The Wairarapa Coast

- a literature review -

marine biology, geology, archaeology

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"Our search for understanding
is like a well without a bottom."

Neils Bohr

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Abstract

This review of the scientific literature of the marine biology of the Wairarapa coastline was conducted to aid the identification of areas with marine reserve potential. The review includes geology, hydrography, bathymetry, terrestrial biology, archaeology, history and current human use of the coast, as these topics may influence marine biology or protected area siting.

For the purposes of this review, Wairarapa Coast means the area between Waimata River (north of Akitio) and Windy Point (eastern Rimutaka coast). The northern boundary corresponds with that of the Department of Conservation Wellington Conservancy.

Thirteen sites are identified as having possible reserve potential, and are discussed in detail in the Site List. They are, from north to south, as follows: Owahanga, Omaruapakihau / Mataikona, Whakataki, Castlepoint, Whareama, Uruti Point, Kaiwhata, Flat Point, Honeycomb Rock, Pahaoa, Te Awaiti / Tora, White Rock, and Cape Palliser.

The review found that little literature exists relating to the marine ecology of the Wairarapa coast. In contrast, the geology of the area has been well studied.

Within the limits of this knowledge, the suitability of each of the above sites is discussed in relation to criteria likely to be used in decision-making. Areas and topics needing significant future research are suggested.

Introduction

The Wairarapa coast has been characterised as “impressive and interesting” with “scenic”, “scientific", and "educational” value, but it is “perhaps one of the least well known parts of New Zealand” (Homer and Moore 1989:4).

This literature review was conducted for the purposes of cataloguing published biological knowledge about the Wairarapa coast, and gaining knowledge about sites which may have marine reserve potential. Although it is centred around marine biology, a much wider focus was considered important. Thus, the review is a journey through geology, bathymetry, hydrography to marine and terrestrial ecology; a journey through pre-history and history, to current human use. It has not been possible or worthwhile to cover all topics with the same detail. The Methodology describes the scope of the review in relation to each of these topics, and includes a list of journals searched.

The Results section presents an overview of the information gained about each topic. The Discussion considers the implications for the marine reserve potential of the coast, and outlines some of the unknowns. A Site Summary Table in the Discussion attempts to synthesise the site information in an accessible manner. The Site List presents the detailed information found for each site. The Annotated Bibliography, organised by topic, briefly states the relevance of each piece of literature.

The review is a preliminary investigation only, to discover the extent of published knowledge at this time. It does not investigate local unpublished knowledge about the coast and its marine life.

For those who are not directly involved in harvesting food from the ocean, the sea tends to be a forgotten habitat. Biologists have been relatively slow to categorise its 'forests' and the smaller members of its fauna. Those involved in protecting New Zealand's biodiversity, have until recently, overlooked it. Carlin (1980), for example, discusses the scenic, geological, ecological, climatic, and past and present cultural significance of the Palliser coast. He comments that “the inshore waters and sea bed that border the study area ... are such an integral part of most recreational activities and the overall scenic attractiveness of the area that they will be considered part of the study area”. But Carlin (1980:see pp. 37 and 140), none-the-less maps the “Unprotected Natural Landscapes” of the Aorangi area, on land only.

The Wairarapa coast is unusual in that it still has some Blue Water Titles - that is, title to coastal land extends to mean low water mark. Owahanga station is an example (J. MacDonald, pers. comm. 2001). In any cases such as this, there is, strictly speaking, no public access to the beach. More usually there is a public 'riparian zone'. It appears that the seabed and marine life are legally the property of the government, and the sea water is owned by no-one:

> “Though the sea bed is considered crown land, no surveys have been undertaken and no tenure maps show this status. The marine animals and plant life are vested in the Crown for management purposes but the actual sea water is not owned by the Crown” (Carlin 1980:37).

The sea is our largest commons. Ours, but not ours; it is our attitude which determines our relationship with it, and ultimately, its, and our own, well-being.

Methodology

The aim of the literature review was, firstly, to identify all published marine biology relating to the Wairarapa coast, and, secondly, to identify a variety of other literature with relevance to potential marine reserve sites. In relation to the latter, the focus has been on finding recent research, and providing an overview of each topic for decision-makers, and in such a way that more detail can easily be obtained.

A starting point, and an invaluable source of information was the Department of Conservation's *Coastal Resource Inventory - first order survey* (Dix *et al.* 1990). Two relevant bibliographies were searched for references. These are:

'Cape Palliser to Cape Turnagain: A Bibliography', prepared by Bardsley (1977), and

'Bibliography of Scientific Studies of Wellington Harbour', prepared by Lis Pedersen (1974).

The Contents Lists of New Zealand journals most likely to contain relevant papers were systematically searched. The reference lists of any papers found were searched, and the consequent references located if possible. All references in the Annotated Bibliography have been seen, and their reference lists checked, except those marked "Not seen". Some grey literature publications are, following extensive government restructuring (and usually the downsizing, relocation, or loss of departmental libraries) extremely difficult to locate. Where known, the location of scarce documents has been included.

Overseas journals were not examined, except in those cases where a specific reference was found. It seems unlikely that much Wairarapa marine biology is published overseas, as it is almost absent from New Zealand journals.

The following journals were searched:

New Zealand Journal of Marine and Freshwater Research
(Vol. 1, 1967 to Vol. 34(2) June 2000)
New Zealand Journal of Geology and Geophysics
(Vol. 18, 1975 to Vol. 43(4) Dec 2000)
Journal of the Royal Society of New Zealand
(Vol. 1, 1971 to Vol. 30(3) Sept 2000)
Tuatara
(Vol. 1, 1947 to Vol. 32 April 1993)
New Zealand Journal of Ecology
(Vol. 1, 1978 to Vol. 24(2) 2000)
New Zealand Journal of Archaeology
(Vol. 1, 1979 to Vol. 21 1999)

The next most relevant publications which have *not* been searched are: *The Proceedings and Transactions of the New Zealand Institute* (precursor to the *Journal of the Royal Society*), *The New Zealand Journal of Zoology*, and *New Zealand Bird Notes* / *Notornis*.

In addition to the literature search, a variety of people were contacted, and asked for relevant literature, information or opinion:

Bruce Dix (DoC, Wellington Conservancy)
Bill Carlin (DoC, Wanganui Conservator)
Clinton Duffy (DoC, Wellington Conservancy)
Dr. Jonathan Gardner (Victoria University, Marine Biology)
Dr. Bob Wear (Victoria University, Marine Biology)
Dr. John Collen (Victoria University, Geology)
Dr. Lionel Carter (NIWA)
Dr. Steve Chiswell (NIWA)
Dr. F. Hoe Chang (NIWA)
Dr. Wendy Nelson (Te Papa)
Paul Cresswell (MAF Nelson)
Barry Strong (Wellington Regional Council)
Chris Petersen (Forest and Bird, Wairarapa)
Dr. Geoff Park
Joe MacDonald (Rangitane o Wairarapa)

The topics covered by the Annotated Bibliography are as follows:

General

The general section of the Annotated Bibliography contains a small number of relevant references which did not easily fit the other topic categories, such as other relevant bibliographies.

Geology

The geological references included are those which appear to have most relevance for the coastal area, and the marine environment. Many other papers exist, which are concerned with other aspects of Wairarapa geology. Geophysics (gravity modelling and faulting etc.), geological history and palaeontology are not included, even where studies are relevant to the coast.

Geological references from the 19th or very early 20th century were not included.

Oil and Gas

A limited number of references is provided to give an overview of the present exploration situation.

Hydrography and Bathymetry

Most study of these topics has been undertaken in Cook Strait. Those which appear to be most relevant to the Wairarapa coast have been included.

Marine Biology

All references found to the marine biology / ecology of the Wairarapa coast are included.

Ichthyology

References to papers about offshore marine species (fin-fish), were included when found, but not searched for. The greatest number of ichthyological references will be found in fisheries literature, and this has not been reviewed. Hence, the review does not cover commercial or recreational fishing in any detail.

Terrestrial Biology

Archaeology / History

Geography / Current Human Use

References to terrestrial biology, archaeology, anthropology, history, human geography and current human use are included only where the topic appears to be directly relevant to the coast, and may have a bearing on decision-making. Many of these aspects will become relevant if a site is chosen for protection.

Marine or Coastal Reserve Proposals

Included are all past suggestions found from various parties about protecting the Wairarapa's coastal or marine ecology.

Maps, Charts, and Photographs

Maps of topography, geology, bathymetry, sediments were used to form an initial overview of the area.

An excellent collection of colour aerial photographs of the whole length of the Wairarapa coastline, taken in (year?) from a small plane, is held at the Wellington Conservancy Office of the Department of Conservation.

Results

The following is an overview of each topic area, in relation to the Wairarapa coast in general. For a complete reference list relating to each topic see the Annotated Bibliography (Appendix 2). For a detailed description of each of the 13 sites with possible marine reserve potential, see the Site List (Appendix 1).

Bardsley's (1977) excellent annotated bibliography covers the scientific literature up until 1977, from Cape Palliser to Cape Turnagain. It includes several rather old geological references which I have not included. Pedersen's (1974) bibliography of scientific studies of Wellington harbour has some references with relevance to the Wairarapa coast.

The Department of Conservation's *Coastal Resource Inventory, First Order Survey, Wellington Conservancy*, (Dix *et al*. 1990), provides a comprehensive introduction to the "physical, biological, recreational, cultural, historic, archaeological, human modification, uses, protection and threats to" the Wairarapa coast.

Geology

The Wairarapa coast has been much studied geologically, and a long list of references is to be found in the Annotated Bibliography. Much of this is the work of graduate and post-graduate students of Victoria University, Wellington.

In Reading the Rocks - A Guide to Geological Features of the Wairarapa Coast (1989), Homer and Moore provide an excellent introduction to the coast (including spectacular photographs, travel directions, and Field Guide cards) for visitors interested in geology. This is an excellent popular book.

The Wairarapa area, including the coast, is described by Dr. John Collen (pers. comm. 2000) as some of "the most complex geology in the world". It is the "crumple zone" between the Pacific and Indo-Australian plates as the former plunges beneath the latter. Rocks have been “folded”, “faulted”, “severely eroded”, and there have even been “submarine eruptions” (Homer and Moore 1989:4). “In places, 20 million year old sedimentary rocks ... are tilted almost on end” ... “related to collision and movement” along the boundary between the Australian and Pacific plates - “the Earth’s surface is continually on the move!” (Homer and Moore 1989:4). Homer and Moore (1989:4-5) give a brief description of the geological history of the area - “a remarkable record of upheavals” (see figure ‘Geological time scale and age of geological features’).

“Nearly all the rocks along the Wairarapa coast are sedimentary - mainly sandstone, mudstone, and various types of limestone. There are no metamorphic rocks, and the only igneous rocks are the old volcanic lavas at Cape Palliser and Mukamuka, and basalt dykes at Glenburn” (Homer and Moore 1989:6). “The Wairarapa District is dotted with regionally important geological anomalies such as the volcanic intrusion at Cape Palliser” (Dix *et al.* 1990:13)

“The structure and shape of the coastal hills of the Wairarapa are the result of periods of deep water sedimentation, emergence and erosion (Webby and van den Heuvel 1965, Nelson 1968 in Stevenson *et al.* 1987). These processes have worked together to produce

steep hill country composed of generally soft sedimentary rocks (Eade 1966 in Stevenson *et al.* (1987).

"The eastern Wairarapa coast is complex, with sandy beaches, dunes, rocky outcrops and shore platforms". There are "blocks of limestone [the White Rock reef], sandstone [Honeycomb Rock], mudstone, volcanics, and a fossil totara forest" [at Kaiwhata River mouth] (Dix *et al.* 1990:10).

".... The eastern Wairarapa coast is being uplifted by tectonic activity and is characterised by raised beaches that are visible up to 5 km inland and 250 m above sea level. A narrow (100-800 m wide) coastal bench runs for most of the length of the coast and raised Holocene marine beach ridges are particularly obvious ..." (Dix *et al.* 1990:10). King (1930) describes the raised beaches from Cape Palliser to Whareama. However, King (1932) describes the coastline between Castlepoint and Napier, as "most disappointing", as there is only one raised terrace!

"Most of the Wairarapa coast is retreating with sea erosion, in some cases at rates of over 1m/year" (Dix *et al.* 1990:10). In fact, the coast at the base of the "spectacular" Ngapotiki Fan is eroding "at 3.45 m/year, the fastest rate of any cliff erosion recorded in New Zealand" (Gibb 1978).

"Many small river estuaries exist, but with their catchments thus modified, few natural values remain intact and their value to wildlife is limited. Because their exits are often blocked by sandbars, river water backs up and drowns potential feeding habitats". Rare seabirds breed at some of the estuaries (Dix *et al.* 1990:10).

Oil and Gas

The East Coast Basin is the area (onshore and offshore) from East Cape to north-eastern Marlborough, a total of around 70,000 sq. km. (Cole *et al. 1992*:55). This area "represents one of the most stratigraphically and structurally complex" sedimentary basins in New Zealand (Geosearch 1991:28), and is currently under exploration for oil and gas. The main focus for prospecting has, so far, been the northern part of this basin - the Hawkes Bay area, both on and offshore. The history of exploration in this basis is detailed in three articles (Francis, 1993,1994,1995).

However, in the last 5-10 years, images of the Wairarapa coast have begun to appear regularly in publications such as *Petroleum News*. In an advertisement in *Petroleum News* (vol. 44, 1995), the Institute of Geological and Nuclear Sciences claims:

> We've got the east coast covered ... We have taken a comprehensive review of East Coast geology including:
> - interpretation of all available onshore and offshore seismic reflection data,
> - a review of the biostratigraphy of key wells,
> - well-summary data prepared in graphic and digital form,
> - extensive field studies including geological mapping and assessments of the structural geology, sedimentology, stratigraphy and petroleum geology of the Basin.

Consultant geologist Dick Francis specialises in East Coast Basin petroleum geology. He suggests (1992:31) that there should be "good prospects" in offshore Wairarapa, and parts of onshore Wairarapa.

Included in the photocopied material is a colour copy of a map with current exploration areas, exploration rights, and wells drilled, to date.

Hydrography and Bathymetry

Three major current systems meet around the south-eastern coast of the North Island of New Zealand (see figure x). Stevenson *et al.* (1987) summarise the work of Heath (1971, 1974, 1975), and describe the current flows thus:

The Southland Current, “composed of subtropical water from the Tasman Sea and cooler, less saline subantarctic water”, flows northward along the eastern Wairarapa coast. “The northward extension of the Southland Current is highly variable but usually turns eastward at about Cape Turnagain".

The East Cape Current “derived from eddies shed off from the East Auckland Current”, flows southwards along the coast, outside the Southland Current.

The D’Urville Current (derived from the subtropical waters of the Westland Current) flows from the west through Cook Strait, and “mixes in the Cook Strait narrows with components of both the Southland Current and the East Cape Current”.

