

## INTERTIDAL BIOTA OF TE MATUKU BAY, WAIHEKE ISLAND, AUCKLAND

**Bruce W. Hayward, A. Brett Stephenson, Margaret S. Morley, Nancy  
Smith, Fiona Thompson, Wilma Blom, Glenys Stace, Jenny L. Riley,  
Ramola Prasad and Catherine Reid**

Auckland Museum, Private Bag 92018, Auckland

### SUMMARY

Ninety-seven Mollusca (7 chitons, 52 gastropods, 38 bivalves), 33 Crustacea (8 amphipods, 4 barnacles, 18 decapods) 10 Echinodermata (3 echinoids, 3 asteroids, 3 ophiuroids, 1 holothurian), 21 Polychaeta and 31 other animals and plants are recorded from Te Matuku Bay, on the south-east corner of Waiheke Island, Auckland.

The intertidal communities and their constituent fauna and flora are similar to those encountered around the middle and upper Waitemata Harbour, except for the abundance at Te Matuku Bay of the tube worm *Pomatoceros caeruleus*. This species used to be equally abundant on Meola Reef but has now disappeared from there. The Pacific oyster is well established on the rocks around Te Matuku Bay, but other introduced organisms (*Musculista senhousia*, *Limaria orientalis*, *Codium fragile tomentosoides*) are present in only small numbers.

**Keywords:** New Zealand; Waiheke Island; Te Matuku Bay; intertidal ecology; Mollusca; Polychaeta; Crustacea; Amphipoda; Decapoda.

### INTRODUCTION

Te Matuku Bay (latitude 36°50'S, longitude 175°08'E) lies on the sheltered south coast of Waiheke Island, near its eastern end (Fig. 1). The bay is long and relatively narrow (2.5 x 1km) and opens to the south into the east end of Tamaki Strait. Both sides of the bay rise relatively steeply to 60-100m high ridge lines. These adjacent slopes are mostly in regenerating scrub, although partly in grazed grassland and partly in mature coastal forest (middle point on eastern side). Several streams draining catchments with a similar mix of uses flow into the head of the bay. Around the edge of the bay, dwellings and baches are restricted to Pearl Bay in the east and two farm cottages on the west side near the mouth. An old oyster farm is present on the sand flats on the west side of the bay.

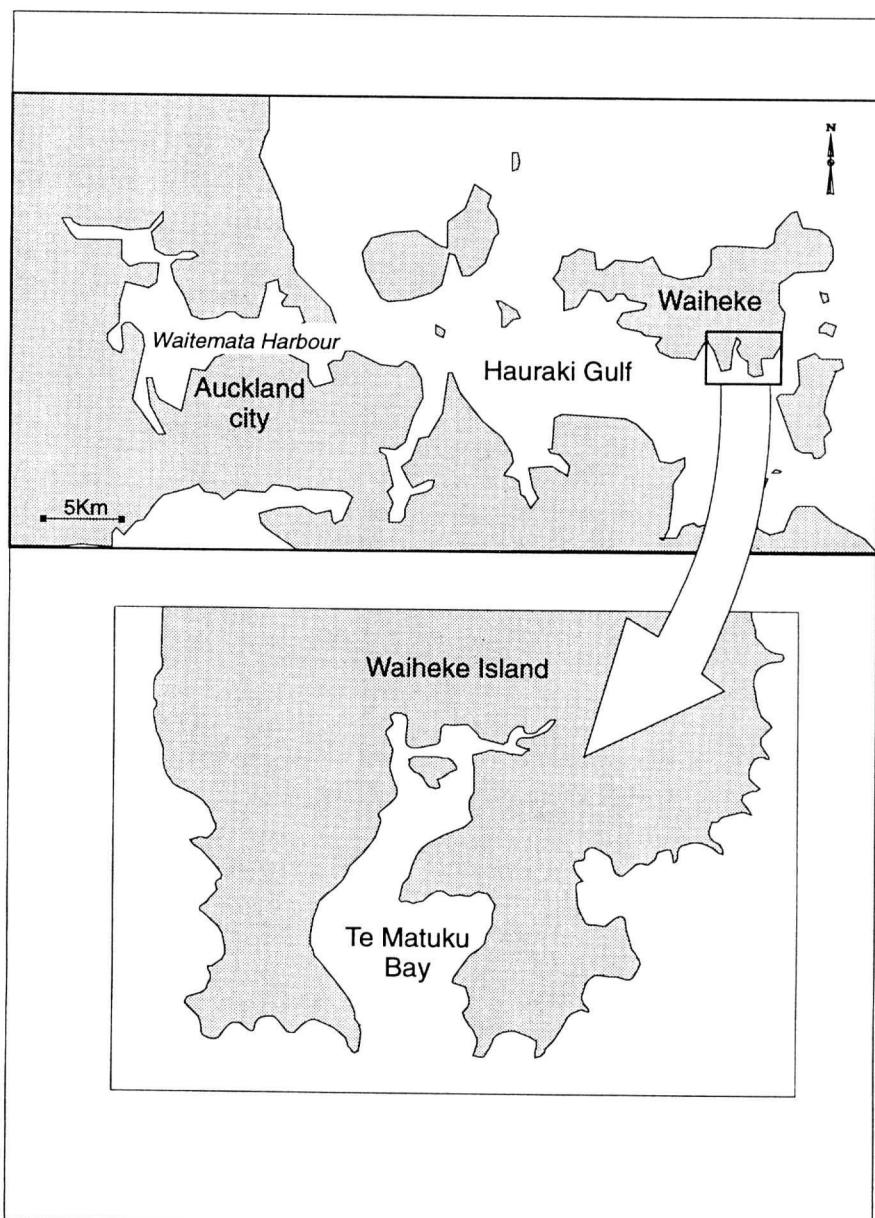


Fig. 1. Te Matuku Bay lies at the south-eastern end of Waiheke Island, inner Hauraki Gulf.

