which has been the subject of an extensive DSIR project (Pauatahanui Environmental Programme). Most of the present information comes from that study.

The maximum depth of Pauatahanui Inlet is 9 m where the channel passes under the road and rail bridges. The channel follows the southern shore and becomes steadily shallower until it is 3–4 m deep when it rounds the Golden Gate Peninsula. The channel continues around the south side of the peninsula at about 3 m depth and broadens, shallows and joins the main basin. The north and east sides of the inlet have extensive tidal flats with depths of less than 1 m. The tidal flats and channel areas consist of olive-grey sand with less than 20% mud. Stream deltas have a variable particle-size range with all combinations of mud, sand and gravel possible. Subtidal area is muddiest, with up to 96% silt and clay. Porirua Inlet is particularly muddy and usually very turbid.

Hydrology Surface water temperatures range between 7.0 and 19.8°C with summer and winter averages of 17.3 and 11.4°C respectively. Salinities range between 17.0 and 35.0‰ but are usually only slightly lower than that of sea water. Porirua Harbour has spring and neap tide ranges of 1.42 and 0.34 m, respectively.

Biology Seagrass beds occupy 1.5 ha at the head of the inlet and smaller areas on the tidal flats. In the low to mid-tide zone, sea rush is the dominant plant while the upper tidal area at the inlet head consists of sea rush and jointed rush. Subtidal banks of sea lettuce occur during summer along the western shore.

The cockle and polychaete worms are particularly abundant, with densities of up to 2,500 m² and 8,000 m² respectively. On Mana Bank the harpacticoid copepod (*Paraslenhelia megarostrum*) reaches high population densities.

Porirua Harbour is an important nursery and feeding area for some 30 species of fish, eg snapper, elephant fish, horse mackerel, red gurnard, anchovy, pilchard, kahawai, red cod and warehou.

Pauatahanui Inlet is used by over 30 species of bird as a breeding and feeding ground or as a stopover during migrations. Species include the pied stilt, spur-winged plover, eastern bar-tailed godwit, banded dotterel, four species of shag, two of heron, two of oystercatcher and various gulls and terns.

Existing Coastal PNAs

Duck Creek Scenic Reserve
Pauatahanui Inlet Wildlife Refuge

Hydrology Southland Current moves north along this shore with local inshore rips and currents. Velocity and direction of the Southland Current is influenced by wind direction and strength and at times may flow to the south.

Biology Haulout area for NZ fur seal. District contains colonies of shags with terns and oystercatchers around river mouths. Trout, salmon, whitebait, paua and crayfish are taken along the coast.

Existing Coastal PNAs
Napenape Scenic Reserve
Gore Bay Scenic Reserve
Waiau River Mouth Scenic Reserve

21-3 Kaikoura Coastal Ecological District

Marine Topography Area from Oaro to Waipapa Bay consisting of sections of hard shore made up of resistant greywacke to the south and north and a central section of river flats and gravel beaches merging into the wave cut platforms of the Kaikoura Peninsula. In the southern part of this district the hard shore is comprised of a series of rocky headlands and wave-cut platforms separating small crescent shaped stoney beaches that are exposed to ocean swells. Both beaches and shore platforms are derived of greywacke from a narrow coastal strip. This situation is largely mirrored in the north of the district also. The alluvium outwash plains of the Kahutara, Kowhai and Hapuku Rivers form extensive mixed sand and gravel beaches to the north and south of Kaikoura Peninsula. In places this shingle zone may be 600-700 m wide and capped by low dunes. Projecting into the Pacific the raised horizontal mass of the Kaikoura Peninsula is comprised of sandstone and siltstone and forms cliffs, extensive wave-cut platforms and gravel beaches.

Hydrology The Kaikoura Peninsula has a considerable influence on the current pattern and wave climate of this district. It provides shelter from the north or south depending on the swell direction. Projecting offshore the peninsula traps sediment moving north in the Southland Current or south in the counter currents caused by the peninsula and northerly winds. At Kaikoura the Southland Current diverges. One part moves east to meet the southward flowing East Cape Current and subsequently travels along the eastern Chatham Rise. The remaining flow moves north along the coast towards Cook Strait.

Biology Coastal vegetation of lupin, marram grass on dunes with cliff grasses, flax, and remnant mahoe forest with taupata and akeake on steep coastal hills. Crayfish, paua, and algae collection occurs on this coast.

Existing Coastal PNAs
Waipapa Point Scenic Reserve
Paparoa Point Scenic Reserve
Half Moon Bay Scenic Reserve
Mangamaunu Scenic Reserve
Rakautara Scenic Reserve
Hapuku Scenic Reserve
Parinuio Tea Scenic Reserve
Kaikoura Peninsula Reefs Wildlife Refuge

21-4 Kekerengu Coastal Ecological District

Marine Topography District extends from Waipapa Bay to Needles Point and consists of a section of soft

shore of steep, medium to coarse grained sand south of the Clarence River and mixed sand and gravel beaches to the north. The shoreline is relatively smooth with occasional limestone outcrops in the north. The coastal strip is frequently backed by sand dunes and medium height coastal hills.

Hydrology North flowing littoral currents with sediment and freshwater inputs from the Clarence, Kekerengu and Waima Rivers.

Biology Highly modified dune vegetation with marram grass, lupin and occasional ngaio and cabbage tree.

Existing Coastal PNAs Nil

21-5 Cloudy Bay Coastal Ecological District

Marine Topography This district extends from Needles Point to Rarangi but excludes the sheltered shores of Lake Grassmere and Big Lagoon. It consists of large mudstone shore platforms and pink limestone rocky outcrops adjacent to Cape Campbell with exposed rock and cliffs at the Cape and White Cliffs.

Fine grained sandy beaches occur at Clifford Bay and grade into mixed sand and gravel then boulder beaches towards White Cliffs. To the northeast of White Cliffs boulder beaches grade back to mixed sand and gravel beaches that terminate abruptly at Rarangi with the hard indented shores of the Sounds CER. This shore is largely sheltered from the south but exposed to the east and north. A great deal of sediment moves northeast along the shore, principally from the Awatere and Wairau Rivers and eroded from Cape Campbell and White Cliffs.

Hydrology At Cape Campbell the Southland Current moves northeast into Cook Strait with some of the flow moving directly north towards the North Island. Strong littoral currents also move north and, along with wave exposure, shape the coastline of this district.

Biology

Existing Coastal PNAs
Chancet Rocks Scientific Reserve
Muritai Scientific Reserve

21-6 Cloudy Bay Wetlands Coastal Ecological District

Marine Topography Disjoint district containing the sheltered shores of Lake Grassmere, Big Lagoon and the Wairau River mouth. Lake Grassmere has been modified by the saltworks although the eastern side is less disturbed. Both shores are muddy bottomed. Salinities of the two vary greatly, with Big Lagoon receiving much more freshwater input from the Wairau River.

Hydrology

Biology Big Lagoon contains horse's mane weed. Both wetlands are surrounded by salt marsh – mudflats (seagrass, shore pimperl, selliera, glasswort, jointed rush and sea rush). Breeding, feeding and roosting area for waterfowl, indigenous and migratory waders, gulls and terns. In Lake Grassmere the high salinity of the evaporation ponds has produced unusual communities dominated by the brine shrimp. Flounder, whitebait, larval fish, yellow-eyed mullet and bullies occupy the wetlands.

Existing Coastal PNAs
Wairau River Lagoons Wildlife Refuge

There are large beds of the green-lipped mussel in the entrance channel.

The harbour is an important feeding and nursery ground for many fish species including snapper, trevally, spotty, eels and whitebait. The latter breed in the saltmarsh.

Over 39 species of indigenous and migratory wading birds, and waterfowl use the harbour for nesting, feeding or roosting. Abundant species include the eastern bar-tailed godwit, eastern knot, banded dotterel, white-faced heron, southern black-backed gull, terns, shags and oystercatchers.

Existing Coastal PNAs
Motuotu Island Nature Reserve
Patawa Island Scientific Reserve
Ohope Spit Wildlife Refuge
Tern Island Government Purpose Reserve

2-3 Tauranga Harbour Coastal Ecological District

Marine Topography A large, shallow tidal estuary of 224 km², of which 93% (208 km²) is exposed at low tide. The harbour is sheltered along its seaward side by the low lying Matakana Island. It has two entrances, both of which are about 800 m wide and guarded by ancient volcanoes (Mt Maunganui at the eastern entrance and Bowentown at the western entrance).

The harbour is a drowned river valley system impounded by a system of beach ridges comprising a barrier island and two tombolos connecting the volcanic cones to the mainland.

Harbour sediments are largely sand, mixed with shells (mainly pipi, tuatua, cockle and scallop). Tidal scour maintains deep channels at both entrances - the eastern or Tauranga Entrance has a gorge of 30 m depth.

Hydrology The harbour has a tidal range of 1.6 m with a tidal stream at the Tauranga Entrance of 7 knots during spring tides.

Biology Mangroves are present along the coastline and are backed by salt marsh.

There are commercial quantities of flatfish and trevally.

This district is an important area for waders including banded dotterel, South Island pied oystercatcher, pied stilt and eastern bar-tailed godwit.

Existing Coastal PNAs
Matakana Island Wildlife Refuge
Waikaere Estuary Wildlife Refuge

2-4 White Island Coastal Ecological District

Marine Topography White Island is the crater of an active volcanic mountain rising from deep water about 44 km off the Tauranga district coast. The island has an area of 19.8 km² and is bordered by almost continuous wave cut cliffs. The cliffs are generally about 30 m high but merge into very steep slopes up to 300 m high on the western edge. The only major breaks are on the eastern edge, at Te Awapuia, Wilson Bay and Shark Bay. This district also includes the lava plugs of Volkner Rocks 8 km north of White Island, and the small group of active, andesitic islands northwest of Whakatane ie Moutoki, Rurima, Takata and Whale (Motuhora) Island.

Hydrology This district is influenced by the subtropical East Auckland Current and localised warming of water from subtidal hot springs and gas vents.

Biology Terrestrial vegetation of White Island is limited to 14 species, of which the most obvious are pohutukawa forest and shrub. The grey-faced petrel breeds in burrows under the forest. Common birds include the white-fronted tern, red-billed gull, northern blue penguin, sooty shearwater, southern black-backed gull and white-faced storm petrel. A number of species also breed on the islands off Whakatane.

The effect of volcanic activity on intertidal life is marked, such as the reduced biota near the acid stream outlet in Crater Bay. Much of the White Island shore consists of boulder beaches, housing dense populations of the orange crab *Cyclograpsus insularum*. A dense band of the vermetid gastropod *Novastoa lamellosa* seen on the Volkner Rocks is a subtropical influence. The absence of *Carpophyllum angustifolium* and *Lessonia variegata* is a peculiarity of White Island.

Intertidal life on the Whakatane Islands is similar to that of adjacent mainland rocky shores, common species being *Littorina unifasciata*, *Nerita melanotragus*, *Chamaesipho columna*, etc.

Existing Coastal PNAs
Moutoki, Rurima and Takata Islands Wildlife Refuge
Whale (Motuhora) Island Wildlife Refuge
White Island Protected Private Land

2-5 Motiti Coastal Ecological District

Marine Topography This district consists of three rocky, steeply cliffed islands of volcanic origin lying off the northern part of the Tauranga CED. These are Karewa Island (3.6 ha), Motiti Island and Motunau (Plate) Island (2.8 ha).

Hydrology The district is influenced by subtropical water of the East Auckland Current and has a tidal range of about 1.6 m.

Biology This is an important area for sea birds including breeding colonies of the fleshfooted shearwater, grey-faced petrel, northern diving petrel, fluttering shearwater and (possibly) white-fronted tern. Tuatara are present on Karewa Island.

Existing Coastal PNAs
Karewa Island Wildlife Sanctuary
Motunau Island Wildlife Sanctuary

3 EASTERN COROMANDEL COASTAL ECOLOGICAL REGION (Fig 2)

Area from Waihi Beach to Cape Colville, including the offshore islands of Mayor, the Aldermen and Mercurys. Exposed shore dominated by high cliffs and rock, broken by small estuarine harbours and sandy beaches. This region is bordered to the south by extensive sandy beaches of the Bay of Plenty CER and to the north by the sheltered shores of the Inner Hauraki Gulf CER. This region encloses two districts – Tairua and the Coromandel Islands.

3-1 Tairua Coastal Ecological District

Marine Topography Area from Waihi Beach to Cape Colville comprising an exposed shore of rock and cliff interspersed by numerous small sandy beaches and a number of minor estuarine harbours. This district includes near shore islands such as Slipper Island.

Hydrology Influenced by subtropical East Auckland Current, especially outlying points and islands. The maximum tidal range is 1.6 m.

Biology Because of the exposure, there is a distinct elevation of subtidal algae into the littoral zone with *Carpophyllum plumosum* and *Xiphophora bchondrophylla* occurring with *Corallina* turf and *Hormosira banksii*.

Mangroves are found in 9 localities and occupy an area of 728 ha. The northern blue penguin, grey-faced petrel and banded dotterel breed in this district. Commercial harvesting of crayfish, scallops and flounders.