“This combined current passes around Cape Palliser and up the east coast of the North Island with a portion of the Southland current."

The mean current speed along the Wairarapa coast is around 20 cm/second (L. Carter, pers. comm. 2000).

Most of the detailed hydrographic and bathymetric research has been conducted in Cook Strait, rather than the eastern Wairarapa coast (see Annotated Bibliography). I have included in the Annotated Bibliography only the publications which seemed most recent and relevant to the Wairarapa coast. Carter (eg. 1987, 1992) has described geology, sediments, tides and faulting in Cook Strait. "Cook Strait, between the North and South Islands of New Zealand, is one of the great tidal raceways with surface currents reaching speeds of 300 cm s^{-1}" (Carter 1987).

North of Castle Point the continental shelf is “narrow (usually less than 20 km)” in width, but between Castle Point and Wellington, the shelf is “very narrow (less than 10 km)”. “The shelf edge along the east coast is very irregular but usually well defined" and the coast is characterised by its "many submerged reef systems" (see Brodie 1960, van der Linden 1968).

Griffiths and Glasby (1985) provide an interesting paper on 'Input of River-derived Sediment to the New Zealand Continental Shelf' which includes figures on the sediment loads of Wairarapa rivers.

Matthews (1983) study of 'Wave disturbance and texture of beaches in Palliser Bay, southern North Island, New Zealand' is unusual in topic, and filled with detail.

Marine Biology

The convergence of three oceanic current systems "results in a unique and diverse community with distribution overlaps" (Dix *et al.* 1990:13).

Typical marine ecology of the Wairarapa Coast is described by Morton and Miller (1973:336-343). Morton and Miller emphasise that the coast is a transition zone, influenced by both the warm East Auckland Current and the colder Canterbury Current. This can be seen in the changing biology. They state that "the boundary of the Aupourian and Cookian 'provinces', generally set at East Cape, provides, however, no sharp biological threshold". They include a

chart of the "changing distribution of 16 selected plants and animals at 25 stations" along the east coast from Bay of Plenty to Cape Palliser (1973:339). Castlepoint appears to be a transition point for several organisms (see Site List).

With "no major rivers" along the Wairarapa coast, coastal marine life is largely dependent on the nutrients derived from "algal rack recycling", and the offshore seabed is "sterile" compared with many other New Zealand waters (Dr. Bob Wear, pers. comm. 2001).

Young crayfish or young paua appear to congregate in particular areas. "I think every beach has its own breeding ground for paua ... [A place] where the young seem to congregate ... Wherever the most breeding is, would be a good place" for a marine reserve. All the commercial fishermen will know where these bays are" (MAF Fisheries Officer Peter Himona, pers. comm. 2000).

A body of literature discusses the relationship between currents and the dispersal and settlement of crayfish larvae along the Wairarapa coast (see papers by Chiswell, Booth and others).

Recent literature by Chang describes the effect of toxic algal blooms along the Wairarapa coastline.

Adams (1972), in a list of 'The marine algae of the Wellington area', includes species from the Wairarapa coast to just north of Castlepoint. Fraser *et al.* (1987) reported on 'An ecological assessment of seaweed harvesting from beaches of the Wairarapa coastline'. This is an excellent study of both the ecological and cultural significance the harvesting of *Pterocladia* spp.

Seabirds have not been extensively studied on the coast, but there are several other brief studies (eg. those by Stidolph). Bartle (1970s) provides observations of seabirds, and work on the euphausiids of Cook Strait. Likewise, there is some study of the fur seal populations on the coast. Dix (1993) records the first observations of breeding at the Cape Palliser seal colony.

The most extensive intertidal research on the Wairarapa coast has been conducted at Castlepoint, particularly that of two 1965 studies by undergraduate and postgraduate students of biology and geology, from Victoria University (see Site List). These studies should perhaps be considered classics of New Zealand biological literature. The topics chosen for study include: algae, intertidal animals of both hard and soft shores, fish, plankton, and seabirds.

Clinton Duffy of DoC has dived extensively along the Wairarapa coast, and the Site List includes some of his recorded observations. Duffy has also interviewed several fishermen, and notes from the interviews are provided among the photocopied material.

Many other articles mention the Wairarapa coast in some way, and are therefore included in the Annotated Bibliography.

Studies of fin-fish species off the Wairarapa coast are included in the Annotated Bibliography, under the heading Ichthyology.

Terrestrial biology

It appears that the entire coastline was devoid of forest by 1853 (Hill 1963:85). In fact, it “was largely deforested in pre-European times, and never recovered, probably because of unstable soils, harsh climate and regular burning during summer droughts" (Dix *et al.* 1990:10). Remaining now, is a patch of coastal forest at Tora, some coastal scrub/forest at Castlepoint,

and native dune vegetation at various localities. Castlepoint is the only site in New Zealand with the rare endemic daisy, *Brachyglottis compacta* (Dix *et al.* 1990:13).

Lists of indigenous vascular plants have been made by A.P. Druce, for the following areas: Cape Palliser, Pahaoa Gorge Taipos (sea-level to 1500 feet); Wairarapa Taipos (sea-level to 2000 feet); the Aorangi Range; Mount Percy; and Castlepoint (see Milne and Sawyer, draft, 2000:33-34). The vegetation of Castlepoint has been described by Park (1965 and 1967), and Turner and Carlin (1975).

"Several parts of the coast (eg. Pahaoa estuary, Uruti Point and South Riversdale) still retain native vegetation such as pingao, spinifex and sand daphne (*Pimelea arenaria*) on fragile small dune systems. (Dix *et al.* 1990:13). See Milne and Sawyer (draft, 2000) for a discussion of the dune vegetation, and identification of key sites for protection and restoration.

Native skinks and geckos are found at a variety of coastal sites (see Dix *et al.* 1990).

Prehistory

The human story of the Wairarapa coast begins by at least 1200 AD, with Cape Palliser being one of the earliest settled areas in New Zealand (Anon. 1980s:8). Cape Palliser's prehistory is regarded as unusual in that the earliest inhabitants appear to have been well-fed horticulturalists, that over time became a "more sickly hunting and gathering society that had all but disappeared by the advent of European settlers" (Carlin 1980:41).

The coast is noted for its extensive archaeological remains. The Historic Places Amendment Act (1975) extends its protection to all archaeological sites, registered under the Act or not, and recorded or not, known or unknown (see McKinlay 1979, in Carlin 1980:260).

The majority of work in the Palliser area has been carried out by H. and F. Leach, and the Annotated Bibliography contains several references to their work.

European History

The work of writers such as Bagnall (1976) and Fearon (1980) provides interesting and highly readable accounts of early European life on the coast.

“The area known to the Maori as Tehukakore was charted and renamed Flat Point by James Cook, commander of the HMS ‘Endeavour’, on 11 February 1770. It was another 60 years before Europeans again visited the coast. In 1830 the American whaling vessel “Antarctic” visited the area and traded with the local Maori (Fearon 1980).

“The known records do not tell of any European who travelled into or through the Wairarapa before 1840” (Bagnall 1976:23). In Chapter 3 of *Wairarapa* (1976), Bagnall describes the coastal journeys made by several of the first European explorers.

“The first European settler took up residence in the area in 1850 with the lease of a massive tract of land extending between the Pahoa and Whareama Rivers. However, it was not until 1853 that firm holdings were established when the crown acquired Te Werata’s (Waikekeno’s Chief) Pahoa Block of 250,000 acres. The founding stations of Glenburn and Flat Point were established in the mid 1870s (Fearon 1980).

Current Human Use

The coast has motivated a small amount of interesting geographical and anthropological research - see, for example, Hendry (1972), Seconi (1972), and Levine (1984).

“The Wairarapa Coast is one of New Zealand’s major collecting areas for the agar seaweeds *Pterocladia lucida* and *P. capillacea* (Bradstock and Luxton 1984, in Stevenson *et al.* 1987).

"The continental shelf is very narrow, and so commercial and recreational fishing is concentrated within this narrow band" (Dix *et al.* 1990:10).

“Twelve commercial paua divers hold quota for the Wairarapa - Hastings area. The areas that can be worked are restricted by [lack of] access to the coast. Most private landowners in the Wairarapa do not allow commercial paua divers to launch from their properties” (Stevenson *et al.* 1987).

The most productive areas for paua are currently Tora and Cape Palliser to Ocean Beach. These are more rocky than Castlepoint or Riversdale, and the paua are "cleaner" and "hold their weight better" (MAF Fisheries Officer Peter Himona, pers. comm. 2000).

The most productive areas for crayfish have recently been Castlepoint, Flat Point and Tora, but "two years ago it was really good at Ngawi ... It seems to go in cycles" (MAF Fisheries Officer Peter Himona, pers. comm. 2000).

"Fishermen say they're running out of hapuka [groper] on Uruti bank, south of Riversdale" (MAF Fisheries Officer Peter Himona, pers. comm. 2000).

See C. Duffy's 'Notes from Interviews with Wairarapa fishermen' for aspects of history of groper and rock lobster fishing.

The Ministry of Fisheries maintains a Catch and Effort Database for the Wairarapa coast. Information can be easily extracted for particular a species, time period, and area. However, the areas used as recording categories are fairly large - the Wairarapa coast falls into three: Cape Kidnappers to Castlepoint, Castlepoint to Cape Palliser, Cape Palliser to Pukerua Bay (P. Cresswell, pers. comm. 2001).

MFish also contracts out research into stock assessment, and larvae settlement etc. which is published in its own grey literature (P. Cresswell, pers. comm. 2001).

Toxic sites

The Wellington Regional council holds information about toxic sites in their "ANZECC Site Use Database". They state "Sites are included in the database either on the basis of a site assessment indication the presence of contamination , or on evidence that a past or present land use has the potential to cause contamination (usually involving the storage, use, or disposal of hazardous substances). E.g. the storage of petrol or diesel, chemical manufacture, and landfills" (Strong, letter, 2000).

Very limited information relating to toxic sites was gained from Barry Strong at the Wellington office of the Regional Council and is included in the site descriptions. Strong characterises the information provided as "brief" and "vague", and adds the disclaimer that "No reliance can, or should be, placed on this information, by any person, as indicating the presence of contaminants on the site." The information is obviously incomplete, as only four sites are mentioned (3 landfills and one public septic tank system), and all would be public knowledge for residents of the areas concerned.

Marine reserve proposals

Forest and Bird

Chris Peterson of Forest and Bird has been promoting the idea of a marine reserve for the Wairarapa since at least mid 1996, with the goal of establishing a reserve in time to celebrate the millennium. More recently he commented "I was quite enthusiastic about a Wairarapa Marine Reserve for a while and spoke to several fishing groups etc. but it seemed too hard and I sort of gave it away. Perhaps it's time I got invigorated again ..."

Arguing that a reserve could have "importance for tourism", and spin-offs for fishermen, as well as biological value, he questions "why restrict ourselves to just one Reserve? Marine ecologists argue that we should be looking to retire 10% of our coastline as 'no-take' area if we want to restore the situation to what it was formerly" (in letters to the editor, 1996).

Forest and Bird has not proposed a specific site for a marine reserve.

Proposals from iwi

According to Joe MacDonald (Rangitane o Wairarapa), an area between the Whareama River mouth and Cape Turnagain, has been proposed as a kaitiaki area. This proposal was submitted by the hapu Te Hika o Papaumu, to the Minister of Fisheries, around 1999.

Other proposals

Both Castlepoint and Honeycomb Rock have been suggested as marine reserve areas by biologists, at various times.

Castlepoint: Dix *et al.* (1990) propose Castlepoint as a "potential site for a marine reserve", as it is "accessible by road and it has a range of habitats ... [and] is also important as a settlement site for crayfish in larvae".

Honeycomb Rock: Dix *et al.* (1990) state that Honeycomb Rock was suggested for Marine Reserve status "as long ago as 1981". Stevenson *et al.* (1987) also propose Honeycomb Rock as a marine protected area.

Ministry of Fisheries

The Ministry of Fisheries has no legislative power to propose marine reserves, however, it does have the power to impose other forms of protection, such as lowering the total allowable catch (TAC) of a species in a particular area (P. Cresswell pers. comm. 2001).

In addition, studies of *coastal* reserve potential (such as the work of Bill Carlin (see Turner *et al*. various dates), are included in the Annotated Bibliography. It must be remembered that these are land-focused.

13 sites with marine reserve potential

Thirteen sites along the Wairarapa coast were identified as having marine reserve potential, largely on the basis of the presence of offshore reefs. From north to south, these are:

1. Owahanga
2. Omaruapakihau / Mataikona
3. Whakataki
4. Castlepoint
5. Whareama
6. Uruti Point
7. Kaiwhata
8. Flat Point
9. Honeycomb Rock
10. Pahaoa
11. Te Awaiti / Tora
12. White Rock
13. Cape Palliser

These sites are variable in size and no attempt has been made to define their boundaries.

See Site List for details of these sites, including marine and terrestrial biology, geology, archaeology, and current human use. The **Site Summary Table** in the Discussion, briefly synthesises some of this information.

Discussion

The published resources relating to the marine biology of the Wairarapa coastline are exceedingly scarce. A far greater volume of work exists relating to Wellington harbour and Cook Strait. In hydrographic, bathymetric, or ichthyological studies, the southern Wairarapa Coast is frequently sampled or mentioned as part Cook Strait. But studies specifically of the Wairarapa coast, especially the intertidal zone, are virtually non-existent.

Castlepoint is unequivocally the best studied area on the Wairarapa coast. The studies conducted here of the marine and terrestrial biology by Victoria University students in July and November 1965, provide a remarkable and comprehensive record of the place at that time, and form an excellent base for further research. These studies were informally published in two thick reports which are now difficult to obtain, presumably because there were never many copies and some have already been consigned to the garbage due to their age and informal binding. Yet, these two volumes remain the best scientific record of the coast. The students involved would be surprised that their work has attained such status. Mr. R.G. Wear (now Dr. Bob Wear, Senior Lecturer in Zoology, VUW) was the staff supervisor at the time. According to him (pers. comm. 2001), the fieldtrips were immense fun, everyone had a great time, and many stories have lost none of their repeatability[1]. As the writer of the Introduction to the November volume makes clear, these were considered preliminary studies only:

> Again we found that the natural history of the Castlepoint area is a fascinating study; it is hoped that future visits may be made to other parts of the eastern Wairarapa coastline so that a broader picture may be obtained. .... in examining the results of our visits to Castlepoint in 1965, we wish to emphasize their inadequacy, and the preliminary nature of the report. All those who have visited Castlepoint in July and November wish to record their hope that visits of undergraduate and graduate students to Castlepoint and to many other places will continue, and prove as enjoyable and as scientifically rewarding as those visits have been to those who have worked at Castlepoint.