The southern quarter of the bay (c. 70ha) is subtidal with a coastline of greywacke rocks and gravel beaches. The middle half of the bay (c. 150ha) is intertidal muddy and shelly sand flats fringed by sandy pebble gravel beaches at high tide level. Muddy mangrove forest covers the remaining quarter (c. 50ha) at the head of the bay. Two sandy shell spits have built out across embayments on the eastern side of the muddy sand flats. The larger provides roosting areas for waders and supports nesting New Zealand dotterel.

The Te Matuku Bay area was chosen for study at the invitation of the Royal Forest and Bird Society, who are investigating the site as a possibility for a marine reserve application. Our study was designed to document the intertidal biota of their selected area, which also includes a subtidal portion extending out through the mouth of the bay to Passage Rock.

This paper records the biota that was found intertidally in Te Matuku Bay and the rocky points on either side, on a five hour Auckland Museum field trip by most of the authors during a spring low tide in September 1996. Field work included mapping the distribution of the major intertidal communities (Fig. 1), extensive searching of the range of intertidal habitats present in the bay, beach combing around the mid and high tide beaches and digging and dip netting in the muddy sand, especially around low tide level.

All records are supported by voucher specimens in the collections of the Auckland Museum (AK).

## SPECIES LIST

### Habitat where found (Fig. 2):

ir = inner bay rocks

s = sand and mud flats

m = mangroves

ss = subtidal sea floor (wash-up)

or = outer bay rocks and gravels

d = only seen dead

l = seen alive

Double letter = common

Molluscan nomenclature follows Spencer & Willan (1995).

### MOLLUSCA - POLYPLACOPHORA

*Acanthochitona (Notoplax) violacea* (Quoy & Gaimard, 1835)

m s ir or ss

l

*Acanthochitona zelandica* (Quoy & Gaimard, 1835)

l

*Chiton (Amaurochiton) glaucus* Gray, 1828

l l l

*Cryptoconchus porosus* (Burrow, 1815)

l

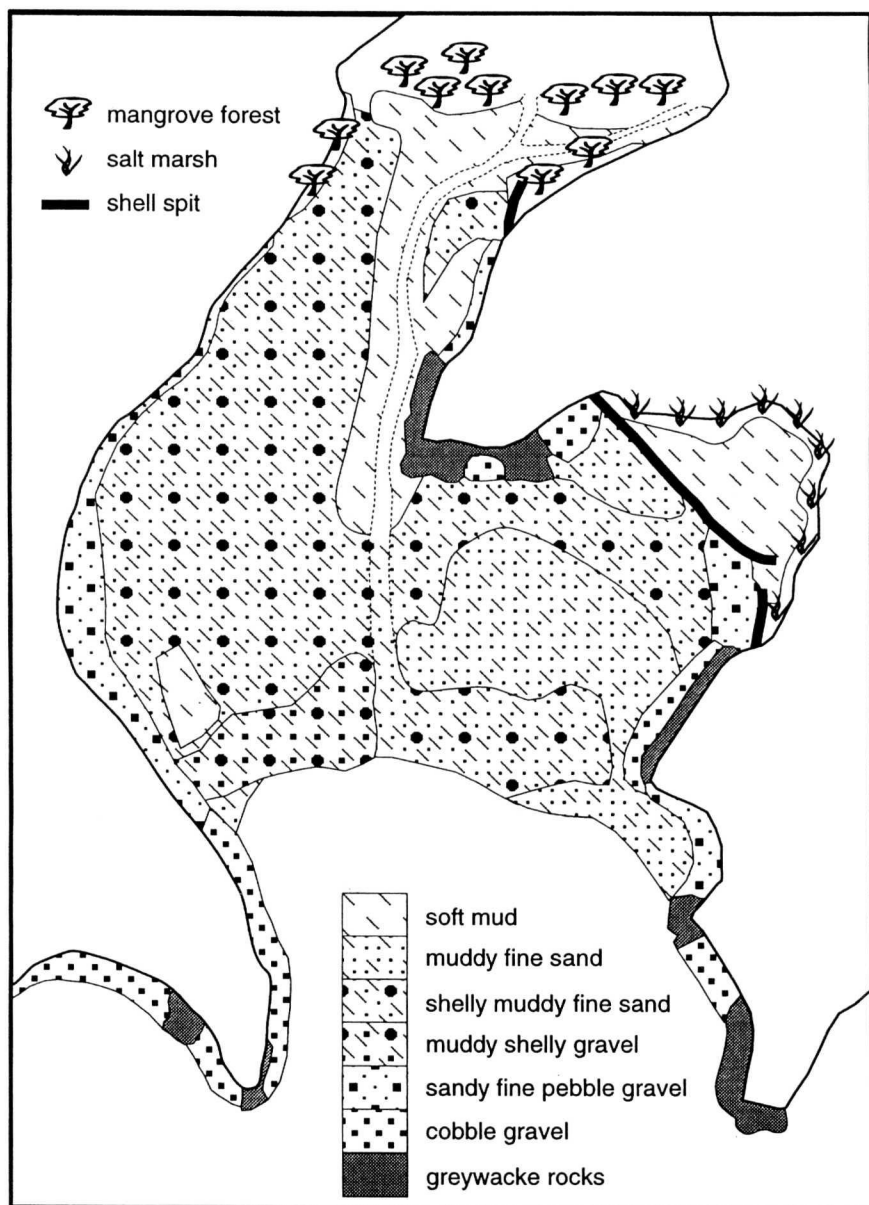


Fig. 2. Intertidal substrates and fringe communities in Te Matuku Bay, Waiheke Island.

	m	s	ir	or	ss
<i>Ischnochiton maorianus</i> Iredale, 1914				l	
<i>Leptochiton inquinatus</i> (Reeve, 1847)				l	
<i>Sypharochiton pelliserpentis</i> (Quoy & Gaimard, 1835)			l		