Existing Coastal PNAs

Blackjack Scenic Reserve
Matarangi Bluff Scenic Reserve
Buffalo Beach Scenic Reserve
Whitianga Rock Scenic Reserve
Shakespeare's Cliff Scenic Reserve
Kaitoke Scenic Reserve
Diggers Hill Scenic Reserve
Cook Bluff Scenic Reserve
Onewhero Pa Scenic Reserve
Tapuaetahi Scenic Reserve
Te Ramarama Scenic Reserve
Orokawa Scenic Reserve
White Pine Bush Scenic Reserve
Onemana Scenic Reserve
Whangamata Islands Wildlife Sanctuary
Wharekawa Harbour Wildlife Refuge
Opitonui River Mouth Government Purpose Reserve

3-2 Coromandel Islands Coastal Ecological District

Marine Topography This district includes Mayor Island, the Aldermen Islands, Mercury Islands and Cuvier Island. Generally steeply cliffed although there are sandy beaches on the lee shore of Great Mercury Island and boulder beaches on Cuvier. Mayor Island is a rhyolite dome.

Hydrology Influenced by subtropical East Auckland Current and has a tidal range of 1.6 m.

Biology Characteristic zone-forming organisms include barnacles *Chamaesipho brunnea* and *C. columna*, *Apophloea sinclairii* and/or *Novastoa lamellosa*, coralline paint, *Xiphophora chondrophylla* and *Carpophyllum angustifolium*.

The Aldermen Islands have a greater subtropical fauna than the Mercury group with, for example, *Novastoa lamellosa* being present on the former but absent on the latter. This difference appears to be current related.

Crayfish and scallops are harvested.

Important breeding area for seabirds including the grey-faced petrel, Pycroft's petrel, sooty shearwater and fleshfooted shearwater.

Existing Coastal PNAs

Cuvier Island Nature Reserve
Double and Stanley (Kawhitihu) Islands Nature Reserve
Aldermen Islands Nature Reserve
Mercury Island Scenic Reserve

4 INNER HAURAKI GULF COASTAL ECOLOGICAL REGION (Fig 2)

Area from Cape Colville to Pakiri consisting of a variety of hard and softshores of semi-exposed to sheltered

character. Outer, relatively exposed areas consist of rock and cliffs and sandy beaches while sheltered areas have extensive mudflats and mangrove swamps.

This region is bordered to the north and south by exposed coasts of sand and rock. There are eight districts – Colville, Outer Thames, Inner Thames, Tamaki, Outer Waiheke, Rangitoto, Waitemata Harbour and Whangaparaoa.

4-1 Colville Coastal Ecological District

Marine Topography Area from Cape Colville to the northern tip of Koputauaki Bay comprising a shore of rock and cliff broken by the estuarine Colville Bay and considerable lengths of sand and shingle. The district is exposed to the southwest but sheltered from the easterly driven Pacific swell.

Hydrology Coastal waters are characterised by variable temperature and salinity, and high turbidity. The maximum tidal range is 2.1 m.

Biology Littoral organisms include *Littorina unifasciata*, half-crab, *Melagraphia aethiops*, cats-eye, rock oyster, *Cominella virgata*, *Corallina-Hormosira*, etc. Colville Bay has an area of mangroves plus tidal flats containing cockles, pipis etc.

Existing Coastal PNAs

Ahirau Scenic Reserve
Papaaroha Scenic Reserve
Ward PJC Open Space Covenant

4-2 Outer Thames Coastal Ecological District

Marine Topography This is a disjoint area from Deadmans Point to Tararu on the west coast of the Coromandel Peninsula and from Matingarahi to Raukura Point on the west coast of the Firth of Thames. It consists of a semi-exposed shore of boulders and gravel and rocky platforms. Sand and silt content of the shore increases towards the south as a result of decreasing exposure.

Hydrology The district has variable salinity and temperature regimes, and high turbidity. The maximum tidal range is 2 m.

Biology Common organisms of this shore include *Littorina unifasciata*, half-crab, *Melagraphia aethiops*, *Elminius modestus*, cats-eye, rock oyster, *Cominella virgata*, *Corallina-Hormosira* and towards ELW, the brown algae *Carpophyllum maschalocarpum*.

Existing Coastal PNAs

Tapu Ruamahunga Scenic Reserve
Puru Scenic Reserve
Thorntons Bay Scenic Reserve
Waiongana Protected Private Land
Covewood Farms Open Space Covenant

4-3 Inner Thames Coastal Ecological District

Marine Topography Area of sheltered shore in the Firth of Thames from slightly north of Tararu to Matingarahi Point. The southern and southwestern portion of this shore is dominated by extensive mudflats, with high shell banks between Miranda and Kaiaua. Towards the western boundary there is an increase in boulder and gravel cover and a reduction in silt content as a result of increasing exposure.

19-3 Outer Banks Coastal Ecological District

Marine Topography A highly indented coastline of exposed rock and cliffs from the base of Kaitorete Spit to Sumner Head. This district includes numerous small bays. Each bay has a bay-head beach 85-200 m wide and 200-800 m long with differing degrees of exposure to the sea. The beaches derive material either locally from surrounding hills (volcanic cobbles and boulders) or from offshore wave action (sand and silt). They vary from a thin veneer of sediment surrounded by steep cliffs and boulder banks to mudflats, sand ridges and dunes systems.

Hydrology Wave generated littoral currents travelling north along the Canterbury Bight shoreline transport large quantities of sediment to the southern margin of this district. To the north littoral currents are variable but tend to move south in Pegasus Bay and deposit sediment along the northern margin of Banks Peninsula.

Although altered by wind and water conditions the strongest currents of the peninsula are tide generated, setting to the north during the flood and south during the ebb. The projection of Banks Peninsula from the Canterbury Coast distorts tidal flows and causes streams to have greatest velocity at the eastern extremity. This flow is compounded by the northwards passage of the Southland Current.

Wave exposure has a strong influence on the ecology of this district. Swells originating from the storm centres of the South Pacific approach the shore virtually unimpeded because of the flat topography of the Canterbury Bight and Pegasus Bay. Swells approach from the southeast, east and northeast and are modified at the shore by local winds.

Biology Shores contain coastal cliff vegetation of kanuka, occasional kowhai, mahoe, ngaio mixed broad-leaved forest and scrub. Breeding area for spotted shag. White-faced tern, red-billed gull and penguin present. Crayfish, mussel, paua occupy the littoral zone.

Existing Coastal PNAs

Peraki Bay Scenic Reserve
Long Bay Scenic Reserve
Magnet Bay Scenic Reserve
Te Oka Bay Wildlife Refuge
Sumner Head Wildlife Refuge

20 PEGASUS BAY COASTAL ECOLOGICAL REGION (Fig4)

20-1 Pegasus Bay Coastal Ecological District

Marine Topography Repeating sequence of exposed and sheltered soft shores and coastal dunes from Sumner Head to 2 km north of the Waipara River. Exposed to the east and northeast but not to the south. The shore grades from high profile shingle beaches in the north to low profile fine sands in the south. The projection of Banks Peninsula interferes with the flow of sediments to the north and produces conditions that are suitable for the deposition of fine sediments. The Waimakariri, Ashley, Kowai and Waipara Rivers deposit material into Pegasus Bay but unlike the rivers to the south the coarser fractions of their load are deposited before reaching the sea and only fine sediments enter the bay. At the mouths of rivers are bar built estuaries and lagoons (Brooklands Lagoon and Waimakariri River

mouth, Saltwater Creek, Ashley River mouth and the largest soft shore – Avon-Heathcote Estuary).

Hydrology The Southland Current moving through the Mernoo Gap brings subantarctic water to the surface and along the western (inshore) side of this flow. This cooler less saline water may move north of Pegasus Bay during the prevailing southerly winds but during winds from the north and east a south flowing gyre is formed around Pegasus Bay. Neritic water flows inside the Southland Current with direction being wind dependent.

Biology Dune vegetation of marram grass, lupin (some pingao); interdunes of raupo, NZ flax, cabbage tree; saltmarsh vegetation. Estuaries are feeding grounds for many waterfowl and migratory and non-migratory waders. Caspian tern and black fronted tern occur in the region. Estuaries and river mouths contain cockles; on open shores pipis and tuatua occur with *Dosina* and *Macra* offshore. Eels, salmon, yellow-eyed mullet, kahawai, red cod and paddle crabs occupy the coastal zone.

Existing Coastal PNAs

Woodend Lagoon Government Purpose Reserve

21 MARLBOROUGH COASTAL ECOLOGICAL REGION (Fig4)

Region extending from 2 km north of the Waipara River mouth to Rarangi. This is a complex coastline of predominantly exposed mixed sand and gravel beaches with sections of rocky shore and wave-cut platforms. This shore is exposed to the north, east and south. Coastal plains are narrow or absent except for the flood plains at Kaikoura and the Awatere and Wairau Rivers. The Southland Current flows north along this coast. A part of the current branches at Cape Campbell to flow directly to the east coast of the North Island. A further branching of this current occurs off Kaikoura, flowing east to combine with the East Cape Current. This region contains six districts – Motunau, Cheviot, Kaikoura, Cloudy Bay and Cloudy Bay Wetlands.

21-1 Motunau Coastal Ecological District

Marine Topography Exposed medium resistant rock and cliffed shore extending 2 km north of Waipara River to Napenape.

Hydrology

Biology Hard shore with commercial concentrations of crayfish.

Existing Coastal PNAs

Motunau Island Nature Reserve

21-2 Cheviot Coastal Ecological District

Marine Topography District extending from Napenape to Oaro consisting of rock cliffs projecting offshore at Port Robinson and Haumuri Bluffs with sections of hard shore, shore platforms, gravel and steep sandy beaches. This district lacks significant coastal plains. The Hurunui, Waiau and Conway Rivers form small river deltas through medium height cliffed hills. Sediment from these rivers is moved north by the Southland Current. This district is made up of low resistant marine sandstone and siltstone overlaying harder greywacke which contrasts with the harder more resistant shore of greywacke to the north. The shore is exposed to south, east and northerly swells.

Biology

Existing Coastal PNAs

Fiordland National Park
Open Bay Islands Wildlife Refuge

18 CANTERBURY BIGHT COASTAL ECOLOGICAL REGION (Fig4)

18-1 Canterbury Bight Coastal Ecological District

Marine Topography 200 km of exposed, greywacke-derived mixed sand and gravel beaches, with intermittent lagoons and large river deltas extending from Cape Wanbrow to the outlet of Lake Ellesmere. This low resistant shore can be divided into the eroding cliffed alluvium plain coastline with large, high bed load, braided river deltas of the Canterbury Bight; the section of narrow barrier shore at Timaru formed of high resistant lava; and the cliffed soft shore of the Waitaki River flood plain. This district is exposed to the prevailing southeast conditions and also to storms from the northeast. Wave height on this coast averages 1-2 m with storm waves reaching 3-4 m. Wave aggradation has resulted in considerable mixing of the river-derived sediments both across and along the beaches.

Hydrology Wave generated littoral currents travel north along the Canterbury Bight shoreline, transporting large quantities of sediment to the southern margin of Banks Peninsula. Low salinity, variable temperature neritic water from large snow fed rivers strongly influence the species composition on the shore, particularly at the river mouths.

Biology District is an important location for salmon and whitebait.

Existing Coastal PNAs

Hutchisons Quarry and Target Gully Shell Pit Scientific Reserve
Washdyke Lagoon Wildlife Refuge
Lake Wainono Government Purpose Reserve
Waihao Box Government Purpose Reserve
Milford Lagoon Government Purpose Reserve
Coopers Lagoon Government Purpose Reserve

19 BANKS COASTAL ECOLOGICAL REGION (Fig4)

Peninsula of resistant basalt projecting from the east coast of the South Island. This region is dominated by the sheltered shores of two calderas (Lyttelton and Akaroa). It is characterised by a radial pattern of drowned valleys and near vertical cliffs that terminate long sloping interfluvies separating small bay-head beaches. This region also contains the largely landlocked sheltered shore of Lakes Ellesmere and Forsyth. This highly indented hard shore region projecting into the Pacific is a distinctive feature on the east coast of New Zealand and is in stark contrast to the large tracts of soft shore to the south (from the base of Kaitorete Spit) and north (from Sumner Head). It is exposed to the northeast, east and southeast and interferes with the Southland Current over the narrow confines of the Mernoo Gap, forcing neritic water offshore north of the Chatham Rise. This region contains three districts – Inner Banks, Ellesmere and Outer Banks.

19-1 Inner Banks Coastal Ecological District

Marine Topography Sheltered steep sided rocky shores of Banks Peninsula with estuary/saltmarsh at the

heads of the indentations. This district contains Akaroa and Lyttelton Harbours and Port Levy. The sheltered shore consists of high resistant basalt that is exposed to the south (Akaroa) and the northeast (Lyttelton, Levy). Sediments tend to become coarser towards the inlet mouths.

Hydrology Oceanic swells move into the harbours although there is little direct impact due to aspect. However, the swells affect bottom sediments, disturbing the fine sediment as far as the heads of these inlets. Strong tidal currents are also generated in this district.