Unfortunately these wishes were not to be granted. To my knowledge, this was the second and last visit made by a group of Victoria University biology students, to any part of the Wairarapa coast. One presumes that funding for group visits was not found, and/or the Marine Department house in which students stayed at Castlepoint was sold.

The task of studying the Wairarapa was not taken up by individual students of biology. I have found no theses relating to the marine or terrestrial biology of the Wairarapa coast. As most students do not design their own research topics, this lack must be laid at the doors of their supervisors.

In contrast, the School of Earth Sciences at Victoria University, has, over the years and the last decade in particular, produced a series of theses about the geology of the Wairarapa, including the coast. In conjunction with the published literature, this amounts to a comprehensive body of knowledge about Wairarapa geology.

It is to be hoped that a new interest in the Wairarapa coast can be fostered, to encourage research, and that the major biological gaps in knowledge will, over time, be filled.

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1 [1]... including the time when a wild hind from the nearby forest walked coolly into the Castlepoint Tavern, looked around, decided it was not for her, and departed.

The sites identified by this literature review as having potential for marine protection are preliminary only. The suitability of these sites remains unknown. In the absence of adequate biological information most of these sites are recommended largely on the basis of the presence of offshore reefs - suggesting that local biodiversity may be high. In the absence of adequate socio-cultural information, such as that relating to recreational and commercial fishing, it is realised that there may be good reasons against protecting any or all of these sites.

On the basis of the limited knowledge gained by this literature review, the following summary was made from the Site List, of potentially important aspects of the thirteen sites (see also Site Summary Table):

- The marine ecological value of these sites is either unknown or high for all sites listed.
- All sites have offshore reefs (see topographic and bathymetric maps).
- Several, such as Whakataki, Castlepoint, Kaiwhata, and Honeycomb Rock, have geological features on the shore which may interest the general public (see Homer and Moore 1989), or other terrestrial features of interest, such as sanddunes. Most of the potential reserve sites identified by this review are accorded local, regional, or even national importance, for scenic, geological, or (terrestrial) biological reasons, by the Department of Conservation (Dix *et al*. 1990).
- Around half of the sites include a river mouth and estuary, which may provide habitat for sea birds, and interest for visitors. However, sea water discolouration due either to the high sediment loads carried to the shore by rivers, or by active sea erosion, is, according to Dix *et al.* (1990), a factor in nearly all sites. How this affects species composition and diversity is unknown, although diversity could be expected to decrease if quantities of suspended or deposited sediment are high. Whether water clarity could be a problem for visitors at any sites is unknown.
- Several sites have small or large sanddunes with native dune vegetation. Again this could be of interest to visitors, but it should also be kept in mind that these sites are fragile, and are likely to need protection from visitors if a marine reserve is sited in their vicinity (see Dix *et al.* 1990, and Milne and Sawyer, draft, 2000).
- The accessibility of these sites to the public is extremely variable. If road access is considered important, and extending roads inadvisable, it would seem that several sites must be immediately eliminated from consideration. The ease of access needed is a matter of opinion. If visitors' experiences are enhanced by being able to get away from roads and automobiles, a site with good walking access only should not be discounted (see Dix *et al.* 1990, and topographic maps). According to Homer and Moore (1989) the track to Honeycomb Rock is closed for two months over the lambing season.
- Likewise, what facilities are needed for visitors be a matter of opinion. The proximity to settlements or individual dwellings may also be important in deciding whether a protected area will be able to be managed adequately, and regulations enforced (see topographic maps).
- Most of the sites include a place where fishing boats are launched. However, the absence of a launch site does not necessarily indicate the absence of fishing interests. Much more work needs to be done to assess recreational and commercial fishing along the coast (see Dix *et al.* 1990 and maps held by DoC, and annotated for Coastal Resource Inventory).

From a biological point of view it is unknown what percentage of coastline, if any, it is necessary to protect in order to safeguard New Zealand's inter- and sub-tidal biodiversity. It is

often said that marine protected areas should cover 10% of New Zealand's coastline, but this figure is not based on science, it is merely a convenient number. The Wairarapa coastline is over 200 km in length, thus 10% percent would be a length of over 20 km. Even if this goal is deemed desirable, to have several smaller areas may be more practical. Whether there is an optimum reserve size for particular species is unknown.

Currently, the marine reserve closest to the Wairarapa is Te Angiangi (446ha), between Blackhead and Aramoana beaches, Hawkes Bay, which was established in 1997. This reserve "includes broad rock platforms exposed at low tide, shallow rock reefs ideal for snorkelling, boulder banks and sponge gardens" (DoC 2000:49). How this area compares biologically with the Wairarapa coast is beyond the scope of this report, but may be of interest to decision-makers.

At this time New Zealand's Marine Reserves Act 1971 is under review and its "purpose and scope" are some of the major aspects being reconsidered (see DoC 2000). The purpose of the Marine Reserves Act has been to preserve areas in their natural state for scientific study (DoC 2000:8). Thus the focus has been for the purposes of protection rather than restoration, and both recreational and commercial fishing have, in the past been outlawed. It is suggested by DoC that the purpose of the Act should be broadened "to protecting and preserving marine areas for all New Zealanders and for future generations". What this change would mean is unknown. This literature review endeavours to provide a range of information which will be helpful irrespective of the outcome of the Marine Reserve Act reconsideration. But obviously the purpose of a protected area (whether for scientists or the public, for example) is of great importance in identifying possible suitable sites.

Oil and gas exploration

To what extent may oil and gas exploration or discovery impact on the coastal environment?

Dr. John Collen (pers. comm. 2000) described three main phases in the petroleum process. In the pre-drilling phase of exploration, seismic methods are used offshore, and the surf zone is avoided. Offshore drilling should have little environmental impact if nothing goes wrong, however, spillages are always a possibility. With present technology drilling can be deviated, and near-shore wells, for example, can be drilled from land. If a commercially significant find is made, and wells are at sea, production would entail pipelines, with the ongoing possibility of spillages.

Exploratory drilling requires resource consents from the appropriate regional councils - "for discharges to the air from flaring, and to the sea from drilling mud additives and drill cuttings ... and to place structures on and drill the seabed ..." (Anon 1994:3). In discussing the drilling of a well to 3500 m, 13 km off Mataikona, in 1994, an environmental consultant told a Regional Council Hearing Committee that "seabed impact from exploration drilling would be minimal and that the risk of an oil spill was extremely low" (Anon 1994:3).

It seems likely that a marine protected area (focused on the inter- and sub-tidal zones), and an oil or gas discovery (probably further offshore), could coexist without conflict, but this should be investigated further, particularly in relation to responsibility for spillages.

As Cometti and Morton (1985:92) comment, the Wairarapa coastline is currently free from “national developments”, and even from “small townships with industries ...” Whether this will continue to be the case in an area in which a commercially viable oil or gas discovery is

currently sought, is unknown. Dr. Collen (pers. comm. 2000) is of the opinion that any refineries needed are likely to be situated in Masterton, rather than on the coast itself.

Toxic sites - potential for water pollution

As land contamination has the potential to affect marine biology, it would seem important to gain more information than was provided for the purposes of this report by Barry Strong of Wellington Regional Council. According to Strong (pers. comm. 2000), the Regional Council is worried about "influencing land values" if information is made public. However, Strong stated that an Official Information Act request from the Department of Conservation would require the Regional Council to make their information available to the Department.

It does not seem advisable for DoC to operate in ignorance of such information. DoC should be in possession of such knowledge as may affect marine biological diversity, and ecological relationships. One purpose of a marine protected area may be to further scientific knowledge, and thus, it is important to be aware of possible contamination as a variable in research. Contamination may even have educational value and give potential for community-based restoration work. It also has the potential to endanger public safety, for example, the safety of children playing in the intertial zone or contributary streams.

Local biological knowledge

Residents and regular visitors to the coast, who are involved in coastal or marine activities such as diving and fishing, must hold extensive and valuable knowledge of the local biology of the coast. An oral history project may be the best method of recording this knowledge from willing participants. As Clinton Duffy's 'Notes from interviews with Wairarapa fishermen' illustrate, more knowledge is held by fishermen and other locals, than by the scientific community. The members of Victoria University's November 1965 trip to Castlepoint, acknowledge the help of Mr. Gordon Brown:

> "In connection with the marine aspect of this study, we wish to thank Mr. Gordon Brown for a 22 mile coastal trip, North of Castlepoint to Owahanga Station. This enabled us to obtain an insight into the type of animals, plants and hatitats occurring north of the study area. Without Mr. Brown's invaluable help and local knowledge concerning the coastal flora and fauna, obtained through many years of Algae collecting for the Agar industry, and fishing, we would have missed a great deal" (1965:35).

It is for today's decision-makers to recognise that biological knowledge is not just found in published literature or the heads of scientists. And, as in this case, when biological knowledge is so clearly lacking in these places, it is not accurate to assume that the knowledge does not exist. Oral history has a further advantage. People have memories, and in this way oral history can realistically hope to capture some types of change over time, and compensate for the lack of longitudinal scientific study of the coast.

Possible student research projects on the Wairarapa coast

The following possible research projects are suggested which would help fill major gaps in our knowledge of coastal biology and ecology:

- Comprehensive studies of particular sites.
- Importance of offshore reefs for species diversity.

- Importance of microhabitats for species diversity.
- Significance of sandy shores for ecology of coast.
- Relationship between algal diversity and faunal diversity.
- Relationship between sediment (suspended and/or deposited) and species composition and diversity.
- Relationship between coastal erosion rate and species composition and diversity.
- Significance and distribution of areas with predominance of female or young crayfish or paua.
- Significance of algal rack recycling for ecology.
- Effect of algal toxins on ecology.
- Effect of landfill leachate on species composition and diversity in streams.
- Comparison of estuarine systems e.g. relationships between nutrients, sediments, water flow, species composition and diversity, bird life etc.
- Biogeography e.g. to what extent do biogeographical provinces have clear boundaries?
- Genetic relationships of Wairarapa species with those on other New Zealand coasts.

These projects are only a beginning. It is to be expected that talking to knowledgeable locals would bring to light many more potential research projects.

Conclusion

"Our search for understanding
is like a well without a bottom."
Neils Bohr

It appears that the comment that the Wairarapa is "perhaps one of the least well known parts of New Zealand" (Homer and Moore 1989:4), is well founded, particularly in relation to marine biology. It will take many years to repair this knowledge gap, and it will not happen without some commitment on the part of universities and/or government agencies. The Wairarapa coast is an unused natural laboratory, accessible to both Victoria and Massey Universities, and of course, to the people of our capital city.

But it must be remembered that it is its unknown, undeveloped, isolated nature, which creates the mystery which is a large part of its charm.

The past is very close on the Wairarapa coast. And the coast itself seems an active player in that past. As a read though the Site List will show, this is the place where Maori chiefs fall down blowholes, porpoises are scared away by stock-whips, farm houses and outbuildings burn, settlers and their horses drown in rivers, and boat after boat is wrecked on the wild shore. In the past everything is connected:

> "The Maoris say that on a hummock or mound like hill stretching into the sea [somewhere in a day's march north of Pahaoa] ... are two springs bubbling close to each other one of fresh and the other of salt water, & that in the latter

are a small kind of scafish[2]. The Maori traditions say that it is fatal to visit them which was perhaps the reason why our people said nothing about it until we had passed onwards ..." (Weld 1844, in Bagnall 1976:42).

"On the top of the Range above Waikekeno is a sulphur mud patch - a kind of tidal spring. It is 3 or 4 chain square with small airholes in the mud which emit strong sulphur gases. The Maoris maintain that the spring is somehow connected underground, with the blowholes on Kahu Rocks off the Glenburn coast. .... This theory is quite possible, as activity in the spring appears to wax and wane in unison with the tides" (Fearon 1980:28).

Is the present any different? Have these mysteries been solved?

The ocean continues to hide its biodiversity under water; to ignorant visitors appearing as if nothing happens beneath. Tides reveal or obscure the tantalising margin between land and sea. Local people guard their knowledge, unrecorded on paper, not easily accessible to others.

The coast retains its mystery, and draws us into the mesh of its discovery.

2 [2]This term may be archaic - I have not been able to find out what type of fish this is.

Acknowledgements

I thank Aalbert Rebergen (DoC Masterton) and Bruce Dix (DoC Wellington) for their help and good humour.

I thank the following people for having time to provide information: Bill Carlin, Clinton Duffy, Dr. Jonathan Gardner, Dr. Bob Wear, Dr. Wendy Nelson, Dr. Lionel Carter, Dr. Steve Chiswell, Dr. F. Hoe Chang, Paul Cresswell, Barry Strong, Dr. Geoff Park, Chris Petersen, Dr. John Collen.

My thanks to Jean Potter and Maria Paulin of the NIWA library (Greta Point, Wellington), for their extensive help. It would have taken considerably longer without Jean and Maria, and the excellent NIWA library.

I commend the Victoria University School of Earth Science for the immense contribution they have made, particularly in the last decade, to geological and geophysical knowledge of the Wairarapa.

1	Marine Ecological value	Bathymetry	Other Geological interest	River-mouth	Dunes	Archaeology	Oth ter int
Owahanga	unknown	shore platforms	?	yes - largest river between Palliser and Turnagain, high sediment load	-	3 sites (2 pa)	400 tida >4k ups bird
Omaruapakihau - Mataikona (incl. Whakataki)	microhabitats, great algal diversity	wide shore platform, parallel grooves	?	yes - two, high sediment load	a 50ha area of hillside north of Mataikona	14 sites (3 pa)	est bird
Castlepoint	wide variety of habitats, transition zone	exposed, rocky to sandy, sheltered	limestone, shelly sandstone, 2 mill year fossils - 70 fossil species	no river, but high sediment load	around 60ha	9 sites (2 urupa)	sce bird kat *Bra con*
Whareama	unknown	rock platforms, offshore reefs at Waimimi	?	yes - largest between Palliser and Castlepoint, mudflats 2-3km upstream	-	no sites in HPT, but a pa north of Whareama stream?	rare

2	Marine Ecological value	Bathymetry	Other Geological interest	River-mouth	Dunes	Archaeology	Oth terr inte
Uruti	unknown	shore platform, offshore reefs	raised terraces	no	around 100ha - largest area on coast, dune lake	1 site (urupa, and burial)	_
Kaiwhata	unknown	large shore platform, offshore reefs	fossil totara forest	yes, water also discoloured due to sea erosion	-	a pa - 50m inland	birds
Flat	unknown	offshore reefs	a flat bare tombolo	no, but water discoloured due to sea erosion	small area, important vegetation - all 5 spp.	6 sites	
Honeycomb (Kahu)	high diversity	extensive offshore reefs	a distinctively weathered sandstone outcrop, also conglomerates, and volcanic dyke	no, but water discoloured due to sea erosion	small area	6 sites (1 pa)	3 ho walk Glen Stati

	Marine Ecological value	Bathymetry	Other Geological interest	River-mouth	Dunes	Archaeology	Oth ter int
Pahaoa	unknown	offshore reefs		yes, largest between Palliser and Flat Point, ?W, water also discoloured due to sea erosion	largest area is 2ha, largest stand of pingao and spinnifex on coast	36 sites (3 pa)	rare *Ino* loca
Te Awaiti	unknown	offshore reefs	redeposited gravels, raised beaches	yes, Awhea river/estuary, water also discoloured due to sea erosion	small - 10sq.m. of pingao	2 sites (also 3 pa within 3km to south)	10h fore esc Tor
Te Kaukau / White Rock	unknown	offshore reefs	tilted sheet of limestone forms a reef, also Ngapotiki Fan	yes, also very active sea erosion	-	40 sites (4 pa)	birc
Palliser	unknown	offshore reefs	volcanics, greywake and sandstone	streams	a 200ft high dune between Cod Rocks and Waitetuna Stream (2.5km beyond roadend)	75-200 sites (3 pa)	bre sea alpi alor

Appendix 1.