## GASTROPODA

<i>Alcithoe arabica</i> (Gmelin, 1791)		d		d	
<i>Amphibola crenata</i> (Gmelin, 1791)	ll	ll			
<i>Buccinulum linea linea</i> (Martyn, 1784)			l		
<i>Buccinulum vittatum vittatum</i> (Quoy & Gaimard, 1833)				l	
<i>Bulla quoyii</i> Gray, 1843		d			
<i>Calliostoma pellucidum</i> (Valenciennes, 1846)				d	
<i>Cellana ornata</i> (Dillwyn, 1817)			l	d	
<i>Chemnitzia</i> sp.		l			
<i>Cominella adpersa</i> (Bruguere, 1789)		l		l	
<i>Cominella (Josepha) glandiformis</i> (Reeve, 1847)		ll	ll		
<i>Cominella maculosa</i> (Martyn, 1784)		d		d	
<i>Cominella (Josepha) quoyana quoyana</i> A.Adams, 1854					d
<i>Cominella (Josepha) virgata</i> H. & A. Adams, 1853				d	
<i>Cookia sulcata</i> (Gmelin, 1791)				l	
<i>Crepidula costata</i> Sowerby, 1824				ll	
<i>Crepidula monoxyla</i> (Lesson, 1831)		l		d	
<i>Dicathais orbita</i> (Gmelin, 1791)				l	
<i>Diloma (Fractarmilla) subrostrata subrostrata</i> (Gray, 1835)		ll		l	
<i>Haminoea zelandiae</i> (Gray, 1843)		d			
<i>Haustrum haustorium</i> (Gmelin, 1791)			l	l	
<i>Lepsiella scobina</i> (Quoy & Gaimard, 1833)			ll	ll	
<i>Maoricolpus roseus roseus</i> (Quoy & Gaimard, 1834)				l	d
<i>Melagraphia aethiops</i> (Gmelin, 1791)			ll	ll	
<i>Murexul octogonus</i> (Quoy & Gaimard, 1833)				d	
<i>Neoguraleus murdochi</i> (Finlay, 1924)				d	
<i>Nerita (Melanerita) atramentosa</i> Reeve, 1855				l	
<i>Nodilittorina antipodum</i> (Philippi, 1847)			ll	ll	
<i>Nodilittorina cincta</i> (Quoy & Gaimard, 1833)				l	
<i>Notoacmea elongata</i> (Quoy & Gaimard, 1834)				l	
<i>Notoacmea helmsi</i> (E.A.Smith, 1894)		ll			
<i>Onchidella nigricans</i> (Quoy & Gaimard, 1832)	ll	l	ll		
<i>Ophicardelus costellaris</i> (H. & A. Adams, 1854)		l			
<i>Penion sulcatus</i> (Lamarck, 1816)					d
<i>Pleurobranchaea maculata</i> (Quoy & Gaimard, 1832)		l			
<i>Potamopyrgus estuarinus</i> Winterbourn, 1971	l	d			
<i>Serpulorbis zelandicus</i> (Quoy & Gaimard, 1834)				d	
<i>Sigapatella novaezelandiae</i> (Lesson, 1831)				l	
<i>Siphonaria australis</i> Quoy & Gaimard, 1833			l	l	

	m	s	ir	or	ss
<i>Struthiolaria papulosa</i> (Martyn, 1784)		d			
<i>Struthiolaria (Pelicaria) vermis vermis</i> (Martyn, 1784)		d			d
<i>Taron dubius</i> (Hutton, 1878)				d	
<i>Trochus (Coelotrohus) tiaratus</i> Quoy & Gaimard, 1834				d	
<i>Trochus (Thorista) viridis</i> Gmelin, 1791				l	
<i>Turbo smaragdus</i> Gmelin, 1791	ll	l	ll	ll	
<i>Xymene plebeius</i> (Hutton, 1873)				d	
<i>Xymene traversi</i> (Hutton, 1873)				l	
<i>Zeacolpus (Stiracolpus) pagoda pagoda</i> (Reeve, 1849)					d
<i>Zeacumantus lutulentus</i> (Kiener, 1841)	l	ll			
<i>Zeacumantus subcarinatus</i> (Sowerby, 1855)			ll	l	
<i>Zebittium exile</i> (Hutton, 1873)			l		
<i>Zegalerus tenuis</i> (Gray, 1867)					d
<i>Zemitrella chaova</i> (Reeve, 1859)					d

## BIVALVES

<i>Anomia trigonopsis</i> Hutton, 1877				l	
<i>Arthritica bifurca</i> (Webster, 1908)		ll			d
<i>Atrina pectinata zelandica</i> (Gray, 1835)		l			l
<i>Austrovenus stutchburyi</i> (Gray, 1828)		ll			
<i>Cleidothaerus albidus</i> (Lamarck, 1819)				ll	
<i>Corbula (Caryocorbula) zelandica</i> Quoy & Gaimard, 1835		l			d
<i>Crassostrea gigas</i> (Thunberg, 1793)	ll	l	ll	ll	
<i>Cyclomactra ovata</i> (Gray, 1843)		l			
<i>Diplodonta (Zemysina) striatula</i> (Finlay, 1926)					d
<i>Dosina zelandica</i> Gray, 1835					dd
<i>Dosinia (Phacosoma) subrosea</i> (Gray, 1835)		l			d
<i>Felaniella (Zemysia) zelandica</i> (Gray, 1835)		l			d
<i>Gari (Psammobia) lineolata</i> (Gray, 1835)					d
<i>Gari (Gobraeus) stangeri</i> (Gray, 1843)					dd
<i>Hiatella arctica</i> (Linne, 1767)				l	
<i>Irus (Notirus) reflexus</i> (Gray, 1843)				d	
<i>Leptomya retiaria retiaria</i> (Hutton, 1885)					d
<i>Limaria orientalis</i> (A. Adams & Reeve, 1850)				l	
<i>Macomona liliana</i> (Iredale, 1915)		ll			
<i>Modiolarca impacta</i> (Hermann, 1782)				l	
<i>Musculista senhousia</i> (Benson, 1842)		d		l	
<i>Myadora striata</i> (Quoy & Gaimard, 1835)					d
<i>Myllita (Zemyllita) stoweii</i> (Hutton, 1873)					d
<i>Mytilus edulis aoteanus</i> Powell, 1958				d	
<i>Nucula hartvigiana</i> Pfeiffer, 1864		ll			d
<i>Paphies australis</i> (Gmelin, 1791)		ll			
<i>Paphies subtriangulata</i> (Gray, 1828)		d			