Biology In Lyttelton Harbour four major benthic communities have been recognised: *Hemiplex hirtipes* – *Virgularia gracillima* on fine muds; *Zeacolpus vittatus* – *Pectinaria australis* on sand; *Ostrea heffordii* – *Sigapatella novaezelandiae* on solid shell fragments and jetsum; cockles on medium to fine sediments. These harbours are important nursery areas for rig, common sole, red cod, gurnard, spotted stargazer and trevally. In addition, commercial catches of sand flounder are taken, with a significant bi-catch of puffer fish. There are colonies of spotted shag, southern black backed gull and red-billed gull.

Existing Coastal PNAs

Dan Rogers Creek Nature Reserve
Buckley's Bay Scenic Reserve
Hoon Hay Scenic Reserve
Governor's Bay Scenic Reserve
Sugarloaf Scenic Reserve
Witch Hill Scenic Reserve
King Billy Island Scenic Reserve
Hay Scenic Reserve
Wainui Scenic Reserve
Te Oka Bay Wildlife Refuge
Palm Gully Protected Private Land
Hunter Native Forest Protected Private Land

19-2 Ellesmere Coastal Ecological District

Marine Topography This district is a complex geomorphic unit containing the high profile advancing cobble beach of Kaitorete Spit with its complex dune system separating Lakes Ellesmere and Forsyth from the sea. The lakes are shallow, muddy bottomed, contain brackish, highly mixed water, and are periodically opened to the sea to lower the water level.

Hydrology The lake waters are mixed by the action of wind from the south and northwest. The barrier of Kaitorete Spit has been formed by deposition of material moving north from the Canterbury Bight by long shore drift. Low salinity, temperature variable neritic water flows along the coast. The cooler Southland Current interacts with this neritic water as it strikes the promontory of Banks Peninsula.

Biology The lakes are important waterfowl and wading-bird habitats. The shores are surrounded by willow, raupo and salt tolerant herbfields with horse's mane weed offshore. Pingao occupies the fore dunes of Kaitorete Spit with lichen and scabweed in deflation hollows, and small-leaved pohuehue and *Carmichaelia appressa* on older dunes. Eels, flatfish and whitebait occupy Lake Ellesmere.

Existing Coastal PNAs

Kaitorete Spit Scientific Reserve
Hart's Creek Government Purpose Reserve and Wildlife Refuge
Yarrrs Flat Government Purpose Reserve

Hydrology The district has considerable freshwater inflow from Hauraki Plains with variable temperatures and salinities, and high turbidity. The tidal range is 2 m.

Biology Mangroves occupy an area of 663 ha. The mudflat area is dominated by cockles, pipis, whelks *Cominella maculosa*, *C. glandiformis* and *C. adspersa*. Also a major nursery for flatfishes.

Over 30,000 shore birds use this district for feeding and high tide roosting, notably the godwit and knot. The shell banks are important roosting sites.

Area supports a considerable flounder fishery.

Existing Coastal PNAs

Taramaire Government Purpose Reserve

4-4 Tamaki Coastal Ecological District

Marine Topography This is a disjoint area from Raukura Point to Milford, including inner Waiheke, Motuihe and Ponui Islands, and from Koputauaki Bay to Deadmans Point on the western shore of Coromandel Peninsula. It is a sheltered shore of rock, sandy beach and extensive estuarine bays. The largest estuary, Waitemata Harbour, is treated as a separate district.

Hydrology The high turbidity seen here is characteristic of shallow, often muddy shore. Temperatures and salinities are variable with the former ranging from 12 to 21°C. The tidal range is 2-2.5 m.

Biology Rocky shore biota include *Littorina unifasciata*, *Nerita melanotragus*, *Chamaesipho columna*, *Corallina-Hormosira* and *Carpophyllum maschalocarpum*. Soft shore fauna is similar to that described for Waitemata Harbour, common species being the cockle, pipi, wedge shell, *Nucula hartvigiana*, etc.

These shores provide important feeding and roosting grounds for local and migratory shore birds.

Oyster farming in the sheltered bays of inner Waiheke and Coromandel Harbour. Mangroves occupy an area of 486 ha.

Existing Coastal PNAs Nil

4-5 Outer Waiheke Coastal Ecological District

Marine Topography This is a disjoint district of relatively exposed coastline comprising Tokatu Point, Kawau Island, Whangaparaoa Peninsula, the islands of Rakino and Motutapu, and the northern shore of Waiheke Island (from Garden Bay to Whetumatarau Point). Mostly rugged coast of rock and cliffs although broken by some sandy beaches, notably on Waiheke.

Hydrology Coastal waters are of variable salinity and temperature and high turbidity, although the water here is generally clearer than other Inner Gulf areas.

Biology Characteristic organisms of this shore include *Littorina unifasciata*, barnacles *Chamaesipho brunnea* and *Elminius plicatus*, *Corallina-Hormosira*, and *Carpophyllum maschalocarpum*, rock oysters.

Oyster farming occurs in some of the more sheltered bays, eg Owhanake Bay on Waiheke.

Coastline provides an important habitat for sea birds. A gannet colony occurs on Horuhoru Rock, seaward of the northern most tip of Waiheke.

Existing Coastal PNAs

Kawau Island Scenic Reserve
Waiheke Island Bush Protected Private Land
Tawharanui Marine Park

4-6 Rangitoto Coastal Ecological District

Marine Topography This district comprises Rangitoto Island, an extinct volcanic cone of symmetrical appearance that dominates the Auckland landscape. The coastline is built up of a low-lying and much indented reef of hard basalt, mostly of pitted and irregular scoria. A cover of loose boulders fringes the island in its calmest stretches.

Hydrology Highly variable salinity and temperature ranges typical of an inshore coastline, with associated high turbidity from the introduction of suspended material in freshwater run-off and by wave action on mudflats. Approximate maximum tidal range of 2 m.

Biology Zoning organisms include *Littorina unifasciata*, *Nerita melanotragus*, *Chamaesipho columna*, the rock oyster, tubeworm *Pomatoceros caeruleus* and algae *Corallina* turf and *Hormosira banksii*. Subtidally, the brown algae are represented by *Carpophyllum* spp, *Sargassum sinclairii* and *Cystophora* spp. A coastal fringe near Rangitoto Beacon is the main nesting area of southern black-backed gulls in Auckland. The dominant vegetation is pohutukawa. A rich and diverse fauna exists underneath the boulders, including crabs, sponges, seasquirts and tubeworms. The brachiopod *Terebratella rubicunda* is particularly common in this habitat.

Existing Coastal PNAs

Rangitoto Island Scenic Reserve

4-7 Waitemata Harbour Coastal Ecological District

Marine Topography This district consists of the deeply embayed inlet west of North Head and St Heliers on the Auckland east coast. Formed from a drowned valley system, the harbour receives numerous tidal rivers. The shoreline is of sheltered rock near the entrance and along the northeastern shore, and estuarine mudflat along the remaining coast.

Hydrology The average salinity range of this harbour is 25-35‰ with wide fluctuations occurring in the upper reaches. Surface temperatures range between 9° and 25°C. The maximum tidal range is 3.5 m, with tidal currents up to 3 knots near the harbour entrance.

Biology The softshores of Waitemata Harbour are dominated by the mud crab, cockle, wedge shell, *Nucula hartvigiana*, *Macra ovata*, mud snail, *Zeacumantus lutulentus*, horse mussel, *Cominella glandiformis* and mantis shrimp. Rock surfaces are inhabited by the rock oyster and *Melagraphia aethiops*. Mangroves occupy an area of 951 ha.

Common fish species include the snapper, kahawai, koheru, piper, mullet, stargazer, short-tailed stingray, eagle ray and flounders.

This is a feeding and roosting area for a considerable number of shore birds including shags, the Australian gannet, herons, pied oystercatcher, banded dotterel and gulls and terns.

Existing Coastal PNAs

Northcote Borough Scenic Reserve

4-8 Whangaparaoa Coastal Ecological District

Marine Topography District extending from Milford to Pakiri comprising a semi-exposed shore of rock, wave-cut platforms and medium-coarse grained sandy beaches broken by a number of minor estuarine bays.

Hydrology The district is of coastal character grading towards oceanic at Cape Rodney with decreasing turbidity and more stable temperature and salinity profiles. The tidal range is 2 m.

Biology Littoral species include *Chamaesipho columna*, limpets *Cellana radians* and *C. stellana*, *Borallina-Hormosira* flats and *Carpophyllum* spp. Beyond the *Carpophyllum* zone at Goat Island, there is a region of bare rock dominated by kina followed by a zone of *Ecklonia radiata*. In deeper water there are filter feeders, notably sponges and ascidians although brachiopods, tubeworms, bryozoa and barnacles are also present. There is a wide variety of fish species especially towards the outer limits of the district.

The estuarine areas are inhabited by similar species to Waitemata Harbour CED with mangroves occupying an area of over 7.5 km².

Existing Coastal PNAs

Goat Island Scientific Reserve
Leigh Scenic Reserve
Ti Point Scenic Reserve
Hamiltons Landing Scenic Reserve
Burton Wells Scenic Reserve
Okahu Creek Scenic Reserve
Waiwera Hill Scenic Reserve
Cape Rodney to Okakari Point Marine Reserve

5 OUTER HAURAKI GULF COASTAL ECOLOGICAL REGION (Fig 2)

This region contains the most exposed shores of the Hauraki Gulf extending from Pakiri to Marsden Point plus the offshore islands. The islands are dominated by steep cliffs while the mainland section consists of ocean beaches. There are three districts – Great Barrier, Outer Gulf Islands and Bream.

5-1 Great Barrier Coastal Ecological District

Marine Topography Great Barrier Island, with an area of 285 km², occupies a prominent position at the outer limits of the Hauraki Gulf sheltering much of its inner reaches from the northeast. For much of its length, the coastline is steeply cliffed and exposed. On the sheltered, western side, the coast is intricately indented by numerous bays and inlets. The island is primarily of volcanic origin, apart from the portion north of Motairehe and Waikaro Point which consists of greywacke. Long ocean beaches of medium to coarse grained sand break the otherwise precipitous eastern coastline, notably Hangapoua, Kaitoke and Medlands Beaches.

This island appears to be a fragment of a range that extended northwards from Coromandel Peninsula.

Hydrology The district is influenced by the southeast flowing subtropical East Auckland Current. It has a maximum tidal range of 2.0 m.

Biology The exposed rocky shore is characterised by the barnacle *Chamaesipho brunnea* and algal species *Gigartina alveata*, *Xiphophora chondrophylla*, *Car-*

pophyllum angustifolium and *Lessonia variegata*. The sheltered shore has as common inhabitants the barnacle *Elminius modestus*, rock oyster, *Hormosira-Corallina* turf, and subtidally *Ecklonia radiata*. Mangroves occur only in the Whangapoua Inlet and occupy an area of 107 ha. This estuary also attracts a wide range of wading birds including the NZ dotterel and wrybill. Spotless crane and brown teal also occur. A large gannetry is found on Mahuki Island in the Broken Islands group off the western coast.

Crayfish are harvested around the coast while offshore waters yield a variety of fish species including john dory, snapper, tarakihi and trevally. Scallops are taken off Katherine Bay and Tryphena Harbour.

Existing Coastal PNAs

Kotuku Point Scenic Reserve
Wairahi State Forest Sanctuary
Sugarloaf Stream Government Purpose Reserve
Webster GE Open Space Covenant

5-2 Outer Gulf Islands Coastal Ecological District

Marine Topography This district contains the Poor Knights Islands, Hen and Chicken Islands, Mokohinau Islands and Little Barrier Island, all of which are characterised by exposed precipitous rocky shorelines.

This group of islands has a unusual assemblage of marine organisms of tropical and subtropical origin.

Hydrology Influenced directly by the subtropical waters of the East Auckland Current and has a maximum tidal range of about 2 m.

Biology The barnacle *Chamaesipho brunnea* is the dominant species of the upper littoral zone, with *Elminius plicatus* occurring directly below. On the Poor Knights, the gastropod *Novastoa lamellosa* forms a zone in the middle shore, below which are found *Lithothamnion*, *Xiphophora chondrophylla*, *Carpophyllum angustifolium* and *Lessonia variegata*. On the most exposed outpoints small stands of bull kelp occur. Some 96 fish species have been recorded at the Poor Knights. At present this represents the greatest variety of fishes in New Zealand.

Sea birds are abundant with petrels, shearwaters, gannets, shags, terns, gulls and penguins either feeding in the rich, surrounding surface waters or roosting ashore. The Poor Knights are the principal breeding site for Buller's shearwater, and Little Barrier a major site for Cook's petrel. Pycroft's petrel breeds at the Poor Knights and the Hen and Chickens. There is a large colony of red-billed gulls on the Mokohinau Islands.

Kina are harvested around the Hen and Chicken Islands.