Site List

1. Owahanga river mouth, and rocks to north and south

Brief description of site: The largest river and tidal flats on the Wairarapa Coast between Cape Palliser and Cape Turnagain, and is considered to be “of regional importance” (Dix *et al*. 1990:100). “The 400 ha area of estuary and nearby beach and shoreline provides varied habitat with tidal mudflats extending at least 4 km upstream, sandy shore immediately north of the river mouth, and rough boulder strewn shore platforms exposed at low tide to the north and south of the estuary”.

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Access: The road runs parallel to the river but stops about 1.5 km short of the river mouth, “so this estuary is less accessible to people than most estuaries along the Wairarapa Coast” (Dix *et al*. 1990:100).

Current human use of area:

“Main recreational activities are swimming and boating in the river, fishing and picnicking” (Dix *et al*. 1990:100).

Paua, crayfish and fishing to south of river mouth (CRI U25D Human use map, 1976).

Area on either side of Owahanga river mouth closed to seaweed extraction (2 nautical miles radius from 4º40'8"S and 176º21'2"E) (CRI U25D Human use map, 1976, Dix *et al*. 1990:100).

Geology / bathymetry

“Land clearance in the catchment ... has led to erosion and a high sediment load in the river and nearby sea” (Dix *et al*. 1990:100).

See Neef (1992), Neef (1995), Neef (1999), Wellwood (1996) and Moore and Speden (1979) for description of the coastal geology.

Biology / Ecology

Owahanga river mouth "site of special wildlife interest" (CRI U25D Physical and Biological map, 1976).

“The Owahanga Estuary and nearby shore provides good feeding habitat for rare Variable Oystercatchers (*Haematopus unicolor*), threatened Banded Dotterel (*Charadrius bicinctus*) and threatened Reef Heron (*Egretta sacra*) and for more common waders, shags, gulls and terns and for this reason the site was ranked “moderate” in the Sites of Special Wildlife Interest register” (Dix *et al*. 1990:100).

Archaeology / history

“Three archaeological sites (2 pa and a midden) of Maori origin have been identified at this site” (Dix *et al*. 1990:100).

Pa site on northern side of Owahanga river, and another pa site on coast to south of river mouth, "cooking area" on southern side of river mouth (CRI U25D Cultural map, 1976).

2. Omaruapakihau to Mataikona

Brief description of site: "The 12 km stretch of coast between the Whakataki River and the Mataikona River has a very narrow (up to 100m wide) coastal platform flanked by a wide shore platform for most of its length. The shore platforms at Whakataki display, at low tide, a series of parallel grooves, extending for hundreds of metres. The "remarkable and unusual ... 'tongue and groove' erosion" along the shore platform is considered of regional importance (Dix *et al.* 1990:98).

Access: "A road traverses the whole 12 km section [Whakataki - Mataikona] close to the coastline and a cutting has been made through a bluff just south of Mt Percy" (Dix *et al.* 1990:98).

Whakataki is 50 minutes drive from Masterton (Homer and Moore 1989:62). Take the Castlepoint road through Tinui to Whakataki, turn off at Whakataki and drive along the coast towards Mataikona for about 2 km. Features are best seen at low tide.

Current human use of area:

"Landing reserve" at Mataikona settlement, fishing boat launching from here (CRI U25C Land Tenure and Human Use maps, 1976).

"A narrow surfboat lane has been cut in the rocks just south of Mataikona beach settlement ... The main recreational activities are walking, picnicking and fishing" (Dix *et al.* 1990:98).

Paua and crayfish, diving and fishing along rocks, seaweed collection along coast (CRI U25C Human Use map, 1976).

Existing Protection: DoC: Recreation Reserve (0.5 ha) at Mataikona Beach. Local: Recreation Reserve (18 ha) at Mataikona (Dix *et al.* 1990:99).

Geology / bathymetry

Dix *et al.* (1990:98): "The unusual geological feature of 'tongue and groove' erosion ... on the shore platform on the Whakataki-Mataikona coast is "of scenic and educational interest ... [This is] due to alternating beds of mudstone and siltstone (of some 20 million years old) being tilted and eroded. The tilt is measured as some 60 degrees to the west."

The "tongue and groove" effect is the result of "alternating layers of hard sandstone and softer mudstone", thought to have been deposited on the sea floor by turbidity currents about 20 million years ago, now raised and tilted almost on end (Homer and Moore 1989:14).

"This section of the coast is retreating from sea and wind erosion as evidenced by eroding sanddunes, sediment-laden sea and drifting sand on a 50 ha face of a 200 m hill just north of Mataikona River" (Dix *et al.* 1990:98). This is a "very prominent feature".

"The Mataikona River mouth is sometimes blocked by a sandbar and water backs up in the estuary" (Dix *et al.* 1990:98).

For details of the geology of the coast see Neef (1995), Neef (1999), Rait (1985), and Wellwood (1996).

Biology / Ecology

Dr. Wendy Nelson describes the shore platform as "extraordinarily lovely", "very diverse and interesting" in terms of algal flora. The subtidal bands of sand, softer rock, and cobbles "provide microhabitat variety", a "complex physical environment" with "gradual slope" for extensive beds of algae, and also seagrass.

Chang (1999) records the toxic marine dinoflagellate *Gymnodinium brevisulcatum* from this area.

“The coast and estuaries of the Whakataki and Mataikona Rivers provide feeding and breeding sites for rare Variable Oystercatchers (*Haematopus unicolor*) and threatened Banded Dotterel (*Charadrius bicinctus*), and for other waders, shags, terns and gulls” (Dix *et al.* 1990:98).

Archaeology / history

“14 archaeological sites of Maori origin have been recorded on this stretch of coast ... including 3 pa sites, 1 urupa, terraces, middens, ovens and karaka grove and a monument (Waipori’s Mark). The middens researched in detail have been of shell only (ie. no fish or birds) and paua (*Haliotis iris*) predominates” (Dix *et al.* 1990:98). Waipori’s Mark “is a stone cairn, erected in 1842 to mark a treaty signed in 1839 to end hostilities between Ngati Awa and Wairarapa Maoris” (Dix *et al.* 1990:98).

Pa site on hill within fork of Mataikona river (CRI U25C Cultural map, 1976).

“Two ships have been lost near Mataikona, the ‘Sovereign’ (1894) and the fishing boat ‘Crusader’ (1970)” (Dix *et al.* 1990:98).

3. Castlepoint

"This Cove presents perhaps the finest specimen of seaside rocks I have yet seen when viewed from its N.E. extremity ... The Natives ... are the most Civil people I have yet met with in this Country they had given us pork potatoes & crawfish refrained from begging accepted our proffered payment for the pig" (Weld, 25 Nov. 1844, in Bagnall 1976:41).

This small village of only a few huts, called Waiorango, [about 2 miles north of the Castlepoint cove] serves merely as a resort for fishing for the natives of Mataikona ... At the village we got a good meal of potatoes and crayfish (of which latter some hundreds were hung up on poles to dry) ..." (Colenso 1843, in Castlepoint Historical Committee 1965:7).

Brief description of site: Castle-rock is 162 m high (Dix *et al.* 1990:95). The area includes a great variety of terrestrial, intertidal and marine habitats, and spectacular scenery. It is considered a site "of national importance" due to the presence of *Brachyglottis compacta*, and is "of at least regional importance" for its coastal vegetation remnants (Dix *et al.* 1990:95). Physically, it is "regionally important as the only limestone of its age in the Wairarapa ... and the marine benches are classified as being of national significance ... This site was ranked as having national significance for the importance, quality and degree of recreational use of the area".

Access: Approximately 1 hour drive from Masterton (see Homer and Moore 1989:62). Take the Castlepoint Road, via Tinui; drive to the very end of road. About 10 minutes walk to the Reef, and 30-40 minutes to top of the Castle. "A raised walkway crosses the length of the tombolo to provide access to the lighthouse at high tide" (Dix *et al.* 1990:96).

Current human use of area:

"Shore based recreation is surfcasting, line fishing, drop potting, dragnetting, motorbike riding, horse riding, birdwatching, swimming and walking/climbing ... It is extensively used by amateur biologists and geologists and for educational visits from schools, universities and clubs. ... This is the most popular land based fishing area on Wairarapa Coast north of Palliser Bay" (Dix *et al.* 1990:96).

Fishing, diving, and waterskiing off the peninsula, swimming and sailing in the bay, paua and crayfishing to south of peninsula (CRI U26A Human Use map, 1976). Fishing boat launch from near settlement (CRI U26A Human Use map, 1976).

"The area is subject to very high levels of recreational line fishing and drop potting from the reef plus diving and boat fishing ... This has undoubtedly reduced the territorial fish species and seasonally depletes crayfish numbers. Commercial craypotting along the reef would also be affecting crayfish numbers... Fishing boats are launched off the beach from tractor-towed cradles ..." (Dix *et al.* 1990:95).

"Aesthetically, Castlepoint is the most prominent physical landscape feature on the Wairarapa Coast and it is painted, photographed and drawn extensively" (Dix *et al.* 1990:95).

"Each year the 'Castlepoint Horse Races' are held on the beach and this attracts very large (1000+) crowds" (Dix *et al.* 1990:95).

Seaweed collection along coast *except* within a 0.5 nautical mile radius of Castlepoint basin (40 degrees 54.7' S and 176 degrees 13.4' E) (CRI U26A Human Use map, 1976, Dix *et al.* 1990:96).

Whole peninsula from lighthouse to trig at Castle Point is a scenic reserve (CRI U26A Land Tenure map, 1976). Maori land on southern bank of Whakataki river (to north of Castlepoint) (CRI U26A Land Tenure map, 1976).

Existing protection: DoC: Castlepoint Scenic Reserve (36 ha). DoC stewardship areas: (three, totalling 0.25 ha) (Dix *et al.* 1990:96).

Geology / bathymetry

"The limestone and shelly sandstone forming the Reef and Castle are among some of the youngest rocks in coastal Wairarapa and contain an important record of conditions near the beginning of the Ice Ages, about 2 million years ago" (Homer and Moore 1989:18). Fossils are abundant, "representing over 70 different species, many of which are now extinct". "Successive layers of broken shell (mainly barnacles) and sand ... were slowly transformed into the limestone and sandstone forming the spectacular 160 m high Castle". The limestone formation "records a change from cool to temperate seas, resulting from shifting currents or perhaps a retreat of the Antarctic ice sheet." The reef "owes its elongate shape to major faults which run along either side", and although geologically very young, these appear to be inactive.

"Large fault trace usually covered by sand" between Castlepoint and mainland, "convoluted mudstones" at Castlepoint (CRI U26A Land Tenure map, 1976). "Large scale folding and slumping in mudstone" between Castlepoint and Ngakauau stream to south (CRI U26A Physical and Biological map, 1976).

"The coastline at Castlepoint is retreating with sea erosion, with a shift of 4.6 m between 1962 and 1977 ... The lighthouse/reef area was having severe erosion problems caused by visitors, but a walking path and revegetation programme has lessened this threat. These erosion processes have led to a high sediment load in the near-shore waters" (Dix *et al.* 1990:95).

For details of the geology see Challis (1960), Homer and Moore (1989), Johnston (1973), King (1932), Kustanowich (1964), Lewis (1973a and b), Moore and Speden (1979), Neef (1999), and Wellwood (1996).

Biology

Dive log notes (C. Duffy):

Location: Castle Point reef **Date:** 8 August 1980
Depth: 12 m **Visibility:** 3 m
Observations: Dive conducted along the seaward side of the reef. Entered the water from the low point of the reef, and covered a large area looking for crays. There is a narrow band of boulders along the base of the reef, giving way to fine clean sand. The reef face is deeply undercut. Red cod (*Pseudophycis bachus*) and blue moki (*Latridopsis ciliaris*) observed under here. Almost all of the rock lobster (*Jasus edwardsii*) found were large females in berry. Of 14 males taken only four were legal (i.e. 6 inch tails). Plenty of lost pots and sinkers on the bottom. One octopus observed well up on the reef face. Reer face covered in small turfing algae and encrusting invertebrates.

Location: Castlepoint Reef **Date:** 9 May 1982
Depth: 15 m **Visibility:** 1.8 m
Observations: Entered off the low part of the reef. Visibility deteriorated below 1.8 m towards the light house, so swam back to point of entry and continued the dive towards the mouth of the lagoon. Rock lobster (*Jasus edwardsii*) were abundant. Large females with eggs were observed standing in the open on the tops of boulders (? releasing larvae). One large male was taken in the open. The only other male was observed deep in a shelter.

"Castlepoint is a potential site for a marine reserve ... The site is one of very few Wairarapa coastal areas easily accessible by road and it has a range of habitats from rocky exposed coast to sheltered sandy bays within limited area. Castlepoint is also important as a settlement site for crayfish in larvae ... In the past, the rocky reef had large populations of crayfish and some finfish species" (Dix *et al.* 1990:97).

The bay to the west of the lighthouse at Castlepoint is noted for young crayfish (MAF Fisheries Officer Peter Himona, pers. comm. 2000).

“[If travelling south along the coast] It is at Castle Point that we first meet the full complement of four species of zoning mussels, by the addition of the common southern species *Mytilus edulis aotaenus* and *Aulacomya maoriana*” (Morton and Miller 1973:338).