	m	s	ir	or	ss
<i>Pecten novaezelandiae</i> Reeve, 1853					d
<i>Perna canaliculus</i> (Gmelin, 1791)			I	II	
<i>Peronaea gaimardi</i> (Iredale, 1915)					d
<i>Protothaca crassicosta</i> (Deshayes, 1835)				d	
<i>Ruditapes largillierti</i> (Philippi, 1849)					d
<i>Soletellina siliquens</i> Willan, 1993					d
<i>Tawera spissa</i> (Deshayes, 1835)					d
<i>Tiostrea chilensis lutaria</i> (Hutton, 1873)					d
<i>Venericardia</i> ( <i>Purpurocardia</i> ) <i>purpurata</i> (Deshayes, 1854)					d
<i>Xenostrobus pulex</i> (Lamarck, 1819)	II			II	

## ECHINODERMATA - ECHINOIDEA

<i>Echinocardium cordatum</i> (Pennant, 1777)					d
<i>Evechinus chloroticus</i> (Valenciennes, 1846)				I	
<i>Fellaster zelandica</i> (Gray, 1855)		d			d

## ASTEROIDEA

<i>Allostichaster polyplax</i> (Muller & Troschel, 1844)				I	
<i>Coscinasterias calamaria</i> Verrill, 1864		I		I	
<i>Patiriella regularis</i> (Verrill, 1867)		II		I	

## OPHIUROIDEA

<i>Amphiocnida pilosa</i> (Lyman, 1882)				I	
<i>Ophionereis fasciata</i> Lutken, 1859				I	
<i>Ophiopteris antipodum</i> Smith, 1877				I	

## HOLOTHUROIDEA

<i>Trochodota dendyi</i> Mortensen, 1925				I	
--	--	--	--	---	--

## ANNELIDA - POLYCHAETA

? <i>Aedicira</i> sp.				I	
<i>Aglaophamus macroura</i> (Schmarda, 1861)				I	
<i>Armandia maculata</i> (Webster, 1884)				II	
<i>Axiothella quadrimaculata</i> Augener, 1914				I	
<i>Eteone</i> sp.					I
<i>Euchone</i> sp.				II	
<i>Glycera americana</i> Leidy, 1855				I	
<i>Glycera lamelliformis</i> McIntosh, 1885				I	
<i>Glycera lamellipodia</i> Knox, 1960				I	
<i>Glycinde dorsalis</i> Ehlers, 1904				II	
<i>Heteromastus</i> sp.				II	
<i>Magelona papillicornis</i> Muller, 1858				I	
Maldanidae				II	

	m	s	ir	or	ss
Nereidae		I		I	
<i>Orbinia papillosa</i> (Ehlers, 1907)		I			
<i>Paraboccardia</i> sp.		II			
<i>Pectinaria australis</i> Ehlers, 1904		I			
Polynoidae		II			
<i>Pomatoceros caeruleus</i> (Schmarda, 1861)		II	II	II	
<i>Prionospio</i> sp.		II			
<i>Streblosoma gracile</i> Caullery, 1944		I			
<b>NEMERTEA</b>					
white nemertine		I			
black nemertine		I			
<b>POGONOPHORA</b>					
indet.		I			
<b>CRUSTACEA -</b>					
<b>OSTRACODA</b>		I			
<b>CIRRIPEDIA</b>					
<i>Balanus trigonus</i> Darwin, 1854					d
<i>Chamaesipho columna</i> (Spengler, 1790)				II	
<i>Elminius modestus</i> Darwin, 1854	II	II	II	II	
<i>Epopella plicata</i> Gray, 1843				I	
<b>MYSIDA</b>		II			
<b>LEPTOSTRACA</b>		II			
<b>CUMACEA</b>					
<i>Colurostylis lemurum</i> Calman, 1917		II			
<i>Cyclaspis levis</i> Thomson, 1892		I			
<b>DECAPODA</b>					
<i>Alpheus richardsoni</i> Yaldwyn, 1971		II			
<i>Callianassa</i> sp.		I			
<i>Cyclograpsus lavauxi</i> Milne Edwards, 1853				I	
<i>Halicarcinus cookii</i> (Filhol, 1885)		I			
<i>Halicarcinus whitei</i> (Miers, 1876)		I			
<i>Helice crassa</i> Dana, 1851	II	II			
<i>Hemigrapsus crenulatus</i> (Milne Edwards, 1837)		II	I	I	
<i>Heterozius rotundifrons</i> Milne Edwards, 1867				I	



	m	s	ir	or	ss
<i>Notomithrax minor</i> (Filhol, 1885)				I	
<i>Macrophthalmus hirtipes</i> (Heller, 1862)		II			
<i>Pagurus novizelandiae</i> (Dana, 1852)		II		II	
<i>Paguristes barbatus</i> (Heller, 1862)				I	
<i>Palaemon affinis</i> Milne Edwards, 1837		II			
<i>Petrolisthes elongatus</i> (Milne Edwards, 1837)		I		II	
<i>Pilumnopus serratifrons</i> (Kinahan, 1856)		II		I	
<i>Pilumnus novaezelandiae</i> Filhol, 1886				II	
<i>Pontophilus australis</i> (Thomson, 1879)		II			
<i>Upogebia hirtifrons</i> (White, 1847)		II			

## AMPHIPODA

<i>Corophium sextonae</i> Crawford, 1937		II			
<i>Liljeborgia aequabilis</i> Stebbing, 1888		I			
<i>Maera mastersi</i> (Haswell, 1880)		I			
<i>Maera</i> sp.		II			
<i>Melita awa</i> Barnard, 1972		II			
<i>Paracallioppe novizealandiae</i> (Dana, 1853)		II			
<i>Paraperioculodes</i> sp.		I			
<i>Torridoharpinia hurleyi</i> Barnard, 1958		II			