Existing Coastal PNAs

Poor Knights Islands Nature Reserve
Hen and Chicken Islands Nature Reserve
Sail Rock Nature Reserve
Mokohinau Islands Nature Reserve
Little Barrier Island Nature Reserve
Poor Knights Islands Marine Reserve

5-3 Bream Coastal Ecological District

Marine Topography District extends from Pakiri to Marsden Point, comprising long stretches of fine grained sandy beaches broken by the wave cut platforms of Bream Tail and the exposed rock and cliffs of Te Arai

Existing Coastal PNAs

Hiwinui Scenic Reserve
Tokomoana Scenic Reserve
Karamea Bluff Scenic Reserve

16-6 Foulwind Coastal Ecological District

Marine Topography Low coastal plains from Granity Township to the Nile River mouth interrupted by a section of medium to high coastal hills (cliffed) at Cape Foulwind. Flat fine grained sandy beaches either side of the exposed rock and cliffs of Cape Foulwind. In the northern part of the district the beaches tend to be steeper and of medium to coarse grained sand. The district contains several small bar built estuaries, notably at the Okari and Buller mouths.

Hydrology Major freshwater and sediment input from the Buller River.

Biology

Existing Coastal PNAs

Buller River Estuary Wildlife Refuge

16-7 Punakaiki Coastal Ecological District

Marine Topography Exposed coastline from Nile River to Point Elizabeth. Paparoa Range impinges on coast in the north and south forming exposed rock and cliffs. Separating these areas is a low coastal plain between Tiromoana and Barrytown with highly sorted beaches of mixed sand and gravel, cobbles and boulders.

Hydrology

Biology

Existing Coastal PNAs

Punakaiki River Nature Reserve
Four Mile Scenic Reserve
Dolomite Point Scenic Reserve
Punakaiki Scenic Reserve
Tiropahi State Forest Ecological Area
Pororari State Forest Ecological Area

17 WESTERN SOUTH ISLAND COASTAL ECOLOGICAL REGION (Fig 4)

Region extends from Point Elizabeth in the north to Stripe Point in the south. The most typical shore types of this region are the extensive sand and gravel beaches although the region also contains the sheltered soft shores of Okarito Lagoon and the exposed rocky shores to the south of Jacksons Head and in the Paringa area. The region contains five districts – Hokitika, Okarito, Paringa, Haast and Cascade.

17-1 Hokitika Coastal Ecological District

Marine Topography Extensive area of well sorted sand and gravel beaches from Point Elizabeth to Heretaniwha Point. Formed from low resistant rock, the coastal strip consists of low hills that are cliffed south of Okarito Lagoon and in the vicinity of Greymouth. Large amounts of freshwater and sediment enter the district from numerous rivers and streams.

Hydrology

Biology Commercial stocks of crayfish and whitebait.

Existing Coastal PNAs

Westland National Park

Taramakau Scenic Reserve
Lake Mahinapua Scenic Reserve
Ferguson's Bush Scenic Reserve
Mahitahi Scenic Reserve
Oroko Swamp State Forest Ecological Area
Totara Lagoon Government Purpose Reserve

17-2 Okarito Coastal Ecological District

Marine Topography Wetland area exhibiting varying degrees of isolation from the sea. The district includes the mouth of the Whataroa River; Three Mile, Okarito and Saltwater Lagoons, and Lake Windemere.

Hydrology Each of the wetlands have differing amounts of saltwater influence, from major intrusion at Three Mile Lagoon, a lesser degree at Okarito Lagoon, protracted isolation from the sea at Saltwater Lagoon, to the complete isolation at Lake Windemere.

Biology Important waterfowl area, breeding ground for the white heron and royal spoonbill (Okarito). Okarito Lagoon has a diverse aquatic flora and fauna with a pronounced zone of transition from marine to freshwater communities. This lagoon has a highly productive benthic macrofauna (43 species recorded). The lagoon contains flounder, kahawai, mullet, salmon and galaxiid species. Okarito grades from extensive swamps to podocarp forest, contrasting with Saltwater Lagoon which is surrounded by podocarp forest and has only a narrow strip of swamp. Three Mile Lagoon has a large area of jointed rush which merges into manuka forest at the lagoon's edge.

Existing Coastal PNAs

Waitangiroto Nature Reserve
Saltwater Lagoon Scenic Reserve
Saltwater State Forest Ecological Area

17-3 Paringa Coastal Ecological District

Marine Topography Section of medium resistance rock from Heretaniwha Point to Adiantum Bluff forming a coastline of medium to high cliffed hills. The shoreline is of exposed rock and cliffs.

Hydrology

Biology

Existing Coastal PNAs

Lake Moeraki Scenic Reserve

17-4 Haast Coastal Ecological District

Marine Topography Low coastal plain from Adiantum Bluff to Neils Beach. Coastline of mixed sand and gravel beaches.

Hydrology

Biology

Existing Coastal PNAs

Okuru Scenic Reserve

17-5 Cascade Coastal Ecological District

Marine Topography Exposed rock and cliffs punctuated by embayments of mixed sand and gravel, gravel, cobble and boulder beaches extending from Neils Beach to Stripe Point. District also includes the Open Bay Islands.

Hydrology

flats extend some 6 km at low tide. Below low water are fine to medium highly graded sands sloping steeply at 10 m depth to the finer sediments of Golden Bay. At high water the spit is from 1-1.5 km wide. It consists of a series of firm sandy beaches and mobile dunes along the northern outer margin, extensive linear sand flats to the south of the northern dunes (sometimes inundated at very high tides) and low rolling generally vegetated dunes along the southern (or inner) margin of the spit.

Hydrology The spit is formed of quartzose sand derived from the Southern Alps and carried north, then east, by the Westland and D'Urville Currents respectively. Strong tidal currents move along the southern edge of the Spit Bank as well as an intensified east flowing residual current. The spit is expanding to the south and east as a result of the load of the D'Urville Current and material moved onshore by Tasman Sea swells. Longshore drift and wind move material to the distal end of the spit and across it to the southern side.

Biology The dominant vegetation habitats of the spit are dune, saltmarsh and seagrass, the major species being tree lupin, NZ flax, marram grass, glasswort, sea rush, jointed rush, shore pimpernel and sea grass.

Tidal flats contain large numbers of:

- molluscs – horn shell (*Zeacumantus* sp), whelk (*Cominella gladiiformis*), cockle, pipi, wedge shell
- polychaetes – lugworm, bamboo worm, *Pectinaria australis*, *Onoscolex pacificus*, *Glycera* sp, *Platynereis australis*;
- crustaceans – sandhopper, mantis shrimp, mud crab, shore crab, pill box crab, swimming crab.

These invertebrates are important food sources for many species of bird, particularly waders, and demersal fish species. On the Spit Bank immature fish are found. Commercial fisheries are important in the area, particularly for rig, snapper and sand flounder. The northern exposed bank of the spit has a different invertebrate species composition to that of the lee side. Paddle crabs and demersal fish species including snapper, rig, flatfish and red gurnard occur in the area.

The area is of great significance of migratory wading birds, and is designated as a Wetland of International Importance.

Existing Coastal PNAs
Farewell Spit Nature Reserve

16 BULLER COASTAL ECOLOGICAL REGION (Fig4)

Region of the northern west coast of the South Island from Pillar Point in the north to Point Elizabeth in the south. This region is predominantly exposed rock cliff and sorted gravel beaches. It contains seven districts – Northwestern Nelson, Whanganui Inlet, Heaphy, Karamea, Mokihinui, Foulwind, and Punakaiki.

16-1 Northwestern Nelson Coastal Ecological District

Marine Topography Coastal strip of exposed medium to low resistant cliffs with mixed sand and gravel beaches. To the north this district ends at Pillar Point where the sandy beaches and dune complex of Farewell Spit begins. To the south the high coastal cliffs of Kahurangi Point designates the end of this district.

Hydrology Coast exposed to westerly winds, with waves rarely less than 1 m.

Biology Economic quantities of paua and whitebait.

Existing Coastal PNAs
Kaihoka Lakes Scenic Reserve

16-2 Whanganui Inlet Coastal Ecological District

Marine Topography Largest bar built sheltered shore on the west coast of the South Island (639 ha). Extensive areas of mud flat exposed at low water. This district ends at the inlet mouth where the exposed shore of Northwestern Nelson CED begins.

Hydrology

Biology Extensive area of seagrass flats and saltmarsh. Feeding grounds for many juvenile and adult fish. Large populations of wading birds occupy the inlet, notably black swans. New Zealand fur seals occur at inlet entrance. A large proportion of the shoreline is surrounded by native forest (rimu, northern rata over hard beech).

Existing Coastal PNAs
Kaihoka Lakes Scenic Reserve
West Haven Inlet Scenic Reserve
North West Nelson State Forest Park

16-3 Heaphy Coastal Ecological District

Marine Topography High coastal hills (cliffed) of resistant rock. Littoral zone of rock cliffs and gravel, cobble and boulder beaches from Kahurangi Point south to Kohaihai Bluff.

Hydrology

Biology Hinterland of native bush (beech-podocarp). Many streams descend rapidly from the coastal ranges with rapid fluctuation in run off from the high rainfall area.

Existing Coastal PNAs
North West Nelson State Forest Park

16-4 Karamea Coastal Ecological District

Marine Topography Exposed coastline from Kohaihai Bluff south to Little Wanganui Head. Several small bar built estuaries occur in this district, notably the Karamea and Oparara River mouths. Exposed coast of steep, medium to coarse, sandy beaches along a low coastal plain.

Hydrology

Biology

Existing Coastal PNAs
Kongahu Swamp Government Purpose Reserve

16-5 Mokihinui Coastal Ecological District

Marine Topography Coastline of high resistant rock from Little Wanganui Head to Granity Township. Exposed high coastal hills and cliffed mountains with mixed sand and gravel, cobble and boulder beaches at base of cliffs.

Hydrology

Biology

Point. A small estuarine harbour, Mangawhai, occurs to the south of Bream Tail.

Hydrology District is influenced by the subtropical East Auckland Current.

Biology Crustacea of the sandy beaches include the seaslater, sandlouse and common sandhopper, isopods of the families Sphaeromidae and Eurydicidae, paddle crab, ghost shrimp and mantis shrimp. The tuatua is the most common bivalve on this and other east coast beaches. Papis are harvested in Bream Bay. Mangawhai Spit is the only regular nesting site for fairy tern in New Zealand. Other shore birds include the Caspian tern, white-fronted tern, banded dotterel, NZ dotterel and variable oystercatcher. Mangroves occur in two localities – Ruakaka River and Mangawhai Harbour.

Existing Coastal PNAs
Bream Tail Scenic Reserve
Mangawhai Spit Wildlife Refuge

6 EASTERN NORTHLAND COASTAL ECOLOGICAL REGION (Fig 2)

Area from Marsden Point to Cape Karikari consisting of an exposed, highly indented rocky shore bordered to the north and south by long stretches of sandy beach. The region is interspersed by a number of large bays, and harbours of estuarine character. The region contains six districts – Whangarei Harbour, Whangarei, Bay of Islands, Cavalli, Whangaroa Harbour and Doubtless Bay.

6-1 Whangarei Harbour Coastal Ecological District

Marine Topography A long estuarine embayment of 95 km², of which 59% is exposed as mudflats and sand/shell banks at low tide. This district 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 are areas of rocky shore in the outer and middle reaches, extensive sand flats at the entrance, and mangrove/salt marsh beds in the sheltered bays and inner reaches.

Hydrology The tidal range of this district is 2.2 m.

Biology The inner reaches of this district are dominated by mangroves and their associated biota. The sand/shell flats are populated by cockles and pipis, both of which are harvested. The sheltered rocky shore is characterised by zones of barnacles (*Chamaesipho columna*), rock oysters, *Pomatoceros tubeworms* and *Corallina/Hormosira*. The sublittoral fringe consists of large brown algae, notably species of *Carpophyllum* and *Cystophora*.

The district contains commercial species including snapper, flatfishes, scallops, rock oysters and pipis.

Over 30 bird species have been observed including common and rare migratory waders.

Existing Coastal PNAs
Manaia Ridge Scenic Reserve
Whangarei Harbour Wildlife Refuge
Waimaru Protected Private Land

6-2 Whangarei Coastal Ecological District

Marine Topography District extends from Busby Head to Cape Brett. It contains exposed rock and cliffs interspersed by a number of medium-coarse grained sandy beaches and minor estuarine harbours, notably

Whangaruru Harbour and Ngunguru. 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.

Hydrology District is influenced by subtropical high salinity and temperature East Auckland Current. The maximum tidal range is 2 m.

Biology Common fauna of the sandy beaches include the tuatua and pipi, sandlouse and sandhopper, polychaete worms and swimming crab. The subtidal sand/gravel habitat is inhabited by the comb star, morning star shell, basket cockle and dog cockle.

Mangroves occur in five localities in the district (520 ha). The dominant algae of the rocky shore include *Ecklonia radiata*, *Lessonia variegata* and *Carpophyllum* spp, the species of which depends on the degree of shore exposure. Animals include the seacucumber, kina, starfishes *Stegnaster inflatus* and *Astrostele scabra* and the red rock crab. Occurring subtidally are the purple spined urchin *Centrostephanus* and the large sponges *Polymastia granulosa* and *Ancorina alata*.

Fish species present include snapper, blue maomao, black angelfish, red moki, demoiselle, labrids, short and longtailed stingrays. Over 50 species have been observed at Mimiwhangata.