“Castle Point, one of the relatively few points of road access to the neglected East Wellington coast, is an exciting place for the shore ecologist. The Lighthouse Rock ... built of richly fossiliferous limestone, forms and virtual island, extremely exposed to the steep outside face, and with its gently sloped inner margin under greater protection. Towards the lighthouse at the northern tip the outer face is completely vertical and here the waves make continual slap-up impact. Great clouds of spray allow *Notoacmea pileopsis* to flourish, along with the lichens *Verrucaria* and *Lichina confinis*, at 50 feet above LWS. Both the periwinkles *Melarapha cincta* and *M. oliveri* continue well beyond this level. At 30 feet from LWS, dull olive green *Gelidium pusillum* covers the vertical face, and below that extends the pink coralline paint, giving place to gnarled and cobbled *Lithothamnion* further down. The rock face lacks the sloping surfaces required for *Durvillea*, and the low water line is skirted merely with tufted red algae, discernible from above only with field glasses, but probably composed of *Pterocladia lucida*, a delicate alga surprisingly resistant to surge. Towards the base of this peninsula, the outer dip face is lower and steeply inclined. The waves surge and pound against it, sweeping even at low tide over the saddles of its 25 to 30 feet ridge. The outer face is clad with the zoning mussels, *Perna canaliculus* and - higher up - *Modiolus neozelanicus*. The navy mussel, *Mytilus aoteanus*, occurs in splash pools on narrow ledges. A pink and white coralline zone extends almost to the top, with small tufting corallines and a diversity of bushy red algae; *Pterocladia lucida* and *Plocamium costatum* are especially typical. *Chamaesipho brunnea* extends tin large sheets and patches over the gentler slope of the landward face. Saddles and channels dip into the ridge to a level of five feet from LWS, and here the surge encourages small stands of *Durvillea antarctica*, with and underlayer of *Lessonia variegata*, *Halopteris* and *Pterocladia*. The only *Carpophyllum* is *C. maschalocarpum* which is confined to the protected inner face” (Morton and Miller 1973:340).

Morton and Miller (1973:342-343) include simple profile diagrams of intertidal zones on Lighthouse Rock, and the Reef at Castlepoint.

Stevenson *et al.* (1987:55) include a summary from Morton and Miller (1973) in their description of Castlepoint marine biology.

According to Cometti and Morton (1985:92) “All the great brown algae of the open coasts are found here, each in its appropriate exposure to waves and currents. On the outside is bull kelp (*Durvillea antarctica*) ... and down below it palm kelp (*Lessonia*) can be glimpsed where the waves suck back. “In the current flow to the leeward of the lighthouse point, in one of its northern-most outposts, grows bladder kelp (*Macrocystis pyrifera*) ... Slenderly built, its attenuate stems and leaves never stand up to the waves, but flow pliantly with the current in channels and harbour mouths. Only in the enclosed stretch to landward does the familiar herringbone weed (*Carpophyllum maschalocarpum*) appear ... In height exposure it is supplanted by the kelps. “

Apophloea sinclairii (a “dull red” crustose algae) is “a northern species ... reaching as far south as Titahi Bay and Castle Point” (Morton and Miller 1973:296). “The bladder kelp, *Macrocystis pyrifera* ... spreads up the East Wellington coast to about Castle Point” (Morton and Miller 1973:338).

The two visits made by Victoria University students, to Castlepoint in July and November 1965, contain a wealth of marine and terrestrial biological information. Some (not all) examples are described below (all marine biology in these volumes is included in the photocopied material).

Roberts and Cooper (1965:38-41) describe the **intertidal animals** in four transects of Castlepoint, and include a species list, and distribution tables. The fauna includes species from the following groups: Nemerteans (2), Sipunculids (1), Polychaetes (15), Planaria (1), Actinia (4), Echinoderms (5), Crustacea (38), Mollusca (48), Pisces (3).

Laing and Wallis (1965:31-32) sampled the **sandy shore** area to the North of Castle Rock, "the strip of beach by the Castlepoint Settlement". One amphipod, one isopod, three polychaete worms, one insect, one crab, and one mollusc were found. Braggins and Neal (1965:34-37) describe the algae of the intertidal zone in four transects at Castlepoint, and include a species list (9 green algae, 21 brown algae, 17 red algae), and distribution tables.

Kelly (1966:13) states that "the Sandy Coast on the western side of Castlepoint [is] where two possibly new species of bristle-worms have been found".

Ritchie (1965:27-30) conducted a **fish survey** around Castlepoint, using seine netting and SCUBA diving (the latter limited due to visibility). A list is provided of "fish found dead in the drift", "fish observed by use of SCUBA", "fish taken by seine net", and "fish commonly caught at Castlepoint". It is suggested that juveniles of *Arripis trutta* (kahawai) and *Aldrichetta forsteri* (yellow-eye mullet) "formed a distinct shoaling population" with *Clupea antipodum* (sprat). The three fish species appear to be "homogeneous with respect to diet requirements and size range" in the protected waters of the lagoon, but form heterogenous shoals in unprotected waters, "for mutual protection from the predacious surface shoals in the area". Several bottom fish were observed, including *Aplodactylus meandratus* (Maori chief), and *Latridopsis ciliaris* (moki), and *Chironemus spectabile* (red moki), which were all observed inhabiting weed and feeding. *Coridodox pullus* (butterfish), *Conger verreauxi* (conger eel), *Jasus edwardsi* (spiny crayfish), and *Octopus vulgaris* were also observed.

Bartle and Williams (1965:20) compiled a species list of **birds** from the Castlepoint area. The total number of species was 38, including 26 native and 12 introduced, 20 sea and shore birds and 18 land birds. During a week's observation of seabirds from the shore at Castlepoint (3-9 July 1965) Nellies [Giant petrels - *Macronectus giganteus*] were the only petrels recorded. On most days they could be seen flying north or along the coast either singly, or in groups of up to four. Often they came quite close inshore, within 100 m of the beach" (Bartle 1974).

Kelly (1966:13) comments that the lagoon provides "an area of sheltered sand flats, frequented particularly by sea birds", and states:

"The Castlepoint area is the nesting place for a large number of sea birds.

a). Castlepoint is one of the nesting sites for the Red-billed Gull along the East Coast of New Zealand. The biggest colony is at the southern end of the reef, but others are scattered throughout.

b). Closely associated with the Red-billed Gulls are White-fronted Terns, especially on the reef.

c). On the cliffs of Castle-Rock are many nests of Black-backed Gulls, with a particularly large colony on a broad ledge at the southern end of the Rock.

d). The Castle-Rock cliffs also support a Black Shag colony, higher up on the cliffs above the gulls.

e). Below these cliffs on the large limestone blocks is one of the few known nesting colonies of the Blue Heron. Although no research as been done on this as yet, the general opinion among ornithologists is that this bird is decreasing in numbers."

"The reef area is a Site of Special Wildlife Interest ... rated as of 'moderate value' because [it]... is of importance to Red-billed Gulls (*Larus novaehollandiae*), White-fronted Terns (*Sterna striata*) and Black-backed Gulls (*Larus dominicanus*) and possibly Reef Herons (*Egretta sacra*) for breeding. The common gecko (*Haplodactylus maculatus*), green gecko (*Naultinus elegans*),

common skink (*Leiolopisma nigriplantare*) are at Castlepiont, and in 1977 a banded sea snake (*Laticauda colubrina*) was recorded there, and a green turtle (*Chelonia mydas*) was seen 3 km offshore in 1975" (Dix *et al.* 1990:95).

Bartle (1965:21-26) describes "preliminary" planktonic and sea-bird (petrel) observations, commenting that zooplankton “seem surprisingly plentiful”, for that time of year (mid-winter).

The **katipo spider** is said to be “plentiful” in the dry sand just above high water mark (Bradbury 1924).

The **vegetation** of the Castlepoint area (including sand dunes, Castle Point, the reef, and Castle Rock) is described in detail by Park (1965:2-10), and the vascular plants are listed. Kelly (1966) also discusses vegetation types, and lists 78 "Higher Plants" from his proposed reserve area.

Mason (1950) records *Celmisia spectabilis* and *Sophora tetraptera*, the large-leaved kowhai, from Castlepoint.

The limestone cliffs at and near Castle Point, are the type locality for *Senecio compactus* (now *Brachyglottis compacta*), and it is limited to this area (see detailed paper by Park and Williams 1965:11-16). In a further paper in the same volume, Park and Williams (1965:17-19) describe the vegetation of the Mount Percy area, north of Castlepoint.

Milne and Sawyer (draft, 2000) identify Castlepoint as a key site for the management of coastal dune vegetation. The Castlepoint Scenic Reserve is “one of the only protected natural areas in Wellington Conservancy that supports coastal dune vegetation and is administered by the Department of Conservation” (Milne and Sawyer draft, 2000:27). It is approximately 60 ha in size. *Pimelea arenaria, Desmoschoenus spiralis, Spinifex sericeus* and *Coprosma acerosa* all occur, as well the rare Castlepoint groundsel (*Brachyglottis compacta*). “Excessive pedestrian use and trail bike use has ... affected some of the dune vegetation” (Milne and Sawyer, draft, 2000).

“... parts of the site are quite modified by erosion (human induced and accelerated by clearing and walking) along the reef and by clearing/grazing at Castlehill [however], regionally it is still relatively ‘natural’" (Dix *et al.* 1990:96).

Archaeology / history

"Nine archaeological sites of Maori origin are identified in the HPT Inventory including 2 urupa, middens and ovens (Dix *et al.* 1990:95). Several burials and middens around Castlepoint settlement and on the peninsula itself. Two oven sites south of Castle Point.

William Colenso visited Castlepoint in 1843 and European settlement followed shortly afterwards ... Castlepoint was of great importance to the early European settlers of the Wairarapa as a shipping port for bringing in goods and shipping out produce, especially wool. At least 2 ships have been wrecked near Castlepoint" (Dix *et al.* 1990:95).

4. Whareama river, Waimimi reefs to north and Orui station to south

Brief description of site: The 15 km stretch of coast from Orui (2 km north of Riversdale Beach) to Otahome is characterised by narrow sandy beaches or rock platforms ...The Whareama River is the largest river between Cape Palliser and Castle Point and has a tidal area of mudflats that extend 2-3 km upstream" (Dix *et al.* 1990:93).

Access: Road does not go within 2.25 km of river mouth.

Current human use of area:

"A small jetty projects into the Whareama River 400 m from its mouth. This site is used for shore and water-based recreation ... with small fishing boats entering the sea from the mouth of the Whareama River ... The beach south of Otahome is popular for surfcasting" (Dix *et al.* 1990:93).

Paua, crayfish, fishing, diving, also possibly sailing from Whareama river (CRI U26C Human use map, 1976).

Seaweed collection along coast (CRI U26C Human use map, 1976).

The "Crystal Park" paua farm was formerly on the coast just south of this site (Dix *et al.* 1990:93, Aalbert Rebergen pers. comm. 2000).

"A county reserve (25 ha) south of Otahome ... and a rahui area (Waimimiha Fishing Reserve) near Waimimi Stream ... are the only protected areas on this stretch of coast" (Dix *et al.* 1990:93).

"Fishing reserve, Maori trustee" at mouth of Waimimi stream (CRI U26C Land tenure map, 1976).

Potential for toxic contamination? (from B. Strong, letter, 2000) "Tinui Valley Road - Tinui township has a large septic tank system and has a permit from WRC for discharges from this system to water [the Tinui/Whareama River?] - this site is a considerable way from the coast."

Also: "Riversdale operative tip. Approximately 5km from Riversdale Beach. This site is still ... operative ... and there is an obvious discharge of leachate to the stream - no analysis of the leachate composition has been done."

And: Riversdale historical tip. Approximately 10 km from Riversdale Beach. This landfill has been closed since 1960 - no analysis of the leachate composition has been done."

Geology / bathymetry

"The coast at this site is retreating quickly with sea erosion; at one site near Orui, the coast receded by 40 m between 1970 and 1977 ... and oblique aerial photographs show active beach erosion along much of this site and high sediment loads in the sea near the shoreline" (Dix *et al.* 1990:93).

For details of geology see Pick (1955) and Wellwood (1996).

Biology / Ecology

"The Whareama River estuary is locally important as a wildlife habitat, but the numbers of birds using the site are not regionally important" (Dix *et al.* 1990:93). "The Whareama River estuary provides good feeding habitat for wading birds such as rare Variable Oystercatchers (*Haematopus unicolor*), threatened Reef Herons (*Egretta sacra*), Banded Dotterels (*Charadrius bicinctus*), and also Pied Stilts (*Himantopus himantopus*) and a few Bar-tailed Godwits (*Limosa lapponica*) ... The Otahome Estuary, although still natural and less disturbed than the Whareama Estuary ... does not appear to have high wildlife values" (Dix *et al.* 1990:93).

Stidolph and Cunningham (1947) recorded a brief note listing the bird species seen on one visit to Whareama on 14/746: "20 black-backed gulls, 1 red-billed gull, 1 white-throated shag, 8 black shags, c. 3 grey ducks, harriers, magpies not numerous, yellow hammers numerous, flocks c. 15 skylarks common"... Comment that it is “not a good estuary for waders”.

McCann (1969) describes epizoic barnacles from the “wrists” of a young female leatherback turtle found stranded at the mouth of the Whareama River.

Archaeology / history

"Skeleton" and "pa site" on coast about 2km to north of Waimimi stream (CRI U26C Cultural map, 1976).

"No sites are listed on the HPT Inventory, but a burial site, a pa site and a karaka grove are present north of Waimimi Stream ..." (Dix *et al.* 1990:93).

"Three ships have been wrecked trying to cross the Whareama Bar: the 'Swift' (1861), the 'Sarah Elizabeth' (1861) and the 'Brothers' (1862)" (Dix *et al.* 1990:93).

Boundaries?

To south:

On rocky promintory just north of Riversdale - "raupo swamp, site of special wildlife interest" (CRI T27B Physical and Biological map, 1976).

Diving from these rocks also (CRI T27B Human use map, 1976).

5. Uruti Point

Brief description of site: By far the largest area of dunes on the Wairarapa coast, these are considered "of regional importance" Dix *et al.* 1990:87).

Access: approximately 1 hour drive from Masterton (Homer and Moore 1989:62). Take the Castlepoint Road, turn off to Riversdale at Awatoitoi, and continue past the Riversdale turnoff to the Uruti Point Road (Waiorongo Road). The shore platform is covered at high tide.

"The beach has road access .... a series of rough roads cut through the dunes and a 250 m long strip of sand has been cleared and bulldozed just above the high tide line immediately north of Uruti Point apparently to park fishing boats..." Dix *et al.* 1990:87).

Potential for toxic contamination? (from B. Strong, letter, 2000) "Riversdale operative tip. Approximately 5km from Riversdale Beach. This site is still ... operative ... and there is an obvious discharge of leachate to the stream - no analysis of the leachate composition has been done." And: Riversdale historical tip. Approximately 10km from Riversdale Beach. This landfill has been closed since 1960 - no analysis of the leachate composition has been done."

Current human use of area:

Paua, crayfish, diving, and fishing boat launch (CRI T27B Human use map, 1976).

"... fishing boats are launched from tractor-towed cradles in a small bay just north or Uruti Point... Surf-fishing, camping, picnicking and walking are the main recreational activities" (Dix *et al.* 1990:87).

Seaweed collection along coast (CRI T27B Human use map, 1976).