## COELENTERATA - ACTINARIA

<i>Anthopleura aureoradiata</i> Stuckey, 1909		II			
---	--	----	--	--	--

## PORIFERA

<i>Aaptos aaptos</i> (Schmidt)				I	
<i>Tethya aurantium</i> (Pallas)				I	

## UROCHORDATA

<i>Pyura</i> sp.		I			
<i>Asterocarpa coerulea</i> (Quoy & Gaimard, 1834)				I	
<i>Cnemidocarpa bicornuata</i> (Sluiter, 1900)				II	

## VERTEBRATA - TELEOSTII

<i>Acanthoclinus fuscus</i> Jenyns, 1842			I	I	
<i>Acentrogobius lentiginosus</i> (Richardson, 1844)		II			
<i>Grahamina capito</i> (Jenyns, 1842)		I			

## ALGAE

<i>Carpophyllum</i> spp.				I	
<i>Codium convolutum</i> (Dellow) Silva				I	
<i>Codium fragile</i> ssp. <i>tomentosoides</i> (van Goor) Silva		I			
<i>Corallina</i> turf				II	

	m	s	ir	or	ss
<i>Ecklonia radiata</i> (C.Agardh) J. Agardh				I	
<i>Hormosira banksii</i> (Turner) Descaisne	II		II	II	
<i>Sargassum</i> spp.				I	
<i>Splachnidium rugosum</i> (Linnaeus) Greville			I	I	

## LICHENS

<i>Buellia</i> sp.	I				
<i>Lichina confinis</i> (Muller) Agardh, 1821				II	
<i>Parmotrema crinitum</i> (Ach.) Choisy, 1952	II				
<i>Pertusaria</i> sp.	I				
<i>Physcia</i> sp.	I				
<i>Ramalina australiensis</i> Nyl., 1870	I				
<i>Ramalina celasteri</i> (Sprengel) Krog & Swinscow, 1974	I				
<i>Rimelia reticulata</i> (Taylor) Hale & Fletcher, 1990	II				
<i>Usnea</i> sp.	I				
<i>Xanthoria parietina</i> (L.) Th.Fr., 1860	I				

## ECOLOGICAL NOTES

### Mangroves and salt marsh

An extensive intertidal mangrove (*Avicennia marina*) forest covers much of the muddy head of Te Matuku Bay. It is dissected by a network of muddy tidal channels. The branches and trunks of the larger mangroves, which grow near the channel margins, support a rich growth of lichens dominated by old man's beard, *Usnea*, and stubby or pendulous forms of *Ramalina*. The most common foliose lichens are *Parmotrema crinitum*, *Rimelia reticulatum* and *Physcia* sp.

Around the seaward fringes of the mangrove forest (time did not permit deeper penetration) Pacific oysters, *Crassostrea gigas*, small black mussels, *Xenostrobus pulex*, and acorn barnacles, *Elminius modestus*, live in clusters on the lower trunks, dangling branches and aerial roots. Numerous mud crabs, *Helice crassa*, scuttle in and out of their burrows and the mud snail, *Amphibola crenata*, is abundant in the soft surface mud. Large cat's eyes, *Turbo smaragdus*, can be found clinging to clumps of oysters or on the lower branches of the mangroves. In places the surface mud is festooned with the golden-brown baubles of Neptune's necklace, *Hormosira banksii*.

Salt marsh of *Leptocarpus* and *Juncus* grows around high tide level in behind two sandy shell spits on the upper east side of Te Matuku Bay (Fig. 2). Living on the sandy mud around the bases of these reeds are common mud snails and the smaller gastropod, *Ophicardelus costellaris*. Glasswort, *Sarcocornia quinqueflora*, grows around high tide level on the shell spits.

## Intertidal sand and mud flats

A large portion of Te Matuku Bay seaward of the mangrove forest is intertidal mud and sand flats (Fig. 2). Soft mud, burrowed extensively by the mud crab *Helice crassa*, lines either side of the main intertidal stream channel for much of its length. A similar substrate is present in behind the sandy shell spit on the east side of the bay, where the mud snail *Amphibola crenata*, is also present in large numbers.

Most of the intertidal flats are muddy fine sand. In mapping, those areas with a liberal coverage of shells (mostly cockle) have been distinguished from areas with very few shells on or in the sand. Around low tide level in the south west corner of the bay, the substrate is muddy shell gravel with abundant large cockle *Austrovenus stutchburyi* and *Cyclomactra ovata* shells. Living on this coarse substrate are common *Turbo smaragdus*, slipper limpet *Crepidula monoxyla*, occasional mussels *Perna canaliculus* and the starfish *Patiriella regularis* and *Coscinasterias calamaria*.

The muddy fine sand substrate is colonised largely by cockles, which in places reaches densities in excess of 500 per square metre. Also commonly present throughout much of this substrate, as evidenced by their distinctive feeding traces, are the wedge shells *Macomona liliana*. Live pipi, *Paphies australis*, are nowhere abundant and are mostly confined to more pebbly sand substrates above mid tide level (Fig. 2). Pipi were apparently more abundant some years ago prior to a period of commercial harvesting (pers.comm. Taffy Masters-Williams).

In several areas of shelly muddy fine sand, the tube worm, *Pomatoceros caeruleus*, has colonised the surface cockle shells (Fig. 3) forming clumps 2-5cm high. Only in several small areas have Pacific oysters become established on the shelly sand, but this could increase as it is in other places around the Waitemata and inner Hauraki Gulf (pers. obs.). Other common members of the epifauna on the shelly muddy sand flats include the gastropods *Cominella glandiformis*, *Diloma subrostrata*, *Turbo smaragdus* and *Zeacumantus lutulentus*, the acorn barnacle *Elminius modestus* and the anenome *Anthopleura aureoradiata*. The infauna at lower tide levels includes: the bivalves *Corbula zelandica*, *Dosinia subrosea*, *Felaniella zelandica*, *Cyclomactra ovata*, *Nucula hartvigiana* and occasional specimens of the introduced Asian mussel *Musculista senhousia*; nineteen species of polychaete dominated by maldanids, polynoids, *Euchone*, *Heteromastus*, *Paraboccardia*, *Prionospio*, *Armandia maculata* and *Goniada dorsalis*; the holothurian *Trochodota dendyi*, nemertines, pogonophorans, mysids and leptostracans.