Investigations at Mimiwhangata Marine Park have highlighted a considerable number of rare species such as the ivory coral *Oculina virgosa*, red-lined bubble shell *Bullina lineata*, an unidentified callianassid shrimp, the spotted black groper, sharp-nosed pufferfish and sabretooth blenny.

The district contains a diverse bird fauna including nesting colonies of the fluttering shearwater and northern diving petrel. Crayfish are harvested along the rocky shore and pipi, tuatua, cockle and scallop are gathered from the estuarine areas.

Existing Coastal PNAs
Bream Islands Nature Reserve
Bream Head Scenic Reserve
Whangaruru Harbour Scenic Reserve
Whangaruru (North Head) Scenic Reserve
Watkin Powell Scenic Reserve
Matapouri Scenic Reserve
Otito Scenic Reserve
Hugh W Crawford Memorial Bush Scenic Reserve
Matapouri Estuary Government Purpose Reserve
Mimiwhangata Marine Park

6-3 Bay of Islands Coastal Ecological District

Marine Topography This district is an open embayment of 179 km² containing several large estuaries and about 200 islands. It is bordered to the north and south by the precipitous headlands of Cape Wiwiki and Cape Brett respectively. Approximately 4% of the total area (8 km²) is exposed as 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.

Hydrology Estuarine district with tidal waters extending inland as far as Kerikeri and Kawakawa, the main freshwater inflows being the Kerikeri, Waitangi, Kawakawa and Waikare Rivers. Seawater temperatures

of the bay range from 15° to 23°C, salinities in the main basin are about 35.5‰ and the tidal range is 2.0 m.

Biology The district is important for the farming of rock oysters and Pacific oysters. The latter species is one example of the many migrant foreign molluscs found in this district (and surrounding areas of Northland in general).

The giant heart urchin *Brissus gigas* occurs in deep water.

Mangroves are common in the upper reaches of the Bay and occupy an area of 10.5 km².

Commercial species include crayfish and packhorse lobster, snapper, kahawai and kingfish. Big game fishing for marlins, sharks and tuna also occurs.

Seabirds such as the southern black-backed gull, grey-faced petrel and white-fronted tern use the area for feeding and breeding. There are a number of brown teal roosting sites.

Existing Coastal PNAs

Rangitane Scenic Reserve
Motutapu Island Scenic Reserve
Taranaki Island Scenic Reserve
Moturua Island Scenic Reserve
Kerikeri Inlet and Waipapa Stream Scenic Reserve
Kaimarama Scenic Reserve
Te Toroa Bay Scenic Reserve
Kororareka Point Scenic Reserve
Toretore (Nobbies) Island Scenic Reserve
Motuapo Island Protected Private Land
Little ECS and MC Open Space Covenant

Existing Coastal PNAs Motukawanui Island Scenic Reserve

6-5 Whangaroa Harbour Coastal Ecological District

Marine Topography An 8 km long estuarine embayment of 19 km², of which 26% is mudflat. Rocky shoreline occurs in the vicinity of the entrance, however most of the shore consists of mangrove/saltmarsh flats. The outer harbour is 9 m deep at low tide.

Hydrology There is a tidal range of 2.0 m.

Biology Mangroves occupy an area of over 4 km². Farming of oysters and commercial gathering of scallops, flatfishes and snapper occur in this district. Birds present include the NZ dotterel, red-billed gull, four species of shag and banded rail. This area is considered of 'moderate-high' value as an estuarine wildlife habitat.

Existing Coastal PNAs Ranfurly Bay Scenic Reserve

6-6 Doubtless Bay Coastal Ecological District

Marine Topography Large bay between Berghan Point in the south and Knuckle Point in the north. It consists of exposed rock/cliff headlands enclosing medium to coarse grained sandy beaches, broken by occasional rocky outcrops, and a small estuarine harbour in the southeastern corner (Mangonui Harbour). This district has an area of 185 km², 6 km² of which is exposed as mudflats at low tide. Mudflats make up 94% of the area of Mangonui Harbour.

Hydrology The tidal range is 2.1 m.

Biology Mangroves occur in Mangonui Harbour and the Taipa River estuary. Reef heron and white-faced heron are recorded from the former. Tokerau Beach has three swamps along it, one of which contains the rare ferns *Cyclosorus interruptus* and *Thelypteris confluentis*. The scallop is an important commercial species.

Existing Coastal PNAs Nil

7 EASTERN AUPOURI COASTAL ECOLOGICAL REGION (Fig 2)

Area from Cape Karikari to Ohao Point. A soft shore broken by a number of minor rocky outcrops and indented by three extensive estuarine systems. This region is bordered to the south and north by the rocky and precipitous coastlines of the East Northland and Te Pahi CERs respectively. This region contains four districts – Great Exhibition Bay, Rangaunu Harbour, Houhora Harbour and Parengarenga Harbour.

7-1 Great Exhibition Bay Coastal Ecological District

Marine Topography Area between Cape Karikari and Ohao Point consisting of open, white sand beaches backed by extensive dunes and wetlands and broken by three harbours and a number of rocky outcrops. The harbours are treated as separate districts. This is a low energy shore with prevailing wind from the west.

Hydrology The district is influenced by subtropical water of the East Auckland Current and has a maximum tidal range of 2 m.

Biology Tuatua and scallops are common bivalves of the shore. Coastal plants include marram grass, pingao

Ports Gore, Hardy and Underwood. The high tidal flow areas of French Pass and Tory Channel are also included in this district.

Sediments tend to be coarser in this district than the inner Sounds ranging from silts in the bays and harbours to sands, gravels and gravelly shell banks at the boundary with Cook Strait and in French Pass and Tory Channel. The boundary with Cook Strait also tends to follow the break in slope at the 50 m contour.

Hydrology Exposed to both the west and east. The D'Urville Current moves around the headlands and through French Pass then south through Cook Strait. The Southland Current moves north into the strait to meet this flow off Arapawa Island. An opposing tidal phase between the east and west coast of central New Zealand results in an amplified flow around the district.

The three compounding factors of strong tidal flows, meeting residual currents and funnel affect of winds moving between the South and North Islands results in an extremely exposed shore.

Biology Commercial fisheries for crayfish, paua, kina, scallops, butterfish, groper, red cod and moki. Mussel farming is undertaken in the more sheltered parts.

Existing Coastal PNAs

Part of the Marlborough Sounds Maritime Park
Consists of: 3 nature reserves
14 scenic reserves
6 wildlife refuges

15 NELSON BAYS COASTAL ECOLOGICAL REGION (Fig 4)

Two large sheltered bays separated by a hard shore. This region contrasts with the exposed hard shores of the West Coast and the complex ria coastline of the Marlborough Sounds. There are five districts – Farewell Spit, Golden Bay, Separation Point, Tasman Bay and Boulder Bank.

15-1 Boulder Bank Coastal Ecological District

Marine Topography District extends from the northern end of Delaware Bay to Nelson City. Complex coastline containing Nelson Haven; a large estuary protected from the sea by the Nelson Boulder Bank; Delaware Bay, protecting the estuary of the Whangamoa River mouth; Mackays Bluff and the Pepin Island tombolo, source of the exposed cobble and boulder beaches in the district.

Hydrology Coastline exposed to the north and west. A strong southwest flowing current moves material from the erosion sources to the boulder and cobble beaches of the Nelson Boulder Bank and Delaware Bay.

Biology

Existing Coastal PNAs

Cable Bay Scenic Reserve

15-2 Tasman Bay Coastal Ecological District

Marine Topography Section of low resistant rock from Nelson City to the Riwaka River mouth. Two large river systems enter the bay from the west and east (Motueka and Wairoa) forming extensive estuaries (Moutere and Waimea Inlets respectively). These two systems are separated by a section of low coastal cliffs with cobble and gravel beaches at their base.

Hydrology

Biology

Existing Coastal PNAs

Moss W F Scenic Reserve
McKee Memorial Scenic Reserve

15-3 Separation Point Coastal Ecological District

Marine Topography Exposed rock and cliff with open beach and estuaries of Separation Point from north of the Riwaka River mouth to Pohara Beach. A predominantly hard shore formed of high resistant rocks.

Hydrology

Biology Coastline surrounds Abel Tasman National Park. Vegetation of rimu, rata over hinau, nikau forest with saltmarsh on sheltered shores of glasswort, shore pimpernel, selliera, sea rush, jointed rush etc.

Existing Coastal PNAs

Abel Tasman National Park
Kaiteriteri Scenic Reserve
Moncrieff Protected Private Land

15-4 Golden Bay Coastal Ecological District

Marine Topography Repetitive series of sheltered and semi-exposed soft shores extending from Pohara Beach in the southeast to Puponga Point in the northwest, a direct distance of 36 km. The coastline is characterised by estuaries and tidal flats separated by sandy beaches.

Hydrology District dominated by extensive tidal currents (excess of 4.4 m at spring tides). Near shore ecology is strongly influenced by freshwater input (particularly Aorere and Takaka Rivers) altering salinity, sediment and current pattern locally. A clockwise residual current tends to move both living and non living material towards Farewell Spit and out of the bay.

Biology The dominant estuary, saltmarsh and open beach vegetation of the bay includes sea rush, shore pimpernel, jointed wire rush, glasswort, selliera, tree lupin, marram grass, silvery sand grass and seagrass.

The wide diversity of fauna includes many species found on Farewell Spit. Also noted in the intertidal zone are the mud whelk, tuatua, *Dosinia* sp, mud snail, small shell borer, ghost shrimp, seaslater and mud crab.

Existing Coastal PNAs

Grove Scenic Reserve
Hanson-Winter Protected Private Land
Puklowski GG Open Space Covenant
North West Nelson State Forest Park

15-5 Farewell Spit Coastal Ecological District

Marine Topography Large sand spit extending eastwards for over 30 km from Pillar Point. The coast is exposed to the Tasman Sea in the north but sheltered in the south with an extensive intertidal zone. The district is defined by a flattening of slope off the Spit Bank at approximately 20 m depth to the southwest and south and 60 m to the east and north.

The northern side of the spit consists of fine, relatively uniform sand, sloping northwards at a moderate gradient onto the Cook Strait Platform. To the south tidal

This is a high energy shore, with wave heights commonly exceeding 3 m. Only in the lee of Kapiti Island, where a cusped headland has developed, is the region protected to a degree. Under these conditions the potential for large quantities of sand to be shifted on and offshore and also along the shore is great.

Hydrology Influenced by warm, saline water of the D'Urville Current. Southeasterly littoral drift along the coast is demonstrated in the numerous small streams whose mouths are deflected to the south by spits. Maximum tidal range of 2.4 m. Beach width between spring tides can reach 150 m.

Biology Dune vegetation consists largely of marram grass, lupin, silvery sand grass and taupata. In the drift zone are commonly found the sandhopper, sandlouse and the larvae of flies and sand scarabs. Common animals of the littoral and sublittoral zones include the toheroa, tuatua, venus shell, worms *Pseudonerine* sp., *Glycera tessellata*, *Platynereis australis* and *Aglaophamus macroura*, and paddle crab.

The mouth of the Waikanae River, with its nearby shallow lakelets, abandoned river channels, saltmarshes and dune shrubland, is a favoured locality for shore birds including five shag species, three species of heron, the South Island pied oystercatcher, banded dotterel, several species of gull and tern and the eastern bar-tailed godwit. Considerable numbers are also found in the estuaries of the Manawatu and Rangitikei rivers.

Existing Coastal PNAs

Himatangi Bush Scientific Reserve
Round Bush Scenic Reserve
Lake Papaitonga Scenic Reserve
Waimeha Wildlife Refuge
Pukepuke Lagoon Government Purpose Reserve
McKays Crossing Government Purpose Reserve

14 SOUNDS COASTAL ECOLOGICAL REGION (Fig 4)

This region is separated from the complex boulder, rock bluff and gravel beaches of Nelson Bays' Boulder CED by the beginning of an extensive area of hard shore and highly indented coastline. The eastern boundary occurs at the change to mixed sand and gravel beaches of Cloudy Bay in the Marlborough CER. The seaward boundary with the shelf regions is at the sand/silt and sand/rock interface. This boundary corresponds with a break in slope and approximates the 50 m contour.

The Marlborough Sounds is a complex system of inter-fingering, high resistant ria coastlines opening into Cook Strait. The shore line consists of sheltered beaches varying from cobbles to sand and broken shell separated by rocky points and sections of hard shore. At the head of the Sounds saltmarsh and mudflats occur, particularly in Pelorus Sound. Exposed rocky headlands, small rocky islands and reefs are features of the outer Sounds. Bottom sediments in most of the inner Sounds are fine muds that grade into sand and gravels at the seaward coast. Circulation is dominated by tidal flows.

In much of the inner Sounds an *Asychis* spp – *Echinocardium cordatum* – *Amphiura rosea* community is found. This community is replaced by estuarine species at the heads; by coarse sediment, high tidal flow species in Tory Channel and French Pass; and by open shore species at the outer Sounds. This region contains three districts – Queen Charlotte, Pelorus and Outer Sounds.