Geology / bathymetry

"The geological features of this site are very young, with the coast having extended 5 km in 125,000 years because of uplift of the whole coast... The dunes have formed in the last 6500 years and are unconsolidated ... There is a dune lake on site which was created by dunes blocking a valley just north of Uruti Point. .... The dunes are up to 800 m wide at Uruti Point but south of Waiorongo Road the dunes become very narrow and peter out about 2 km south of Waiorongo Stream ... Dix *et al.* 1990:87).

"Banded mudstones, flysch sequences, small coal seams" (CRI T27B Physical and Biological map, 1976).

An “impressive series of broad terraces” extend inland from Uruti Point, to the foot of the hills about 5 km away (Homer and Moore 1989:22). These are the result of periodic uplifts of sea bed over the past 125,000 years. The area is presently rising at up to 2 millimetres per year. Features of deposition (slump folds) and erosion (natural cobblestones) can be seen in the alternating sandstone and mudstone beds at low tide.

Biology / Ecology

Dix *et al.* (1990:15): “Uruti Point is regionally important as the largest area of dunes (c. 100 ha) on the Wairarapa Coast, but little is known of their vegetation and wildlife values”.

The Uruti Point dunefields are recommended by Milne and Sawyer (draft, 2000:27), as a key site for the management of coastal vegetation. According to Milne and Sawyer, They have also been recommended for protection in the draft Protected Natural Area programme report for the Eastern Wairarapa Ecological District. Of the five species investigated by Milne and Sawyer (draft, 2000), only *Austrofestuca littoralis* has *not* been reported from this site.

There is no legal or physical protection for the dunes. A road cuts through ... and a strip above the high tide mark north of Uruti Point for the parking of fishing boats, has further damaged the

dune system” (Dix *et al.* 1990 check, quote). The site is privately owned and permission for access must be sought from the landowners (Milne and Sawyer, draft, 2000).

Archaeology / history

"Burial T27/20" around 0.5km inland from bay south of Riversdale (CRI T27B Cultural map, 1976).

"One archaeological site of Maori origin is listed in the HPT Inventory; urupa inland from the northern boundary of this site" Dix *et al.* 1990:87).

"Two ships have been wrecked at Uruti, the 'Sarah Jane' (1847) and the 'White Swan' (1962) Dix *et al.* 1990:87).

Boundaries?

To north:

Promontory between Uruti Point and Riversdale beach "identified by Colin Ogle as important wildlife site" (CRI T27B Physical and Biological map, 1976).

To south:

"Site of special wildlife interest" and a "series of marine terraces" along coast to south of Uruti Point (CRI T27B Physical and Biological map, 1976).

6. Kaiwhata River

"Three square holes in the ground [at Stansborough] ... are apparently the site where human flesh would be eaten after battle. It is said that the tribes in the Homewood-Kaiwhata area were the last in the Wairarapa to practice canibalism. Over the years many skeletons and human remains have been located in the Lower Kaiwhata Valley as a result of cultivation, roading and flooding" (Fearon 1980:76).

In the 1860s the Maori chief of the area "fell down a blowhole on the reef near the Kaiwhata River mouth [and was taken by a shark]. After the shark had taken him it circled the reef for many days and the Maoris put a Tapu on the reef" (Fearon 1980:62-64).

Brief description of site: A river estuary with a fossil totara forest - a "unique landscape feature", it is considered "nationally important" Dix *et al.* 1990:83).

Access: approximately 1½ hours drive from Masterton (Homer and Moore 1989:62). Take the Castlepoint Road, turn off to Riversdale at Awatoitoi, and continue past the Uruti Point turnoff, for about 8 km further south (to 2 km past Homewood Station) to where the road begins to drop down into the Kaiwhata River valley; walk across farmland to the coast (30-40 minutes). Permission must be obtained from Homewood Station. The fossil forest is only exposed at low tide.

Current human use of area:

"Kaiwhata Maori Reserve" - a small area of land 0.5km inland on southern promintory of Kaiwhata river (CRI T27B Land Tenure map, 1976).

Paua, crayfish, diving and fishing (CRI T27B Human use map, 1976).

Geology

The stumps of an 8000 year old totara forest are visible at low tide near the mouth of the Kaiwhata River (Homer and Moore 1989:26). The trees were drowned during a period in which the see level rose "at an incredible rate" of 1 centimetre per year, buried, and are being re-exposed, by the land rising. "Laminations" (lines indicating deposition of sand), "ripples", and "small scale folds", are visible in the tilted sandstone beds south of the river mouth.

"...over 20 fossilised totara stumps (up to 1 m in diameter)" Dix *et al.* 1990:83).

"Aerial photos reveal discolouration of water due to erosion, caused both by land clearance in the catchment and by sea erosion: this part of the coast retreated 40 m in the 15 years from 1962 - 1977" Dix *et al.* 1990:83).

"This estuary is closed by a sandbar except after heavy rain and has a 10 ha wave cut marine bench 300 m to the south .... The wave platform is large for this part of the coast" Dix *et al.* 1990:83).

Biology / Ecology

Black Fronted Dotterel present (CRI T27B Physical and Biological map, 1976).

"Common geckos (*Hoplodactylus maculatus*) and common skinks (*Leiolopisma nigriplantare*) have been recorded at this site" Dix *et al.* 1990:83).

Archaeology / history

"A pa site 500 m up the Kaiwhata River is listed on the HPT Inventory" Dix *et al.* 1990:83), this listed as "Pa T27/19" on northern bank of Kawhata river, 0.5km inland (CRI T27B Cultural map, 1976).

7. Flat Point

"Crawford Camerson used to scare porpoises away with a stock-whip during this operation as they would panic the horses standing in the water" (Fearon 1980:13, describing the loading of wool bales from wagon to "surfboat" at low tide, 1920s).

Brief description of site: A "flat bare tombolo projecting 300 m out from the natural line of the coast to link up with some offshore rocks. Flat Point lies at the northern end of an 11 km long shallow bay ..." The area is "of local importance" (Dix *et al.* 1990:81).

Access: "A remote area with limited access over private land" (Dix *et al.* 1990:82).

Current human use of area:

"Commercial fishing at Flat Point started seriously in 1940 with the brothers Kevin and Dick King-Turner living in the station *whare* and fishing from their boat 'Pandora'. Both men went to war but in 1946 Kevin King-Turner and Geoff Laing started fishing again, averaging 60 tons of crayfish per year between them. These two men held the New Zealand record for many years for the biggest average daily catch and once, over a two day period harvested 77 chaff sacks of crayfish worth 370 pounds! All these crayfish were sold to Cook Strait Fisheries from Island Bay (Wellington), who would come and collect them, cook them, and export them to Australia" (Fearon 1980:19-20).

"Fishing and diving are the main uses, with at least six fishing boats being launched off Flat Point beach from trailers being towed by tractors" (Dix *et al.* 1990:81).

Paua, crayfish, fishing and diving, and also a fishing boat launch site on south aspect of Flat Point (CRI T27D Human Use map, 1976).

"At present six rock lobster boats work the Glenburn coast. They are based at Glenburn, Pahaoa and Flat Point" (Stevenson *et al.* 1987).

Seaweed collection along coast (CRI T27D Human Use map, 1976).

"Proposed coastal reserve" on promontory (Wairarapa South County Council's District Scheme) (CRI T27D Land Tenure map, 1976).

Two blocks of Maori owned or joint Maori-Pakeha owned land - on southern aspect of promintory, and (to south) on north bank of Arawhata stream (CRI T27D Land Tenure map, 1976).

Geology / bathymetry

"The coastline in this vicinity retreated by 100 m between 1927 and 1967, ... at a rate of 2.5 metres per year through sea erosion ... and consequently the sea is cloudy with sediment ..." (Dix *et al.* 1990:81).

"... the tombolo is an unusual feature of the Wairarapa Coast. ... Some small sand dunes lie at the back of Flat Point (Dix *et al.* 1990:81).

For details of geology see van den Heuvel (1959) and (1960), Webby and Van den Heuvel (1965), Wellman (1971) and Wellwood (1996).

Biology / Ecology

The dunes at Flat Point are recommended as a key site for the management of coastal dune vegetation by Milne and Sawyer (draft, 2000:27). All five species investigated by Milne and Sawyer have been recorded at this site. According to Milne and Sawyer, the site has also been recommended for protection in the draft Protected Natural Area Programme report. The site is privately owned and permission for access must be sought from the landowners.

"The spotted skink (*Leiolopisma lineoocelatum*) is resident here and enjoys protected status. A hawksbill turtle (*Eretmochelys imbricata*) has also been recorded off Flat Point ... and a leatherback turtle (*Dermochelys coriacea*) was recorded on the beach around 1982" (Dix *et al.* 1990:81).

Dive log notes (C. Duffy):

Location: Caledonia Reef, Flat Point Station **Date:** 3 January 1986

Observations: Free dive. The reef is located about 2 miles off Kaiwhata River. The top of it just breaks at high water. The bottom surrounding the reef (about 15 m depth) is covered with rounded cobbles. Large boulders rise to within 6 – 9 m of the surface and are topped with kelp. Fish included: kahawai (*Arripus trutta*), butterfish (*Odax pullus*), blue moki (*Latridopsis ciliaris*), leatherjacket (*Parika scaber*) – the first I've ever seen in Wairarapa, blue shark (*Prionace glauca*, 1 m TL).

Archaeology / history

"There is evidence of former Maori occupation, with 6 sites identified on the HTP Inventory including pits, middens and a burial site ..." (Dix *et al.* 1990:81). Five middens, pits, and a burial around Flat Point itself (CRI T27D Cultural map, 1976).

8. **Honeycomb Rock** / Kahu Rocks

"a remarkably perforated & hollow rock" (Weld 1844, in Bagnall 1976:42).

Brief description of site: "a distinctive outcrop of sandstone" "situated on along a narrow strip of coastal flat land backed by rolling to steep hill country with most of the area in pasture for sheep and cattle" (Glenburn Station) (Stevenson *et al.* 1987). "Given the diverse natural values and extensive reef system ... this site is of regional importance" (Dix *et al.* 1990:79).

Access: approximately 1 hour drive from Masterton to Glenburn Station, then allow 3 hours (return) walk from Glenburn Station to Honeycomb Rock, along signposted track (Homer and Moore 1989:62). From Masterton, take the road to Gladstone, turn off before Gladstone on to the Te Wharau Road, continue through Te Wharau to the road end (Glenburn Station). From Martinborough (approximately 50 minutes), take the Hinakura Road to the Pahaoa River mouth (Glendhu Station), and walk to Honeycomb Rock (allow 4 hours return) along signposted track. The track is closed for lambing from 1 August to 30 September.

By road "some 65 km southwest of Masterton" (Stevenson *et al.* 1987).

"The final 20 km of the access road is unsealed and the public road ends about 6 km north of Honeycomb Rock [it does not reach the coast]. Although the general public are not permitted to drive beyond this point, walking is not restricted. This policy is unlikely to be relaxed in the future" (Stevenson *et al.* 1987).

Public walkway "Honeycomb Track" (DoC) follows up this coast to Glenburn (CRI T27C Human Use map, 1976).

Current human use of area:

"Commercial crayfishing started quietly at Glenburn [north of Honeycomb Rock] in 1942 with two men fishing weekends only, ... and receiving one penny per pound for crayfish. The crayfish boom really got underway in 1951 however, when the price was 5d. per pound - then up to 8d. per pound and in 1954 reaching 10d. per pound. In these early days drop pots or ring pots were used - and it was common to get up to 40 bags per day.

"Ted Tozer had a boat, and seeing the potential ... set up a factory in Norfolk Road, Masterton, buying all Glenburn's crayfish (and later Flat Point's) and exporting the tails to America. Sometimes two trucks would come out at night and pick up 200 bags or more and take to Tozer's factory.

"[The fishermen] ... established baches in the Karaka Grove at Horewai Point - these baches now being used only at weekends. The one commercial fisherman remaining on Glenburn is Russell Broughton who has fished here full time for 28 years. Russ has his bach right on the beach front on Horewai Point, fishing for crayfish with set pots, and sometimes doing a little 'wet' fishing. .... Russ ... who was well known as an undefeated light-heavyweight boxer about 30 years ago, has ... rescued many people off the rugged Wairarapa coast. In the 1975 Queen's Birthday Awards, Russ was awarded the British Empire Medal ... for his services to the community.

"Phil Hawksworth tells of the early '50s when one could catch numerous crayfish from the rocks with a piece of Paua on a bit of wire, and when it was no trouble to catch 20 large groper before breakfast. Those days are well gone and the crayfish are rather scarce now ...

"Using handlines - large catches of schnapper and groper were not uncommon during the '50s and '60s. Many local people would buy directly from the fishermen, with the Taylor's from Craigie Lea riding over and regularly taking large quantities of fish home on pack horses."

"Since this time, rock lobster has remained the major species sought around Honeycomb Rock along with some harvesting of agar seaweeds, paua and finfish" Stevenson *et al.* (1987).

Paua, crayfish, diving, fishing, and fishing boat launching from just south of Horewai Point (CRI T27C Human Use map, 1976). Paua, crayfish, diving, and fishing around Honeycomb Rock (CRI T28A Human use map, 1976). The Kahu Rocks and reefs closer to shore are important sites for fishing and diving" (Dix *et al.* 1990:79).

"Fishing is the major recreational activity of visitors to the Glenburn coast. Boating and diving conditions are relatively unfavourable along the Glenburn coast. The coastline is very exposed with predominant north-westerlies producing strong offshore winds. From Kahau Rocks to the Pahaoa River there are many rocks and submerged reefs (many of which are uncharted) which make boating in the area hazardous. The public road does not reach the coast at any point and access to all launching sites is by courtesy of the private landowners. Waikekeno Stream is the only launching site completely open to the public with launching sites at Flat Point, Glenburn and Pahaoa used only with prior consent of the station managers. Most fishing and diving occurs around Kahau Rocks. Station employees and bach owners are virtually the only recreational fishermen who fish as far south as Honeycomb Rock. Amateur methods include potting for rock lobster; gill netting for moki, butterfish and rig; drop lining for groper and blue cod; spearfishing for groper, moki and blue cod; and hand picking of paua. The coast near Honeycomb Rock is gaining popularity as a holiday destination. While the majority of visitors come from Masterton, others travel from Wellington, Palmerston North and Hawke's Bay" (Stevenson *et al.* 1987).

"Several species of commercial finfish occur in the vicinity. Only common warehou and blue moki are caught in large quantities. The moki fishery is seasonal occurring in May, July and spring. There are no commercial set netters based in the Honeycomb Rock area and trawlers work more than 8 km offshore" (Stevenson *et al.* 1987).

See 'Notes from interviews with Wairarapa Fishermen' by C. Duffy - includes comments about groper fishing off Glenburn, and rock lobster harvesting in this area. "Large scale cray fishing" appears to have caused inshore groper to disappear, as the groper were "crayfish eaters".