Though seen under somewhat limited circumstances the crustaceans living in the low tidal muddy sand are typical components of similar shores in the

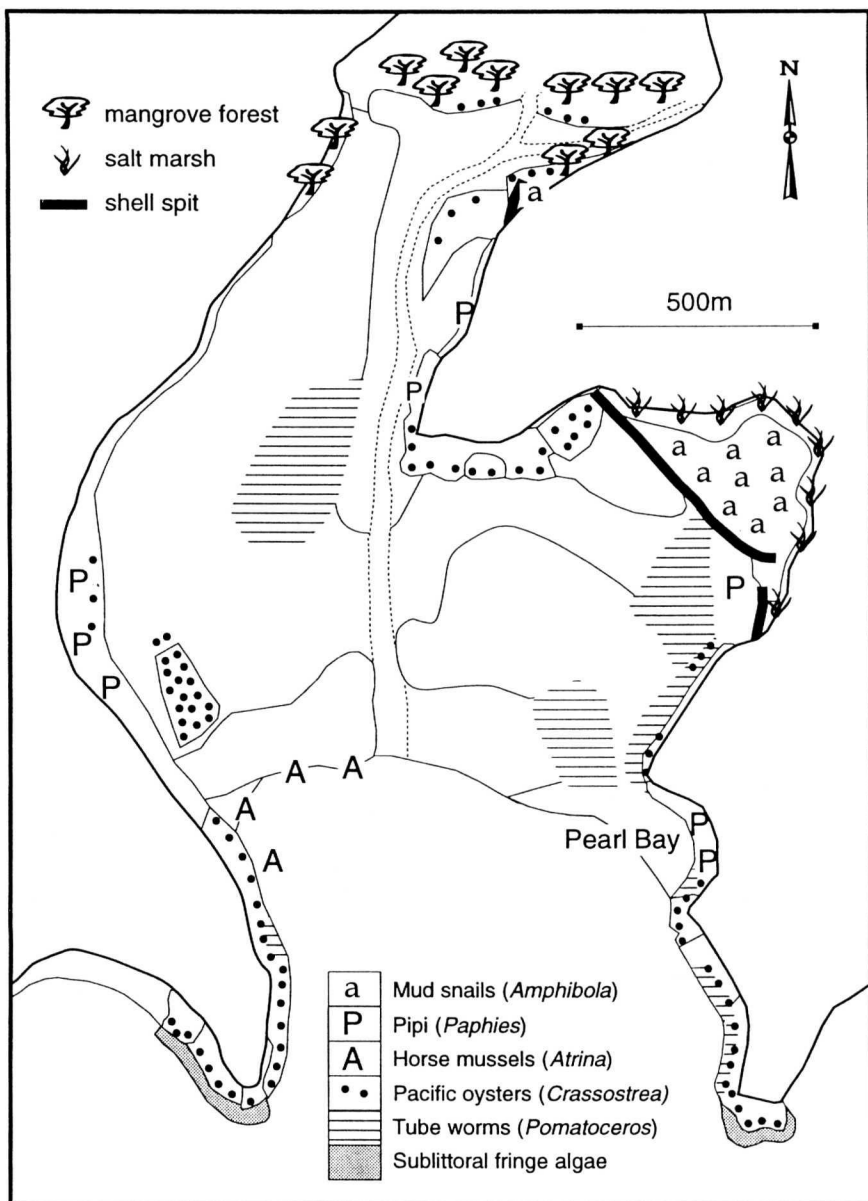


Fig. 3. Distribution of some of the visually dominant organisms in Te Matuku Bay.

Waitemata and other northern harbours generally (McLay 1988). Inevitably, because of animal mobility, camouflage and behaviour, any quantifiable measure of the crustacean species, or their diversity, cannot be easily estimated from this brief visit alone. Since our fieldwork included exploratory digging over a fair volume of sediment it might have been a reasonable expectation to have recorded a larger list of amphipods, particularly burrowing phoxocephalids in addition to *Torridoharpinia hurleyi*. The possible impact of intertidal and euryhaline conditions is noted by the presence of *Paracalliope novizealandiae* and this may underlie a low diversity of amphipods in the area.

As experienced elsewhere the distribution of thalassinidean mud shrimps, *Callinassa* and *Upogebia hirtifrons*, have a semblance of patchiness; at one site though a *Upogebia* population with brood females of extremely large size (claw length 14-22mm) deserves special note as a habitat of particular richness.

In general, many crustacean species are numerically well represented. Mysid and caridean shrimps occurred at all nine spot stations across the intertidal flats. By comparison, there are many other mudflats of the inner Hauraki Gulf where *Alpheus richardsoni* and *Pontophilus australis* have scattered distributions or do not occur together. In addition, our collections at these points contained a wide range of juvenile and egg-bearing adult material which denotes a crustacean community in good health. As such the crustaceans provide an important food source for wading birds.

### **Inner bay rocky shore**

At the back of the middle of Te Matuku Bay is a point surrounded at mid and high tide level by weathered greywacke rocks. At around high tide level abundant small periwinkles, *Nodilittorina unifasciata*, graze. *Onchidella nigricans* also lives at this level, sheltering under rocks when the tide is out. Below this level is a zone inhabited mostly by acorn barnacles, *Elminius modestus*, and small black mussels, *Xenostrobus pulex*. Around mid tide level they are joined by common Pacific oysters, *Crassostrea gigas*, and the tube worm, *Pomatoceros caeruleus*.

Grazing herbivores living on these rocks include common *Melagraphia aethiops* and *Turbo smaragdus* and the chiton, *Sypharochiton pelliserpentis*. Also common are the gastropods *Cominella glandiformis*, *Zeacumantus subcarinatus* and *Diloma subrostrata*. The carnivorous oyster borer, *Lepsiella scobina*, is also present.