14-1 Queen Charlotte Coastal Ecological District

Marine Topography District in the eastern Marlborough Sounds extending from Okiwa Bay seawards to the lee side of Long Island (excluding Tory Channel). The sound contains sheltered hard and soft shores. It has an average depth of 35 m with mud covering most of its length apart from the juncture of Tory Channel and the sound head where silty sediments occur.

Hydrology Queen Charlotte Sound receives small amounts of freshwater from the surrounding hills hence the salinity gradient is not large, changing by approximately 0.24‰ from head to mouth. Tidal flows dominate circulation.

Biology Benthic and littoral communities are determined by tidal flows and not greatly influenced by changes in salinity. Brachiopod – *Chlamys* and *Echinocardium* communities are important parts of the benthic environment. Blue and green-lipped mussels, the algae *Hormosira* and the barnacle *Elminius* are major floral and faunal components of the littoral zone.

Existing Coastal PNAs

Part of the Marlborough Sounds Maritime Park.
Consists of: 41 scenic reserves
1 open space covenant

14-2 Pelorus Coastal Ecological District

Marine Topography District consists of a main sound, four major re-entrants and numerous small bays extending from Havelock to Maud Island. The sound is highly variable in depth and width but tends to broaden and deepen seawards. This soft and hard sheltered shore is delineated by an increase in exposure towards the head and the change from sands and silts of the exposed coast to the finer muds of the inner sound. Sediment thickness increases towards the head with much terrigenous input from the Pelorus and Kaituna Rivers.

Hydrology Pelorus Sound receives freshwater input from two sizeable rivers – Pelorus and Kaituna. A marked salinity gradient exists between the mouth and the head with the greatest change occurring at the confluence with Kenepuru Sound. This situation does not exist in the adjacent Queen Charlotte Sound. Tidal currents are important determinants of community structure in the district with ebb flows stronger and over a shorter period than flood flows.

Biology An *Asychis* spp – *Echinocardium cordatum* – *Amphiura rosea* community dominates the muddy benthic zone. Commercial catches of scallops are important to the district. Green-lipped mussels are farmed, particularly in Kenepuru Sound. At the head of Pelorus Sound extensive mudflat and saltmarsh occur.

Existing Coastal PNAs

Part of the Marlborough Sounds Maritime Park.
Consists of: 1 scientific reserve
41 scenic reserves
1 protected private land

14-3 Outer Sounds Coastal Ecological District

Marine Topography Exposed hard shore of the Marlborough Sounds extending from Rarangi to the northern end of Delaware Bay. District includes the partially sheltered soft and hard shores of Croiselles and Greville Harbours; Admiralty, Forsyth and Guards Bays;

and manuka on the landward side of dunes. There are also clusters of pohutukawa.

Existing Coastal PNAs

Simmonds Islands Nature Reserve
Motutangi Scenic Reserve
Kowhai Beach Wildlife Refuge
Lake Taore Government Purpose Reserve.

7-2 Rangaunu Harbour Coastal Ecological District

Marine Topography This is a circular harbour of 115 km² of which 53% is exposed as mud, seagrass and mangrove flats at low tide. The mangrove area amounts to 31 km² and as such represents 15% of the NZ 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.

Hydrology Tidal flows dominate water movement. At high tide, a strong temperature and salinity gradient develops near the mouth of the Awanui River. This gradient extends at low tide to the middle of the harbour. In the harbour proper, salinities approach 35.3‰, and 35.7‰ at the entrance.

Biology The main ecological component is the mangrove community that occupies 50% of the intertidal area. The remaining flats support dense meadows of seagrass. Common inhabitants include snapping shrimp, tubeworm, venus shell, cockle, mud crab and mud whelk. Among the mangroves occur pipis, mud snails, barnacles and occasional rock oysters on the pneumatophores of the trees. A characteristic snail of the sandy bottom is *Umbonium zelandicum*.

The tidal flats attract many thousands of international wading birds. The Rangiputa shellbank supports a breeding colony of red-billed gulls and Caspian terns. White herons frequent the area around the Okatakata Islands.

The endangered ferns *Thelypteris confluentis* and *Todea barbara* are present in the saltmarsh on the eastern slope of the harbour.

The harbour is an important feeding and nursery ground for a large number of fish species including parore, snapper, john dory and flatfish.

Existing Coastal PNAs Nil

7-3 Houhora Harbour Coastal Ecological District

Marine Topography A shallow harbour of 14.5 km² and 8.5 km long with extensive sandy mud flats. A narrow channel over 4 m deep extends about 3 km upstream. Mount Carmel, 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 and, on the eastern side, an extensive belt of saltmarsh.

Hydrology Maximum tidal range for this district is 2 m.

Biology The intertidal flats have a characteristic molluscan fauna including the mud whelk, *Zeacumantus lutulentus*, *Z. subcarinatus*, *Zediloma subrostrata* and bivalves *Nucula hartvigiana*, wedge shell and the cockle. Crustaceans are relatively scarce but are represented by the snapping shrimp, mantis shrimp and pill-box crabs.

Parore, snapper, spotties, john dory, flounder and stingrays frequent the harbour.

This area is considered an 'excellent' habitat for wading birds. It lies between Parengarenga and Rangaunu Harbours and probably forms an important link in a chain of nationally important estuaries. Extensive saltmarshes grade to freshwater swamps and shrublands. Mangroves are most dense in the upper reaches, where trees attain a height of 7 m.

Existing Coastal PNAs Nil

7-4 Parengarenga Harbour Coastal Ecological District

Marine Topography This is the most northerly harbour in mainland New Zealand. It has an area of 63 km² of which 90% consists of intertidal flats of sand/mud, mangrove, seagrass and saltmarsh. An array of tidal inlets radiate inland from the entrance and terminate in numerous swamp-backed channels. At the harbour mouth there is a wide sand bar. Parengarenga Harbour is formed from a drowned valley system impounded behind a large sandspit.

Hydrology There is a maximum tidal range of 2.1 m.

Biology Parengarenga Harbour is of 'outstanding' value as a wildlife habitat especially for migratory wading birds. Rare visitors include the American whimbrel, greenshank, grey-tailed tattler and terek sandpiper.

The large extent of intertidal seagrass flats with high infaunal biomass provides important feeding grounds for bird and fish populations.

Existing Coastal PNAs Nil

8 TE PAKI COASTAL ECOLOGICAL REGION (Fig 2)

8-1 Te Paki Coastal Ecological District

Marine Topography Area between Ohao Point on the east coast and Scott Point on the west coast. It consists of a repeating sequence of rocky headland and sandy beach. The beaches are often backed by large wetland areas. Because of its size and distinctive nature Te Paki CER is also considered as one district. Most of the headlands are of volcanic origin with steep cliffs and rocky platforms at their bases. Wave exposure changes from high energy on the west coast to low energy lee on the east coast.

Hydrology The district is influenced to the west by the warm, saline waters of the Westland Current and to the north and east by the subtropical East Auckland Current. Salinities are over 35.0‰, with temperatures between 15-21°C and a maximum tidal range of 2.1 m.

Biology Bull kelp occurs from Cape Maria van Diemen to Spirits Bay. Eastern algal species *Carpophyllum angustifolium* and *C. plumosum* do not extend past North Cape. Water off North Cape is considered a nursery area for the packhorse lobster, with the main fishery for the adults occurring off Cape Reinga.

Wetlands backing Spirits Bay and Tom Bowling Bay are important breeding and feeding grounds for birds, including the NZ dotterel, banded dotterel, black swan, grey duck, pied shag and spotless crane. Of special significance are colonies of the flax, and kauri snails.

Existing Coastal PNAs
Motuopao Island Nature Reserve
North Cape Scientific Reserve

9 THREE KINGS ISLANDS COASTAL ECOLOGICAL REGION (Fig 2)

9-1 *Three Kings Islands Coastal Ecological District*

Marine Topography This district is 48 km northwest of Cape Reinga and consists of one large island (Great Island), three small islands (North East, South West and West Islands) and a chain of bare or scrub covered rocks (Princes Islands). It has an exposed and precipitous coastline of volcanic origin.

Hydrology The islands have a mild subtropical climate with much mist and fog. They are influenced by the eastward flowing oceanic waters of the East Australian Current plus the unpredictable south and north flows of the West Auckland and Westland Currents respectively.

Biology Unusual features of this region are the abundance of the Cook Strait limpet *Cellana denticulata* and the complete absence of *C. ornata*. Also present is the subtropical thaid *Neothais smithi*.

The islands are used as breeding sites by the Australian gannet, and petrel and shearwater species. There is also an overwintering colony of New Zealand fur seal.

Existing Coastal PNAs
Three Kings Nature Reserve

10 WESTERN NORTHLAND COASTAL ECOLOGICAL REGION (Fig 2)

Area from Kahokawa Beach south to Murawai Township. Open exposed sand beaches broken by rocky promontories in the central part and indented by four harbours increasing in size from north to south. This shore differs from the Waikato region by; a reduction of the number and size of rocky outcrops, a tendency towards more developed fore dune hill foreshore (rather than cliffs) and beaches having a lower profile. Region comprises five districts – Ninety Mile Beach, Hokianga, Hokianga Harbours, Kaipara and Kaipara Harbour.

10-1 *Ninety Mile Beach Coastal Ecological District*

Marine Topography 90 km length of firm white sand from Kahokawa Beach to Shipwreck Bay backed by a belt of shifting dunes up to 150 m high and, in some places, penetrating 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. This district is exposed to the west although Reef Point affords some shelter to the southernmost beaches.

Ninety Mile Beach is bordered to the north and south by the rocky promontories of Scott Point and Reef Point, respectively.

Hydrology The district is influenced by the Westland Current although the ephemeral West Auckland Current may flow south in winter. Surface inshore salinities range from 35.3-35.5‰, temperatures from 14-21°C and a maximum tidal range of 3.2 m.

Biology

Existing Coastal PNAs
Te Arai State Forest Sanctuary

10-2 *Hokianga Coastal Ecological District*

Marine Topography Open, exposed sandy beaches interspersed by stretches of rocky bluffs and outcrops between Shipwreck Bay and Aranga Township. Three successively larger harbours break the southward running line of this shore. These harbours (Herekino, Whangape and Hokianga) are combined in the Hokianga Harbours CED.

Hydrology The district is influenced by the sub-tropical north flowing Westland Current and occasionally by the south flowing West Auckland Current. Salinities are between 35.0 and 35.5‰ and temperatures range between 15-22°C.

Biology

Existing Coastal PNAs Nil

10-3 *Hokianga Harbours Coastal Ecological District*

Marine Topography District comprises three narrow tidal harbours, Herekino, Whangape and Hokianga with surface areas of 6.3, 8.5 and 115 km², respectively. Tidal mudflats occupy approximately 50% of each harbour. Whangape opens to the sea via a 4 km long, 150 m wide channel bordered by steep hillsides. Herekino entrance lies between huge dunes to the north and a prominent spur to the south. The surrounding land in all three harbours is largely cleared and subject to erosion.

Hydrology The maximum tidal range of these harbours is 3 m.

Biology The harbours contain mangrove stands and *Juncus*, *Leptocarpus* and *Muehlenbeckia* saltmarsh. Reclamation and dumping of rubbish have resulted in some habitat loss.

The harbours are of considerable wildlife value. Hokianga has a small brown teal roost in the Mangamuka arm and high numbers of banded rail and spotless crane. In Herekino, vehicles have caused some disturbance of roosting sites.

Existing Coastal PNAs Nil

10-4 *Kaipara Coastal Ecological District*

Marine Topography Area from Aranga Beach south to Muriwai Township consisting of a uniform stretch of fine sandy beach 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. The Kaipara coast is a high energy shore exposed to the prevailing southwest winds.

Hydrology Area is influenced by subtropical waters of the Westland and West Auckland Currents. Salinities range from 35.0-35.5‰, temperatures between 14 and 22°C and a maximum tidal range is 2.9 m.

Biology Dune vegetation includes silvery sand grass, marram grass, tree lupin, five species of pampas grass and *Muehlenbeckia complexa*.

Dominant molluscs are the toheroa and tuatua. Crustaceans include: seaslater, sandlouse and sandhopper on the upper beach, isopods of families Sphaeromidae and Eurydicidae on the middle beach, and ghost shrimp, paddle crab, mantis shrimp and haustoriid amphipods on the lower beach. Hand gathering of toheroa, tuatua and mussels occur, especially at Muriwai Beach, Mahuta and south of Aranga Beach.

COASTAL ECOLOGICAL REGIONS AND DISTRICTS

12 TARANAKI COASTAL ECOLOGICAL REGION (Fig 3)

Area between Awakino and Kai Iwi River mouths. This region consists of medium height cliffs with boulder/cobble beaches. To the north and south of this shore are two transitional zones of high cliffs and sandy beaches with scattered boulders. These merge into the wavecut platforms and harbours of the Waikato CER to the north and the uniform sandy beaches of the Manawatu CER to the south. Three districts are recorded for this region – Tongaporutu, Egmont and Patea.