"A slipway for launching fishing boats has been built near Horowhai Point and a channel appears to have been cleared in the subtidal zone to allow fishing boats to reach the slipway" (Dix *et al.* 1990:79).

"At present six rock lobster boats work the Glenburn coast. They are based at Glenburn, Pahaoa and Flat Point" (Stevenson *et al.* 1987).

"To work the Glenburn Coast, [commercial paua] divers must travel from Flat Point or Te Awaiti. Due to these access restrictions fishing pressure in the vicinity of Honeycomb Rock is thought to be relatively light" (Stevenson *et al.* 1987).

"Recreational and commercial overfishing, especially of Crayfish (*Jasus edwardsii*) and Paua (*Haliotis iris*) has been suggested" (Dix *et al.* 1990:79).

Seaweed collection along coast (CRI T28A Human use map, 1976). "At present no live weed is picked on the Glenburn coast. Collection of beach cast *Pterocladia* provides a small casual income for about ten people. There are several collection sites in the area with most collection during spring, summer and autumn" (Stevenson *et al.* 1987).

Geology / bathymetry

"Erosive salt etching in sandstone" at Honeycomb rock (CRI T28A Physical and Biological map, 1976). Around 6500 years ago Honeycomb rock was an offshore stack, but the "uplift of the land left it marooned" (Homer and Moore 1989:31). Honeycomb weathering patterns in the rock are a result of a combination of forces, including salt crystals, sand grains, wind and water.

On the point opposite Honeycomb Light (3 km south of Glenburn Station), there are layers of conglomerate, and a volcanic dyke (Homer and Moore 1989:33).

"The geological features of Honeycomb Rock, the intrusive conglomerates (95 million years old) and a volcanic dyke (70 million years old) on the point below Honeycomb Light are unusual landforms ..." (Dix *et al.* 1990:79).

"Large scattered concretions" at Horewai Point, near Glenburn (north of Honeycomb Light) (CRI T27C Physical and Biological map, 1976). "Concretions along coast" between Honeycomb rock and Honeycomb Light (CRI T28A Physical and Biological map, 1976).

Stevenson *et al.* (1987):

"Inshore areas of the Glenburn Coast are predominantly rocky with small sandy beaches, tide pools and reefs usually composed of boulders. There is a habitat change about 500 m offshore to papa and sand flats. Kahau Rocks, 3 km east of Honeycomb Rock [see figure in Stevenson *et al.* (1987), these rocks are not marked on the 1:50,000 topographic map], provides a major offshore reef system. On the seaward side of Kahau Rocks the sea floor is very steep as it descends into Honeycomb Canyon (Brodie 1961)."

"Two marine terraces form the most conspicuous shoreline features of the Glenburn coast. Extensive flattened remnants of the older terrace extend between 129 m and 195 m inland. The younger terrace provides the coastal strip of flat land which is about one meter above the present high water level. Raised beach deposits of well bedded sandstone, siltstone and fine conglomerate overlie the terrace. Alluvial fans deposited by coastal streams now cover large areas of this terrace (Van den Heuvel 1960, Wellman 1971)."

"... the sea is discoloured by sediment" (Dix *et al.* 1990:79).

For details of the geology see Field and Holton (1985).

Biology / Ecology

Dive log notes (C. Duffy):

Location: Blow Hole, Kahu Rocks, Glenburn **Date:** 6 September 1980
Depth: 24 m **Visibility:** 12 m
Observations: Rock lobster (*Jasus edwardsii*) abundant, mostly small males. Abundant fish life, including: large blue cod (*Parapercis colias*), red banded perch (*Hypoplectrodes huntii*), large schools of butterfly perch (*Caesioperca lepidoptera*), large common roughy (*Paratrachichthys trailli*), scarlet wrasse (*Pseudolabrus miles*), girdled wrasse (*Notolabrus cinctus*), banded wrasse (*N. fucicola*), rock cod (*Lotella rhacinus*), conger eels (*Conger verrauxi*), large blue moki (*Latridopsis ciliaris*) and red moki (*Cheilodactylus spectabilus*). Also seen: 1 octopus, several pin cushion stars (*Eurygonias hylacanthus*).

Location: Kahu Rocks, Glenburn **Date:** 15 March 1981
Depth: 15 m **Visibility:** 9 m
Observations: Dove off the south-east corner of the group. Objective of the dive was to get a few crays but no legal size ones found. Abundant fish life including: a very large conger eel (*Conger verrauxi*) foraging amongst the kelp, red moki (*Cheilodactylus spectabilis*), blue moki (*Latridopsis ciliaris*), telescope fish (*Mendosoma lineatum*), blue cod (*Parapercis colias*), scarlet wrasse (*Pseudolabrus miles*), butterfish (*Odax pullus*), red banded perch (*Hypoplectrodes huntii*), butterfly perch (*Caesioperca lepidoptera*) and abundant common roughy (*Paratrachichthys trailli*). Diverse encrusting fauna.

Location: Blow Hole, Kahu Rocks, Glenburn **Date:** 13 December 1981
Depth: 24 m **Visibility:** 12 m
Observations: Dense plankton (predominantly salps) from the surface to 18 m depth. Abundant fish life, including: single sweep (*Scorpis lineolatus*) swimming in a school of butterfly perch (*Caesioperca lepidoptera*), abundant

hagfish (*Eptatretus cirrhatus*), large blue cod (*Parapercis colias*), girdled wrasse (*Notolabrus cinctus*). Invertebrates included sea cucumber (*Stichopus mollis*) and nudibranchs (*Jason mirabilis*).

Location: Blow Hole, Kahu Rocks, Glenburn **Date:** 11 December 1982

Depth: 21 m **Visibility:** 12 m

Observations: Abundant fish life including: common roughy (*Paratrachichthys trailli*), sea perch (*Helicolenus percoides*), girdled wrasse (*Notolabrus fucicola*), one hapuka (*Polyprion oxygeneios*) about 60 cm TL, and a very large school of warehou (*Seriolella brama*).

Location: Kahu Rocks, Glenburn **Date:** 11 December 1982

Depth: 12 m **Visibility:** 9 m

Observations: South side of the exposed rock closest to the Blowhole. Fish seen included: a john dory (*Zeus faber*), blue moki (*Latridopsis ciliaris*), about 10 juvenile telescope fish (*Mendosoma lineatum*), butterfly perch (*Caesioperca lepidoptera*), banded wrasse (*Notolabrus fucicola*), girdled wrasse (*N. cinctus*), butterfish (*Odax pullus*), marblefish (*Aplodactylus arctidens*), blue cod (*Parapercis colias*), 5-6 tarakihi (*Nemadactylus macropterus*). Rock lobster (*Jasus edwardsii*) were abundant.

Location: Kahu Rocks, Glenburn **Date:** 1 April 1984

Depth: 18 m **Visibility:** 3 m

Observations: Dive made on the south side of the main rock. Bottom consisted of boulders interspersed with patches of clean sand. Large boulders rising to about 4.5 m above the bottom. *Ecklonia radiata* on the tops of the boulders. Diverse encrusting fauna on the sides of boulders and beneath overhangs. Large kina (*Evechinus chloroticus*) common. Fish included: butterfly perch (*Caesioperca lepidoptera*) abundant, girdled wrasse (*Notolabrus cinctus*), banded wrasse (*N. fucicola*), scarlet wrasse (*Pseudolabrus miles*), large red moki (*Cheilodactylus spectabilis*), butterfish (*Odax pullus*), common roughy (*Paratrachichthys trailli*), blue cod (*Parapercis colias*), oblique swimming triplefin (*Obliquichthys maryannae*) common, variable triplefin (*Forsterygion varium*).

Location: Kahu Rocks, Glenburn **Date:** 22 December 1985

Depth: 18 m **Visibility:** 4.5 m

Observations: Dive on the south-east rock in the group (i.e. the most seaward rock). Substrate consisted of large scattered boulders, heavily encrusted with sponges and jewel anemones (*Corynactis haddoni*). There were patches of *Ecklonia radiata* and agar weed (*Pterocladia lucida*) on the tops of the boulders. Fish included: schooling butterfly perch (*Caesioperca lepidoptera*), telescope fish (*Mendosoma lineatum*) and jack mackerel (*Trachurus* sp.), banded wrasse (*Notolabrus fucicola*), girdled wrasse (*N. cinctus*) abundant, scarlet wrasse (*Pseudolabrus miles*) abundant, red banded perch (*Hypoplectrodes huntii*), common roughy (*Paratrachichthys trailli*), blue moki (*Latridopsis ciliaris*), blue cod (*Parapercis colias*), juvenile butterfish (*Odax pullus*), oblique swimming triplefins (*Obliquichthys maryannae*). Invertebrates included: very large kina (*Evechinus chloroticus*, > 110 mm TD) well hidden and scattered, sea cucumber (*Stichopus mollis*), abundant small rock lobsters (*Jasus edwardsii*) – only 5 legals taken, many soft shell.

Location: Kahu Rocks, Glenburn **Date:** 22 December 1985

Depth: 15 m **Visibility:** 4.5 m

Observations: Dive along the north-east face of the next rock shoreward. Very different from previous site. Boulders in surge channels scoured clean. Sparse kelp. Algal cover predominantly agar weed (*Pterocladia lucida*) with pockets of kelp (*Ecklonia radiata*) and *Caulerpa ?flexilis*. Some large zooanthid colonies (orange *Parazooanthus* sp.). Very few rock lobster (*Jasus edwardsii*). Large paua (*Haliotis iris*, > 7 inch shells). Few fish, including: spotty (*Notolabrus celidotus*), banded wrasse (*N. fucicola*), marblefish (*Aplodactylus arctidens*), dwarf scorpion fish (*Scorpaena papillosus*).

Location: Blowhole, Kahu Rocks, Glenburn **Date:** 4 January 1986

Depth: 27 m **Visibility:** 12 m

Observations: Spent the majority of the dive on the bottom, at the base of some sheer rock walls. Scattered *Ecklonia radiata* observed down to about 26 m depth. Fish abundant, including: large schools of oblique swimming triplefins (*Obliquichthys maryannae*) and butterfly perch (*Caesioperca lepidoptera*), blue cod (*Parapercis colias*) of all sizes, large blue moki (*Latridopsis ciliaris*) common, red moki (*Latridopsis ciliaris*), banded wrasse (*Notolabrus fucicola*), girdled wrasse (*N. cinctus*) – dominant labrid, scarlet wrasse (*Pseudolabrus miles*), bastard red cod (*Pseudophycis barbatus*), two sweep (*Scorpis lineolatus*) schooling with butterfly perch, dwarf scorpion fish (*Scorpaena papillosus*), hagfish (*Eptatretus cirrhatus*), mottled triplefin (*Forsterygion malcolmi*), common roughy (*Paratrachichthys trailii*) abundant, kingfish (*Seriola lalandi*). Invertebrates included: rock lobster (*Jasus edwardsii*) abundant, very large kina (*Evechinus chloroticus*), pin cushion star (*Eurygonias hylacanthus*).

Note: fish seen while free diving in the gap between the two seaward rocks in the group included: butterfish (*Odax pullus*, females ripe), red moki (*Cheilodactylus spectabilis*), blue moki (*Latridopsis ciliaris*), kahawai (*Arripus trutta*), kingfish (*Seriola lalandi*), banded wrasse (*Notolabrus fucicola*). Other species taken fishing in the same location included: a small hapuku (*Polyprion oxygeneios*), blue cod (*Parapercis colias*), scarlet wrasse (*Pseudolabrus miles*), red banded perch (*Hypoplectrodes huntii*).

Location: Blowhole, Kahu Rocks, Glenburn **Date:** 10 January 1987

Depth: 21 m **Visibility:** 9 m

Observations: Unusually quiet fish-wise today. Those seen included: large blue moki (*Latridopsis ciliaris*), sweep (*Scorpis lineolatus*), telescope fish (*Mendosoma lineatum*), red moki (*Cheilodactylus spectabilis*), common roughy (*Paratrachichthys trailli*), girdled wrasse (*Notolabrus cinctus*), spotty (*N. celidotus*), banded wrasse (*N. fucicola*), scarlet wrasse (*Pseudolabrus miles*), butterfly perch (*Caesioperca lepidoptera*) – unusually few of these, oblique swimming triplefin (*Obliquichthys maryannae*), bastard red cod (*Pseudophycis barbatus*), kahawai (*Arripus trutta*). Large *Parazooanthus* sp. colony photographed.

Note: large short-tailed stingray (*Dasyatis brevicaudatus*) observed from the surface while boat anchored at the main group of rocks.

Stevenson *et al.* (1987) comment that “no specific work has been carried out on the marine biology of the Honeycomb Rock area”.

"The marine area includes an extensive reef system off Honeycomb Rocks and Kahu Rocks, which are the largest group of emergent offshore rocks between Bare and Brothers Islands. The marine community is particularly rich with a good variety of fauna ... The area is influenced by the mixing of three current systems, resulting in distributional overlaps of marine flora and fauna ... (Clinton Duffy in Dix *et al.* 1990:79).

"... suggested as a Marine Reserve area as long ago as 1981" (Dix *et al.* 1990:80).

Stevenson *et al.* (1987) proposed the site as a marine reserve. “The foreshore and sea in the vicinity of Honeycomb Rock has been suggested for consideration as a marine reserve by public submission."

Fur seals at Honeycomb Light (CRI T27C Physical and Biological map, 1976).

"Fur seal overwintering area" at Honeycomb Rock (CRI T28A Physical and Biological map, 1976). “Honeycomb Rock is used as an overwintering area for about 10-15 New Zealand fur seals (probably non-breeding males) (G. Swanson pers. comm.)” (Stevenson *et al.* 1987).

“Breeding colonies of black-backed and red-billed gulls are found at the mouth of the Waihingaia Stream, about one kilometre south of Honeycomb Rock” (Stevenson *et al.* 1987).

"The dune areas and wetland area just south of Honeycomb Rock is grazed by cattle ... and the dunes are eroding, threatnening the pingao ..." (Dix *et al.* 1990:79).

"... small dunes south of Honeycomb Rock have some pingao (*Desmoschoenus spiralis*), and fur seals (*Archtocephalus forsteri*) haulout on Kahu Rocks and the nearby shore in winter ..." (Dix *et al.* 1990:79).

Archaeology / history

“Maori occupation of the area ... since the early 1700s” ... “it is likely that tribes occupied the area prior to this date, [but] much evidence may have been lost through flooding and continual erosion of their settlement sites" (Fearon 1980, in Stevenson *et al.* 1987).

“The Maori people inhabiting the area at this time were probably descendants or sub-tribes of the Ngati Kahungungu. Many of them occupied undefended huts and small villages. Two or three pa were sited on the land now known as Glenburn Station. Horewai was a small fishing pa of probably 10-15 families with a constant population of about 40 people, while on the banks of the Waikekeno (“Seal water”) Stream ... was the major pa of the district inhabited by the Ngati Mapuhia. They cultivated extensive vegetable gardens on the coastal flats and fished for shellfish and rock lobster off the coast (Fearon 1980)”.