### **Outer bay rocky shore and gravel beaches**

On either side of the entrance to Te Matuku Bay are rocky headlands fringed by intertidal cobble beaches interspersed with greywacke platform, particularly

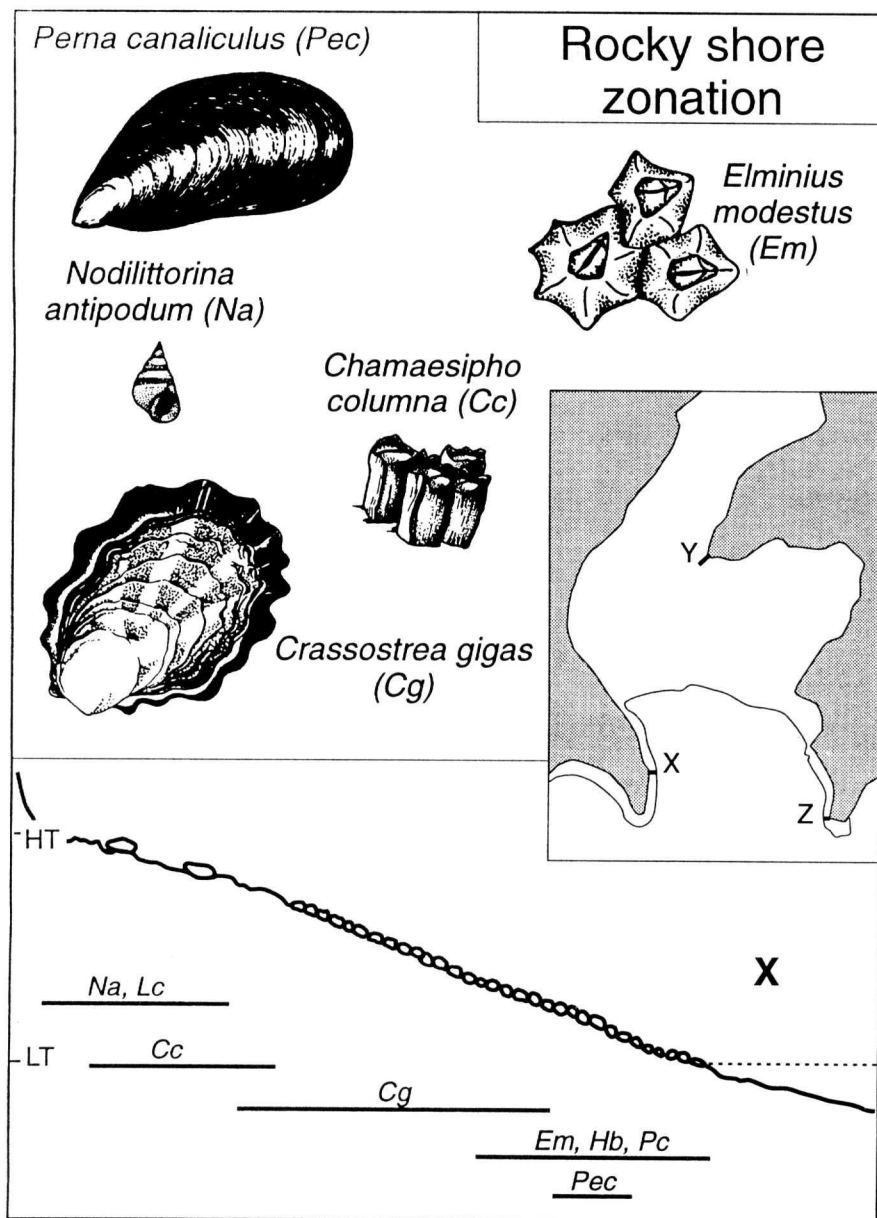


Fig. 4. Intertidal rocky shore zonations, Te Matuku Bay.



*Epopella plicata* (Ep)



*Ecklonia radiata*



*Carpophyllum maschalocarpum*

Brown seaweeds (Bs)

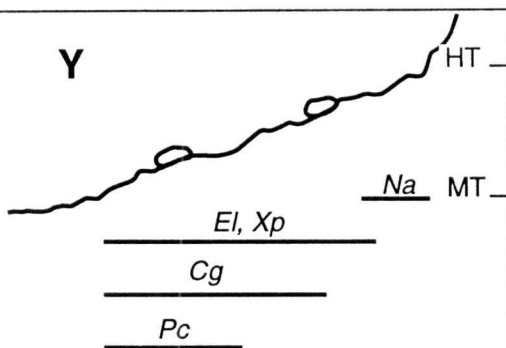


*Xenostrobus pulex*  
(Xp)



*Hormosira banksii*  
(Hb)

Y

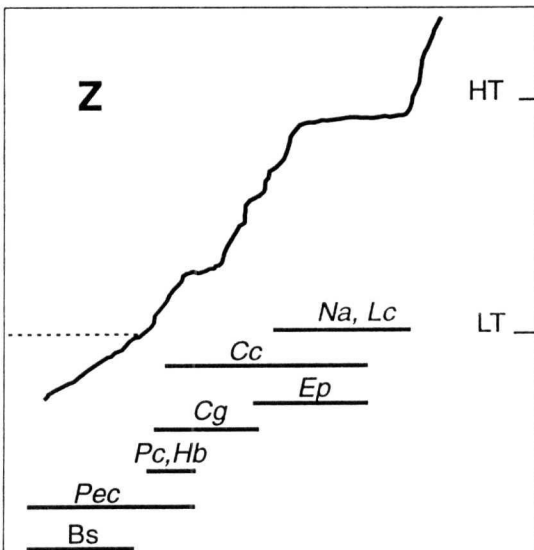


*Pomatoceros caeruleus* (Pc)



*Lichina confinis* (Lc)

Z



on the east side (Fig. 2).