12-1 *Tongaporutu Coastal Ecological District*

Marine Topography District extends from Awakino River mouth to Urenui, enclosing an area of vertical cliffs of sandstone and siltstone layers eroded into short headlands and small bays fronted by beaches of black sand. Only occasionally do somewhat more resistant beds stand out as cut platforms or reefs off headlands, such as Pariokariwa Point. At Whitecliffs the cliffs are 200 m high, with frequent rock and earth falls. The shore is exposed to the west but sheltered from the predominant southwest winds.

Hydrology Influenced by the northward flowing Westland Current and on occasion the West Auckland Current, both of subtropical origin. Inshore seasurface temperatures range from 13-22°C, with salinities of 34.0-35.2‰. Maximum tidal range is 3.1 m.

Biology Few animals occur in the sand although sandhoppers are common in the drift line. A large and varied offshore molluscan fauna is obvious from the shells on the beach, eg scallops, cockles, tuatua, pipi, green-lipped mussel and *Dosinia anus*.

The cliff face is dotted with black and green-lipped mussels, barnacle *Chamaesipho columna*, limpets *Notoacmea* spp. and *Cellana radians*, periwinkles and patches of sea lettuce and *Enteromorpha* spp. Sheltered faces are encrusted with the tubes of *Sabellaria kaiparaensis* and *Pomatoceros caeruleus*. The rocky platforms at Mokau and Pariokariwa have a more diverse life, with rock pools of coralline turf, *Carpophyllum*, etc.

Existing Coastal PNAs Nil

12-2 *Egmont Coastal Ecological District*

Marine Topography Extending from Urenui to Hawera, this district consists of a uniform beach dominated by boulder strewn platforms backed by low cliffs of volcaniclastic deposits. Large and angular boulders are found towards the outer margin of the platforms while landwards cobbles and boulders become more rounded and are often interspersed with patches of sand. This is a high energy shore in the western and southern portions but sheltered to some extent along the northern part. It is in the latter area that the rocky platforms are at their widest (Airedale Reef near Waitara is about 500 m wide) and have a greater sand content.

Hydrology Influenced mainly by the subtropical water of the northward flowing Westland Current and its offshoot, the D'Urville Current. There is evidence of an occasional southward flowing element, the West Auckland current, at Cape Egmont. A considerable amount of freshwater flows from the harbours and rivers

of this and adjacent districts. Inshore sea-surface temperatures are 12-22°C, salinities are 34.0-35.0‰ and the maximum tidal range is 3.0 m.

Biology Down to the ELWN point the boulder tops are usually clean although littorinids commonly occur to the drift line. Sheltering beneath the rocks is a typical fauna of *Zediloma* spp., red beadlet anemones and crabs *Leptograpsus variegatus*, *Cyclograpsus lavauxi* and *Heterozius rotundifrons*. Common limpets include *Cellana ornata*, *C. radians* and *Notoacmea pileopsis*. Towards the low tide mark where the boulders are larger and more stable small pools are fringed with *Hormosira* and *Corallina*. In the sublittoral fringe sea weeds are more luxuriant and include *Cystophora torulosa* and *Carpophyllum maschalocarpum*.

Commercial harvesting of mussels, paua, kina, crayfish and pipi.

Existing Coastal PNAs
Maitahi Scenic Reserve
New Plymouth Offshore Islands Wildlife Refuge

12-3 *Patea Coastal Ecological District*

Marine Topography Area between Hawera and the Kai Iwi River mouth consisting of sandy beaches dotted with andesitic boulders backed by deeply indented siltstone, sandstone and lahar cliffs up to 50 m high. This is a high energy shore, exposed to the west and southwest, with a retreating cliff face of 40-100 cm/year. In some areas the cliffs are masked by a build up of low dunes, such as near Hawera and Nukumaru Beach.

Hydrology Influenced by easterly flowing D'Urville current of warm, saline water. Surface temperatures range from 13-19°C, with salinities between 35.3 and 34.4‰. Maximum tidal range of this district is 2.3 m.

Biology Cliff inhabitants include the periwinkles, scattered *Siphonaria zelandica*, *Enteromorpha*, black mussels and *Perinereis novaehollandiae*, with grazers such as *Sypharochiton pelliserpentis*, *Cellana Bradians*, *C. ornata*, *Notoacmea* spp. and *Onchidella nigricans* found towards the lower shore. Large algae such as sea lettuce and *Gigartina decipiens* occur on the upper surface of boulders. The only large, permanent inhabitant of the beaches is the sandhopper.

Important commercial and amateur harvesting of crayfish, kina, paua, paddle crabs and pipis.

Existing Coastal PNAs Nil

13 MANAWATU COASTAL ECOLOGICAL REGION (Fig 3)

13-1 *Manawatu Coastal Ecological District*

Marine Topography Area from the Kai Iwi River mouth south to Paekakariki consisting of a 130 km stretch of continuous sandy beaches with gentle slopes, backed by extensive dune systems and divided by a repetitive sequence of rivers. The district is bordered to the north by sandy boulder strewn beaches backed by cliffs and to the south by wave cut rock platforms. Because of its size and unity we have given this area both district and regional status.

Sediments are clean, well-sorted medium to fine grained sands. Near the mouths of rivers and larger streams concentrations of pebbles and other coarse detritus occur.

Hydrology This region is exposed to all but southeast storms. Strong inshore tidal currents move around the top of the peninsula, flowing northeast in the ebb tide and southwest in the flood. The oceanic current pattern is dominated by subtropical water of the easterly drifting Tasman Sea. At the Norfolk Ridge the East Australian Current is deflected south past the Three Kings Islands and along the east coast as the East Auckland Current. Some of this flow is known to move occasionally along the west coast as the West Auckland Current. The predominant flow is, however to the north. The northward and eastward flows over the shelf have produced areas of upwelling between Cape Reinga and the Three Kings Islands.

Biology Communities of *Nemocardium pulchellum* – *Venericardia purpurata*, *Scalpomactra scalpellum* – *Macra ordinaria* and *Tawera spissa* – *V. purpurata* have been recorded on sediments ranging from gravelly sands to mud. Commercial fisheries for snapper, trevalley, groper, bass, skipjack tuna and crayfish occur in this area.

C WESTERN AUCKLAND SHELF ECOLOGICAL REGION (Fig 2)

A region of relatively uniform shelf extending west from Tauroa Point and northwest from Waitara. The shelf break has few indentations, the most notable being the Viti Canyons in the south. Sandy sediments occur over much of the shelf with areas of mud off Kaipara Harbour and the inner shelf of North Taranaki. This region is exposed to the westerly quarter with storm surges affecting sediments on the mid and inner shelf. Oceanic currents are indistinct with current direction dependant on direction and strength of winds. The Westland Current may extend north as far as Kaipara Harbour or beyond while the ephemeral West Auckland Current has been detected as far south as Taranaki. There are four districts – Western Northland, Kaipara, Waikato and Northern Taranaki Bight.

C-a Western Northland Shelf Ecological District

Marine Topography An area of uniform shelf sloping evenly to the shelf break approximately 15 km offshore. The shelf consists of medium to fine sands. It is delineated to the north by the change to uneven shelf north of the South Ahipara Bank and to the south by a change to fine sediments off Kaipara Harbour west of Te Maire.

Hydrology District exposed to storm surge from the westerly quarter.

Biology *Scalpomactra scalpellum* – *Macra ordinaria* communities have been recorded on sandy substrates. There are fisheries for snapper and skipjack tuna.

C-b Kaipara Shelf Ecological District

Marine Topography Area of uniform shelf consisting of muddy sand and mud of Kaipara Harbour. It begins west of Te Maire and ends southwest of Muriwai.

Hydrology Affected by sediments from the Kaipara Harbour and storm surges.

Biology Communities of *Scalpomactra scalpellum* – *Macra ordinaria* have been recorded here on sandy sediments ranging to mud. Snapper and skipjack tuna are commercially important species for the district.

C-c Waikato Shelf Ecological District

Marine Topography Area of sand and muddy sand extending southwest from Muriwai to a position west of the Awakino River mouth on the mid and outer shelf and the seaward boundary of the Northern Taranaki Bight SED southwest of Kawhia Harbour on the innershelf. The shelf break is moderately indented, the largest being the Viti Canyons in the south of the district.

Hydrology The northern limit of the Westland Current apparently falls within this district.

Biology *Scalpomactra scalpellum* – *Macra ordinaria*, *Glycymeris laticostata* – *Venericardia purpurata* and *Nemocardium pulchellum* – *V. purpurata* communities are reported on sandy substrates. There are commercial fisheries for snapper, trevalley, john dory, gurnard, albacore tuna, barracouta mackerel and squid.

C-d Northern Taranaki Bight Shelf Ecological District

Marine Topography Section of shelf extending offshore to the 30m contour between Kawhia Harbour and Oakura. The seawards and northern limit of this district is at the transition of muddy sand to sand approximately 40 km offshore and at Kawhia Harbour. The southern limit of the district is at the expansion of a mud belt and increasing depth off Oakura. This district represents a narrow strip of shelf that grades from sand to muds then back to sand over a gradually increasing depth range.

Hydrology The Westland Current moves north through this district but tends to disappear in the vicinity of Kawhia. This northwards flow is reversed by changes in wind direction resulting in a southwards extension of the West Auckland Current. Storm waves from the west and north affect bottom sediments but tend to be less severe than in areas exposed to the dominant southerly storms.

Biology There are *Scalpomactra scalpellum* – *Macra ordinaria*, *Nemocardium pulchellum* – *Dosinia lambata* and *N. pulchellum* – *Venericardia purpurata* communities on sand to mud sediments and hermit crab communities off the Mokau River mouth. Commercial stocks of snapper, barracouta, mackerel, spiky dogfish and trevalley.

southeast. This territory contains cold temperate mixed waters. It approximates the transition zone of northern and southern faunal and floral elements associated with the Cookian Province established in biogeographical literature.

Among the sand dunes, there are areas of swamps and small lakes that support waterfowl and wading birds such as the NZ scaup, paradise shel duck, grey duck, pied shag, little shag and little black shag.

Existing Coastal PNAs

Baylys Beach Scenic Reserve
Lake Okaihau State Forest Ecological Area
Lookout State Forest Ecological Area
Hodges Basin State Forest Ecological Area

10-5 Kaipara Harbour Coastal Ecological District

Marine Topography This harbour is the most extensive of the drowned river valley systems of the North Auckland Peninsula with a surface area of 947 km² and a convoluted coastline of over 4000 km. Tidal flats represent 43% of the area. 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 hardshore consists of grey limestone. The main inflowing rivers are the Wairoa from the north and the Kaipara from the south.

Hydrology The maximum tidal range is 3.7 m.

Biology The hardshore has a wide belt of rock oysters below which are the tubeworm *Pomatoceros caeruleus* and gastropods *Cominella glandiformis*, *Zeacumantus lutulentus* and *Zediloma subrostrata*. The mysid *Tenagomysis Bchiltoni* is abundant.

Commercial fishing occurs for flatfishes, grey mullet, school shark, snapper, whitebait, trevalley, kahawai, scallops, cockles and pipis.

NZ and overseas waders are present, and terns at Waionui Inlet.

Existing Coastal PNAs

Tauhoa Nature Reserve
Kaukapakapa Estuary Scientific Reserve
Kaukapakapa Scenic Reserve
Moturemu Island Scenic Reserve
Coal Seam Hill State Forest Ecological Area
Pouto Point Wildlife Refuge
T R Mann Government Purpose Reserve
Tapora (Sand) Island Government Purpose Reserve

11 WAIKATO COASTAL ECOLOGICAL REGION (Fig 2)

Area from Muriwai Township south to the Awakino River mouth. The region consists of sandy beaches (benched to the south) and wave cut platforms divided by rocky promontories and indented by five estuarine harbours. The region consists of five districts – Western Auckland, Manukau Harbour, Waikato River Mouth, Kawhia Harbours and Ngarupupu.

11-1 Western Auckland Coastal Ecological District

Marine Topography Extending from Muriwai Township south to Tirua Point, this district consists of a sequence of flat, fine sand beaches and wave cut platforms divided by promontories of high cliffs and offshore stacks and reefs. The latter consist of medium to high resistant sandstone and siltstone. This district is also indented by five large estuarine harbours that, because of their unique characters, are considered separately. The district is bounded to the south by the

characteristic stepped beaches of the Ngarupupu CED and to the north by the extensive sandy beaches of the Kaipara CED. Many of the sandy beaches are comprised of ironsand, eg from Waikato River mouth to South Head of Manukau Harbour, with considerable deposits offshore.

Hydrology Influenced by subtropical waters of the Westland Current and, on occasion, the West Auckland Current. Salinities are normally around 35‰, with a temperature range of 13–22°C. The maximum tidal range is 3 m. The coast is exposed to prevailing southwest winds with constant wave action on the shore.

Biology Bull kelp dominates the sublittoral fringe of the more exposed promontories. Littoral biota include barnacles *Chamaesipho columna* and *C. brunnea*, black mussel and green-lipped mussel. In the comparative shelter of Whale Bay (near Raglan) two northern algae, *Gigartina alveata* and *Pachymenia himantophora*, are the dominant zoning plants although both are near their southern limits. Kelp is replaced by *Carpophyllum maschalocarpum*.