The main zoning organisms on these substrates are (Fig. 4): the small barnacle *Chamaesipho columna*, between high and mid tide, but extending to low tide with other zoning organisms; Pacific oysters, *Crassostrea gigas*, in a wide mid tidal zone; encrusting tube worms, *Pomatoceros caeruleus*, between mid and low tide level especially in more sheltered situations inside the bay; the acorn barnacle, *Elminius modestus*, between mid and low tide level on the gravel beaches on the west side of the bay; and brown algae, *Ecklonia*, *Carpophyllum* and *Sargassum*, forming a sublittoral fringe at and below low tide level on the very end of the points and outside the bay (Figs. 3, 4).

Also abundant around high tide level are the black, tufted lichen, *Lichina confinis*, and the small grazing periwinkles, *Nodilittorina antipodum*. Among the oyster zone are plentiful oyster borers *Lepsiella scobina*, cat's eye *Turbo smaragdus*, topshell *Melagraphia aethiops* and under the cobbles the half-crab *Petrolisthes elongatus*. Lower on the shore around low tide level, diversity increases markedly with clumps of green-lipped mussels *Perna canaliculus*, and scattered Neptune's necklace *Hormosira banksii* and green *Codium convolutum*. Under the shelter of rocks are common orange and blue sea squirts *Cnemidocarpa bicornuata* and *Asterocarpa coerulea*, numerous slipper limpets *Crepidula costata* and *Sigapatella novaezelandiae*, the olive green *Chiton glaucus*, the rock fish *Acanthoclinus fuscus* and occasional orange-frilled specimens of the introduced bivalve *Limaria orientalis*. Another introduced bivalve, the small Asian mussel *Musculista senhousia* were found living among *Corallina* turf in mid tide pools around Pearl Bay.

### Wash-up from subtidal seafloor communities

Many of the shells washed up on the beaches, especially around the outer part of the bay, are clearly derived from subtidal mud, sand or gravel communities offshore in or outside the entrance to Te Matuku Bay. All the washed up shells are known living subtidally in the Waitemata Harbour, mostly in muddy shell gravel in the main channel (Powell 1937, Hayward *et al.* in press). A similar current-swept substrate probably exists off the entrance to the bay. Most common are the bivalves *Dosina zelandica* and *Gari stangeri*, but other associated bivalve members of this community include *Corbula zelandica*, *Felaniella zelandica*, *Leptomya retiaria*, *Ruditapes largillierti*, *Tawera spissa* and *Venericardia purpurata*. Washed-up gastropods that are also common members of this subtidal community include *Cominella quoyana*, *Maoricolpus roseus*, *Trochus tiaratus*, *Zeacolpus pagoda* and *Zegalerus tenuis*.

Horse mussels, *Atrina pectinata zelandica*, live subtidally in the sandy mud on the floor of the bay (pers. comm. Taffy Masters-Williams), with some living



around spring low tide level on the western side (Fig. 3). Other washed-up shells that probably live in this finer, more sheltered habitat include the gastropods *Alcithoe arabica*, *Struthiolaria papulosa* and *S. vermis*, and bivalves *Arthritica bifurca*, *Myadora striata*, *Myllitastoweii*, *Nucula hartvigiana*, *Peronaea gaimardi*, *Soletellina siliquens* and *Pecten novaezelandiae*.

## DISCUSSION

Ninety-seven species of Mollusca (7 chitons, 52 gastropods, 38 bivalves), 33 Crustacea (8 amphipods, 4 barnacles, 18 decapods) and 10 Echinodermata (3 echinoids, 3 ophiuroids and 3 asteroids) are recorded here from Te Matuku Bay. This includes all the more common species of these phyla present, but undoubtedly there are many rarer taxa that were not found during this single low tidal study.

The other recorded animals and plants, including the 21 polychaetes, are from phyla that were not specifically targetted during our study and undoubtedly there are many more species not on our preliminary list of more common taxa.

The species and intertidal communities listed and described from Te Matuku Bay are similar to those present in other moderately sheltered environments elsewhere in the Auckland region (cf. Morton & Miller 1978). The single most obvious difference from the biota around the sheltered upper and middle reaches of the Waitemata Harbour is the abundance of the tube worm, *Pomatoceros caeruleus* at Te Matuku. This species used to be abundant in the Waitemata Harbour and was the dominant mid-tidal zoning organism on Meola Reef in the 1920s (Oliver 1923). It has now disappeared from Meola and is rare around the sandstone reefs of the Waitemata.

Te Matuku Bay has not escaped some impacts from introduced exotic species. The Pacific oyster is a major element of the intertidal fauna on all rocky substrates in the bay, as it is throughout the region now. Present in relatively low numbers at present are the introduced Asian mussel, the file shell *Limaria orientalis* and the introduced sea weed *Codium fragile* ssp. *tomentosoides*.

## ACKNOWLEDGEMENTS

We are grateful to Bernard Rhodes for transporting our group to Te Matuku Bay on his catamaran. Leith Duncan, Royal Forest and Bird Society, invited us to undertake this survey to provide background information for a possible marine reserve application for the Bay. Local resident Taffy Masters-Williams provided additional information and hospitality during our visit. The manuscript has benefitted from the critical appraisal of Hugh Grenfell and John Morton.

## REFERENCES

- Hayward, B.W., Stephenson, A.B., Morley, M.S., Riley, J.L. & Grenfell, H.R. in press: Faunal changes in Waitemata Harbour sediments, 1930s - 1990s. *Journal of the Royal Society of New Zealand*.
- McLay, C.L. 1988: Brachyura and crab-like Anomura of New Zealand. *Leigh Laboratory Bulletin* 22. 463pp.
- Morton, J.E. & Miller, M.C. 1968: "The New Zealand Sea Shore". Collins, London. 638 pp.
- Oliver, W.R.B. 1923: Marine littoral plant and animal communities in New Zealand. *Transactions of the New Zealand Institute* 54: 496-546.
- Powell, A.W.B. 1937: Animal communities of the sea-bottom in Auckland and Manukau Harbours. *Transactions of the Royal Society of New Zealand* 66: 354-401.
- Spencer, H.G. & Willan, R.C. 1995: The marine fauna of New Zealand: Index to the fauna 3. Mollusca. *New Zealand Oceanographic Institute Memoir* 105. 125pp.