Toheroas occur in the lower zone of the sandy beaches and are seasonally harvested. Areas adjacent to Auckland City are used extensively for recreational fishing, diving and surfing. Commercial quantities of paua, crayfish and kina occur along the rocky coastline and offshore reefs.

Existing Coastal PNAs

Waipipi Scenic Reserve
Piha Scenic Reserve

11-2 Manukau Harbour Coastal Ecological District

Marine Topography Large, tidal inlet of 344 km² formed from a drowned river valley. Tidal flats comprise 42% of the area. The harbour has a maximum length of 30 km opening to the sea via a narrow (2.2 km wide), deep (30 m) channel with a bar approximately 5 km offshore. There are four main channels in the harbour. The flats consist of sand and the entrance of fine, grey iron-sand. Coastline of rock along northern edge and entrance with areas of saltmarsh/mangroves elsewhere, apart from medium to coarse sand at Clarks Beach.

Hydrology Flow dominated by tides with comparatively little freshwater input. Parts of the harbour receive treated sewage effluent. Salinity and temperature observations show that the water is nearly homogeneous with depth in summer. Salinity increases seawards with a change of 3‰ between the heads and the innermost shore away from rivers. Temperatures of 19–21°C in summer. Maximum tidal range of 3.4 m.

Biology Most widespread species are the wedge shell, cockle, *Soletillina siliqua*, *Nucula hartvigiana*, the anemone *Anthopleura aureoradiata* and polychaete *Owenia fusiformis*. There are local patches of the cake urchin *Arachnoides zelandiae* and gastropod *Zethalia zelandica*. Mangroves and saltmarsh are not greatly developed, being absent in many parts due to the sandy nature of the sediment and the considerable wave fetch along the southwest or west axes.

Harvesting of flatfishes and mullet, recreational gathering of cockles, pipis.

NZ and international waders present.

Existing Coastal PNAs

Puhinui Creek Wildlife Refuge

CENTRAL NERITIC TERRITORY (Fig 1; Fig 3; Fig 4)

Area containing both coastal and shelf regions extending from Awakino River mouth (North Taranaki) in the northwest and Matakaoa Point (East Cape) in the northeast to Stripe Point (South Westland) in the southwest and Cape Wanbrow (North Otago) in the

11-3 Waikato River Mouth Coastal Ecological District

Marine Topography A wide, pot-bellied delta of estuarine character, with the mouth bordered to the south by the greywacke of the Port Waikato Hills and to the north by the Maori Forest sand hills. In the delta there is a pattern of islands and exuberant growth emerging to the clear seascape of Maoro Bay which at its widest is almost 2 km across. From here, the river discharges into the sea via the mouth.

Hydrology Tidal range at the entrance of 3.2 m. In the delta, the spring low tide is masked.

Biology Important area for wading birds and migratory fishes, especially the grey mullet, whitebait, smelt and eels.

Existing Coastal PNAs Nil

11-4 Kawhia Harbours Coastal Ecological District

Marine Topography Comprising three tidal harbours, Raglan, Aotea and Kawhia, with areas of 24, 36, and 67 km², respectively. Tidal mudflats occupy at least 60% of each harbour, and in the case of Aotea, occupies 89%. Maximum lengths of 11–13 km and entrance widths of 0.5–1 km.

Sediments range from clean, well sorted sands in the beaches, dunes, channels and bars in the lower harbour to mainly muddy sands and sandy muds in the tidal flats of the middle and upper harbour.

Hydrology Salinities range from 30–33‰ with truly estuarine conditions restricted to the tidal reaches of small streams. The maximum tidal range is 2.8–3.3 m.

Biology Molluscs dominate the benthic macrofauna and most commonly include the cockle, mud snail, whelks *Cominella maculosa*, *C. glandiformis* and *C. adspersa*, *Zeacumantus lutulentus* and bivalves *Cyclomactra ovata*, *Leptomya etitaria* and *Paphirus largilerti*.

An important feature of these harbours is the mangrove, found here close to its southern limit as a stunted shrub rather than the tree of Northland.

These harbours are important for both New Zealand and international wading birds. The areas support valuable commercial and recreational fisheries for snapper, trevally, mullet, flatfishes and kahawai, plus hand-gathering of mussels, scallops, cockles, pipis, tuatua and kina.

Existing Coastal PNAs

Raglan Harbour – Motukokako Point Scenic Reserve
– Ngatoka A Warihi Scenic Reserve
– Hawea Scenic Reserve
– Pears Finger Protected Private Land

Aotea Harbour – Aotea Heads Scientific Reserve

Kawhia Harbour – Puti Scenic Reserve
– Motu Tara Scenic Reserve
– Awaroa Scenic Reserve
– Rakanui Scenic Reserve
– Te Umuroa Scenic Reserve
– Waiharakeke Scenic Reserve
– Oteke Scenic Reserve

11-5 Ngarupupu Coastal Ecological District

Marine Topography Exposed coastline from Tirua Point south to the Awakino River mouth consisting of stepped or benched profile of medium resistance cal-

careous siltstone and sandstone. There is a well defined dip slope that descends to the shore where it ends at a line of low cliffs. The often undercut and indented cliffs are fronted over some distance by intertidal platforms.

Bordered to the north by the rocky promontories and sandy beaches of the Western Auckland CED and to the south by the sandy beaches/cliffs of the Tongaporutu CED.

Hydrology Influenced by subtropical waters of the Westland and, on occasion, West Auckland Currents. Salinities of 34.2–35.0‰ and temperatures of 13–22°C. Maximum tidal range of 2.8 m.

Biology The cliff faces have zones of *Littorina unifasciata*, *Chamaesipho* spp., *Xenostrobus*, *Porphyra columbina* and *Ulva*. In sheltered areas, such as Ngararahae Beach, there is an increase in shelter preferring species such as the tube worm *Pomatoceros*. At Waikawa, where the intertidal platform is extensive, there are similar species but a greater profusion of algae, including wide *Corallina/Hormosira* flats, and associated animals. Area is important for harvesting of crayfish, paua and mussels. In sandy areas, pipis are also taken. The Awakino River mouth is the southernmost limit of mangroves on this coast.

Existing Coastal PNAs Nil

SHELF ECOLOGICAL REGIONS AND DISTRICTS

A EASTERN AUCKLAND SHELF ECOLOGICAL REGION (Fig 2)

Region of the northeast shelf of the North Island extending between the narrowing of shelf off Matakaoa Point in the southeast and North Cape in the northwest. The shelf is of moderate width (20–30 km) except off Great Barrier Island where the shelf extends to 120 km. The shelf break has few indentations from submarine canyons, the most notable being in the Bay of Plenty and off the Northland Peninsula. The shelf has an irregular bathymetry containing numerous islands and large headlands resulting in a variable sediment distribution and hydrographic pattern.

Muds tend to be located at the outer shelf and in the least exposed areas (Inner Hauraki Gulf). Sands and gravelly sands extend over the mid and inner shelf off the more exposed part of the shoreline as a result of storm surge and the constriction of tidal and residual currents around headlands and islands.

This region is exposed to the tropical storm centres to the north and east but protected from storm centres in the south and west. The shelf receives subtropical water from the eastward drift of the East Australian Current which moves south along the east coast of the North Island from North Cape to East Cape as the East Auckland Current. At the Hauraki Gulf, part of this flow moves into the Gulf from the west and leaves via the Colville Channel.

In this region four districts have been identified – Bay of Plenty, Outer Hauraki Gulf, Inner Hauraki Gulf and Eastern Northland.

A-a Bay of Plenty Shelf Ecological District

Marine Topography An area offshore from Matakaoa and Town Points comprising an inshore zone of sand

grading to an extensive area of silt, silty sands and muds at the mid and outer shelf. The shelf descends gradually to the shelf break with its greatest width off Opotiki. To the east the shelf narrows rapidly at Matakaoa Point and also slightly to the west where it is indented by the White Island Trench and the Whakatane Sea Valleys. Between these indentations is an outer shelf ridge – the Rurima. Towards the west of the district sands tend to become more prevalent until sand and gravelly sand are the dominant sediment type and becomes the Outer Hauraki Gulf SER. The western boundary to this district does not include the shelf near Plate Island and Schooner Rock but includes the outer shelf beyond 50 m depth off Town Point east to the vicinity of the Rangitaiki River Mouth where silts occur near shore.

Hydrology Mean ocean currents tend to move east around the bay resulting in sediment transport of fine fractions into this district.

Biology Communities of *Scalpomactra scalpellum* – *Mactra ordinaria* and *Tawera spissa* – *Venericardia purpurata* have been reported on muds and sand substrate. Commercial species include snapper, trevally, tarakihi, gurnard, moki, kingfish, flatfish, school shark, skipjack and albacore tuna.

A-b Outer Hauraki Gulf Shelf Ecological District

Marine Topography This district is characterised by its sand and gravelly sand sediments on the inner and mid shelf grading to muds on the outer shelf. Silts occur in small patches on the outer shelf with sand and gravel shell beds offshore from Capes Colville and Rodney and around Mercury Islands. The district is delineated to the southeast by the transition from muds and silts off Town Point. The appearance of sand on the outer shelf in the vicinity of the Poor Knights Islands and the extensive area of biogenic sediment off Cape Brett indicates the northwest limit of this district. It is separated from the Inner Hauraki Gulf SER by its greater exposure to the east and north, and the change to muds and clays at a depth of approximately 25 m between Tokatu Point and western Coromandel Peninsula. In the southeast and northwest of the district the shelf grades steadily to the shelf break although the bottom topography tends to be complex particularly between Mercury and the Hen and Chicken Islands. In contrast to the district to the south this district is not highly indented by submarine canyons.

Hydrology The East Auckland Current moves southeast along the coast moving into the Hauraki Gulf and out through the Colville Channel. Tidal currents and storm surges affect the distribution of sediments. In comparison to the Inner Hauraki Gulf temperatures and salinities are stable and not altered by freshwater input.

Biology *Tawera spissa* – *Venericardia purpurata* and *Nemocardium pulchellum* – *V. purpurata* communities are recorded in gravelly sand to mud substrates in this district. Commercial species include scallops, crayfish, flatfish, gurnard, trevally, tarakihi, snapper, kingfish, john dory, mackerel, skipjack tuna, albacore tuna, groper and school shark.

A-c Inner Hauraki Gulf Shelf Ecological District

Marine Topography Inner shelf area in the lee of Coromandel Peninsula, Great and Little Barrier Islands and Tokatu Point. It is delineated by the transition from

sand to fine muds (and clays off the Firth of Thames) in the vicinity of the 25 m depth contour. This district runs southeast from Tokatu Point to Ponui Island, across the Firth and north to Cape Colville.

Hydrology This district contains highly turbid water greatly affected by runoff from the surrounding catchment and subject to marked changes in temperature and salinity.

Biology Communities on mud and sandy mud of *Amphiura rosea* – *Dosinia lambata*, *Tawera spissa* – *Venericardia purpurata* and *Nemocardium pulchellum* – *V. purpurata* are recorded here. Flatfish, snapper, scallop and crayfish are important economic fish species for this area.

A-d Eastern Northland Shelf Ecological District

Marine Topography Area of sands and sandy muds on the mid and outer shelf with muds in and near the large harbours. Coarse shell banks occur off the Bay of Islands and south of North Cape. This district extends southeast of Cape Brett to include the shelf adjacent to the Three Kings Islands and east of North Cape where the shelf narrows and sediments become coarse.

Hydrology District is exposed to storm surges from the east and north and influenced by the southeast passage of the East Auckland Current.

Biology Communities of *Tawera spissa* – *Venericardia purpurata* and *Nemocardium pulchellum* – *V. purpurata* are found on sandy substrates. Commercial stocks of skipjack tuna, albacore tuna, mackerel, trevally, kingfish, gurnard, snapper, scallop and crayfish are caught in this district.

B NORTHERN NORTHLAND SHELF ECOLOGICAL REGION (Fig 2)

B-a Northern Northland Shelf Ecological District

Marine Topography This region and district represent a shelf area that is topographically complex, highly indented by canyons and containing large areas of coarse biogenic sediments, particularly in the northwest. It contrasts with the terrigenous sands and muds on the relatively uniform shelf to the south, hence its designation as both a region and district. The region is delineated to the east by the narrowing of shelf at North Cape. Here a band of coarse sediment and exposed rock crosses the shelf from North Cape to the head of the Parengarenga Canyons. In the west the region is defined by a transition to a narrower more uniform shelf to the west of Tauroa Point and south of South Ahipara Bank. In the north the Three Kings shelf has been included in this region although separated from the main shelf by a narrow 300 m deep trough. Its changing topography and coarse biogenic and authogenic sediments are similar to the northwestern part of the main shelf. The region contains areas of bare rock from volcanic outcrops, shelf terraces and escarpments. To the northwest are areas of coarse biogenic sediments while finer terrigenous sediments are located to the east and southwest. The northwestern part of the region does not receive significant amounts of terrigenous sediments because the predominant southward current pattern, a ridge of volcanic rock west of Cape Maria van Diemen and the shelf constriction to the east tends to block sediment transport from the Northland coast.