"6 archaeological sites of Maori origin are known from this area ... including a possible pa. an urupa, walls, pits, terraces and middens and an oven site" (Dix *et al.* 1990:79).

Walls, pits, midden and terraces (several sites) north of Honeycomb Light. Oven south of Horewai Point (CRI T27C Cultural map, 1976).

Burial near reef to south of Honeycomb Rock (CRI T28A Cultural map, 1976).

In 1957, an “archaic type” of Maori tiki was found “about a mile south of Honeycomb Rock lighthouse, and approximately 400 yards from the shoreline” (Barrow 1959:6). Fragments of human bone suggest it was associated with a burial. It is “remarkable in both form and material” (made from large dog cockle), and seems “more related to Marquesan stone hei-tiki than to the conventional nephrite forms of classic Maori culture”.

"Europeans settled in the district in the 1850s, and the Glenburn Station was established in the 1870s ..." (Dix *et al.* 1990:79).

"The steamer 'Kiwi' hit a submerged rock and sank off Glenburn Station in 1894..." (Dix *et al.* 1990:79). “In January 1967 the Tuvalu ran aground on reefs close to Honeycomb Rock while en route from New Caledonia to Nelson. Both the crew and cargo of high explosives and detonators were taken safely ashore (Ingram 1977). The ship itself was later winched onto the beach and the substantial wreck now rests approximately 200 m south of Honeycomb Rock” (Stevenson *et al.* 1987).

9. Pahaoa River, Glendhu rocks to north, Kairingaringa reef in south

Brief description of site: The large stand of pingao, presence of breeding threatened birds, and the largest estuary between Cape Palliser and Flat Point ... make this site regionaly important" (Dix *et al.* 1990:77).

Access: approximately 50 minutes drive from Martinborough (Homer and Moore 1989:62). Take the Hinakura Road to the Pahaoa River mouth (Glendu Station). Can walk north to Honeycomb Rock (allow 4 hours return) along signposted track.

Current human use of area:

Paua, crayfish, diving and fishing around Pahoa River mouth. Fishing boat launch site "1 mile south of Pahoa homestead" (CRI T28A Human use map, 1976).

"A small boat 'harbour' appears ... to have been cleared at the north side of Kairingaringa Reef, were fishing boats are launched from tractor-towed cradles ... An area of dunes 100 m from the high tide line has been cleared and flattened as a carpark and boat park. ... walking, swimming and diving are pursued at this site ..." (Dix *et al.* 1990:77).

“At present six rock lobster boats work the Glenburn coast. They are based at Glenburn, Pahaoa and Flat Point” (Stevenson *et al.* 1987).

Seaweed collection along coast (CRI T28A Human use map, 1976).

"Maori Reserve: small area immediately south of Pahaoa River mouth (2 ha)" (Dix *et al.* 1990:77). "Maori reserve" between Glendhu Rocks and either side of Pahoa river mouth (CRI T28A Land Tenure map, 1976).

See 'Notes from interviews with Wairarapa Fishermen' by C. Duffy - includes comments about groper fishing off Glenburn, and rock lobster harvesting in this area. "Large scale cray fishing" appears to have caused inshore groper to disappear, as the groper were "crayfish eaters".

Geology / bathymetry

"The shoreline is mainly coarse sand, but parallel sheets of tilted limestone running SW-NE form Kairingaringa Reef (south of Pahaoa River) and Glendhu Rocks, 3 km to the north"" (Dix *et al.* 1990:77).

"Sea erosion of cliffs is particularly noticeable directly ashore from Tokerau Reef, 1 km south of this site and much sediment is entering the sea ..." (Dix *et al.* 1990:77).

For details of the geology see King (1931), Moore and Speden (1979), Nelson (1965), Rishworth (1953), Sweet (1999), Wellman (1971).

Biology / Ecology

"Dune areas as still natural and fragile, with the largest (2 ha) relict 'stand' of rare pingao and spinnifex (*Spinnifex hirsutus*) on the Wairarapa Coast, sited just south of the Kairingaringa Reef". This "is threatened by marram (*Ammophila arenaria*) invasion, and grazing" (Dix *et al.* 1990:14, 77).

The Pahaoa Scientific Reserve is a small reserve (7.5 ha) of coastal dune vegetation, situated at the mouth of the Pahaoa River administered by the Department of Conservation (Milne and Sawyer draft, 2000:28). *Desmoschoenus spiralis* (pingao) is found here. The area has been fenced to exclude stock.

"Common gecko (*Hoplodactylus maculatus*), common skink (*Leiolopisma nigriplantare*) and the spotted skink (*L. lineoocelatum*) have been recorded at the site. Rare Variable Oystercatchers (*Haematopus unicolor*), and threatened Banded Dotterel (*Charadrius bicinctus*) have been

recorded at this sits ... and undoubtedly breed along the coast, and feed on the coast and in the Pahaoa River estuary" (Dix *et al.* 1990:77).

"Inoceramus locality" (is this a fossil dinosaur?) on north bank of Pahoa River mouth (CRI T28A Physical and Biological map, 1976).

Archaeology / history

Dix *et al.* (1990:14): “There is a very high concentration of archaeological sites of Maori origin on both sides of the Pahaoa River estuary (HPT Inventory).”

"36 archaeological sites of Maori origin have been identified ... including 3 pa, an urupa, pits, middens, karaka groves, a whare, and a possible quarry source at Glendhu rocks" (Dix *et al.* 1990:77).

Pa site inland from Kairingaringa Reef promintory, pa site directly behind Pahoa settlement, pa site on western bank of Pahoa River, opposite Glendhu settlement (CRI T28A Cultural map, 1976).

Ten middens, several stone walls, pits, ovens, a whare etc. in vicinity of Karingaringa Reef and Pahoa River mouth. Cemetary on north bank of Pahoa River mouth (CRI T28A Cultural map, 1976).

To south - two pa sites just south of Rerewhakaaitu River (CRI T28A Cultural map, 1976).

10. Te Awaiti to Awhea/Tora River

Brief description of site: Identified as “of local importance” by DoC (Dix *et al.* 1990:73).

Access:”A road traverses the 2 km length of coast 30-300 m from the coast and a large concrete bridge crosses the Awhea River 500 m from its mouth...” (Dix *et al.* 1990:73).

Current human use of area:

“Beach-walking, fossicking and swimming takes place in and near the Awhea estuary ... This is a good surfing beach, especially in northerly conditions” (Dix *et al.* 1990:73).

“... collection of seaweed along the high tide line is common at Tora. .... there are significant beds [of *Pterocladia* spp.] just offshore ... this removal of seaweed could disrupt local nutrient cycling...”” (Dix *et al.* 1990:73).

“Little human modification occurs in this section of coast...” (Dix *et al.* 1990:73).

Existing Protection: DoC Recreation Reserve at Awhea (15 ha). Local: Esplanade Reserves adjoin both ends of the Awhea Recreation Reserve (Dix *et al.* 1990:74).

See 'Notes from interviews with Wairarapa Fishermen' by C. Duffy - includes comments about groper fishing (size and abundance decreasing, fishing began to "go off" about 20 years ago), and rock lobster harvesting in this area.

Potential for toxic contamination? (from B. Strong, letter, 2000) "Tora Landfill. Tora Road. Approximately 7 km from the coast, small in size, illegal landfill - unknown if still operating."

Geology / bathymetry

From Awheaiti Stream to the Awhea River ... largely redeposited gravels ... with several raised beach ridges still visible just south of the Awhea River ... The Awheaiti Stream and Awhea River do not always flow right to the sea because they are impeded by gravel banks built up in south-easterly conditions... The Awhea River estuary is small and sometimes tidal - shingle banks upstream from the road bridge provide feeding sites for birds...” (Dix *et al.* 1990:73).

“Land clearance in the hinterland, especially in the Stony Creek area has hastened erosion and the Awhea River is now carrying much more gravel and silt in its bed in its upper reaches and so water quality in the river is reduced and the sea is cloudy with sediment ...”

For details of Te Await geology see Barnes (1990), Barnes and Korsch (1990) and (1991).

Biology / Ecology

"On the Tora side of the bay at Te Awaiti ... there are hundreds of young crayfish on the reef" (MAF Fisheries Officer Peter Himona, pers. comm. 2000).

“The coastal forest provides a unique landscape feature on this coast and the seascape is an almost continuous gravel beach, rather than rocky-fringed as elsewhere” (Dix *et al.* 1990:73).

“The patch of coastal forest (10 ha) on the escarpment at Tora is an unusual natural habitat on the south-east Wairarapa coast because most coastal forest has been cleared. The vegetation and wildlife of this patch are not known unless it was the ngaio-karaka-mahoe forest referred to in the “Sites of Special Wildlife Interest” database as being heavily grazed. The coastal bench and rivers are typical of this coastline. A common skink (*Leiolopisma nigriplantare*) has been recorded at Awhea estuary .... Rare Variable Oystercatchers (*Haematopus unicolor*) have been recorded here ... A very small (10 sqm) patch of rare pingao (Dismoschoenus spiralis) is on otherwise marram (*Ammophila arenaria*) covered dunes ...” (Dix *et al.* 1990:73).

Dive log notes (C. Duffy):

Location: Rabbit Rocks, Te Awaite **Date:** 10 January 1987

Observations: Free dive. Rabbit Rocks are located about half way between Pahou and Te Awaite (about 30 minutes south by boat from Waikekeno, boundary between Glenburn and Waimoana stations). The rocks are about 100 m offshore and are surrounded by an extensive area of submerged outcropping rock and boulders. Away from the rock the bottom consists of clean sand and gravel. The dominant algae are *Lessonia variegata*, *Landsburgia quercifolia* and agar weed (*Pterocladia lucida*). Fish abundant, including: large schools of butterfish (*Odax pullus*), kahawai (*Arripus trutta*) and blue cod (*Parapercis colias*), large marblefish (*Aplodactylus arctidens*), banded wrasse (*Notolabrus fucicola*), spotty (*N. celidotus*), scarlet wrasse (*Pseudolabrus miles*), red moki (*Cheilodactylus spectabilis*), blue moki (*Latridopsis ciliaris*), sweep (*Scorpis lineolatus*), eagle ray (*Myliobatis tenuicaudatus*), short-tailed stingray (*Dasyatis brevicaudatus*).

Archaeology / history

"Only 2 archaeological sites (terraces and pits) are known from this area, ... but 3 pa existed within 3 km to the south..." (Dix *et al.* 1990:73).

11. Te Kaukau Point to White Rock, or south to Te Rakauwhakamataku Point

Brief description of site: An “unusual tilted sheet of limestone (White Rocks)” forms a reef into the sea, 10 km north east of Cape Palliser (Dix *et al.* 1990:71). Designated of “regional importance” by DoC (Dix *et al.* 1990:71).

Access: approximately 1½ hours from Martinborough (Homer and Moore 1989:62). Take the Lake Ferry Road, turn off about 2 km south of Martinborough to Tuturumuri, turn off at Tuturumuri to White Rock. Te Kaukau Point is reached by walking around the coast to the north (15 minutes). To reach Ngapotiki Fan drive to the end of White Rock Road and walk along the vehicle track towards the south (30 minutes).

“Roads or farm tracks traverse all but 5 km of this coastline, but they are generally over 200 m in from the coast” (Dix *et al.* 1990:71).

Current human use of area:

“Small fishing boats are launched from tractor- or bulldozer-towed cradles at White Rock and Oroi Stream .... this damages natural and aesthetic values of the beach. .... Picnicking, camping (White Rock), tramping, fossicking, fishing and diving are popular recreational pursuits ... Traditional fishing is suggested by a nearby Rahui area ...” (Dix *et al.* 1990:71).

Paua, crayfish, diving, fishing from Te Kaukau Point (CRI S28D Human use map, 1976). Waterskiing, fishing and diving from bay between White Rock and Te Rakauwhakamataku Point (CRI S28C Human use map, 1976). Paua and crayfish from Te Rakauwhakamataku Point (CRI S28C Human use map, 1976).

Seaweed collection along coast (CRI S28D Human use map, 1976).

Existing Protection: “DoC Stewardship: One minute (60 sq. m.) and inadequate area north of Te Kaukau Point. Local: Recreation Reserves at Te Rakauwhakamatuku (50 ha), Esplanade Reserve for 6 km of the coastline south from Pukemuri, where it adjoins the DoC Awhea Recreation Reserve (15 ha). Rahui area near White Rocks. Maori reserve: Opuawe Reserve (5ha) (Dix *et al.* 1990:72). Described as: Reserve with Maori trustee, leased to White Rock station near mouth of Opouawe river, Te Kaukau point (CRI S28D Land Tenure map, 1976).

A "proposed reserve" adjacent to river mouth at White Rock (CRI S28D Land Tenure map, 1976). A "proposed reserve" just south of the White Rock promintary into the sea (CRI S28C Land Tenure map, 1976).

Potential for toxic contamination? An underground petrol holding facility exists near the shore at White Rock (B. Strong, pers. comm. 2000).

Geology / bathymetry

Dix *et al.* (1990:14): “The White Rock to Oroi site is regionally important because of a combination of unusual and distinctive geological features including very active sea erosion (13), and high concentration of archaeological sites (pers. obs.).”

The “spectacular” Ngapotiki Fan to south, between White Rock and Cape Palliser (Homer and Moore 1989:38).

“The shoreline in the Ngapotiki - Te Kaukau Point area is retreating quickly with sea erosion of conglomerate cliffs at the foot of a shingle fan near Te Rakauwhakamataku Point retreating at 3.45 metres per year, the fastest rate of any cliff erosion recorded in New Zealand (see Gibb 1978). White Rock beach retreated 20 m between 1944 and 1973. The land in the headwaters of the Opouawe and Whawanui Rivers is very actively eroding, especially in the Aorangi Range and Rough Hill areas and the shingle beds of these rivers have grown substantially and this erosion debris is reaching the coast ... (Dix *et al.* 1990:71).

Te Kaukau Point: “The hard white limestone, grey mudstone, and green to brownish sandstone beds ... represent many million years of slow sedimentaion beneath the ocean” between 70 and 50 million years ago (Homer and Moore 1989:34). Limestone made up mainly of the skeletons of plankton - coccoliths and foraminifera. The limestone beds are in places “folded in a distinctive zig-zag pattern”.

Te Kaukau point geology - "porcellagenous limestone (White Rock unit), classic slump ?folds, barite and copper pyrites nodules, greensand lens" (CRI S28D Physical and Biological map, 1976).

White Rock: The White Rock reef “represents the “skeleton” of a vast sheet of limestone ... which covered southeastern Wairarapa some 50-60 million years ago” (Homer and Moore 1989:37). Here it was “also severely bent and buckled ... inclined at a high angle, or completely folded over”, partly due to a major fault which runs along the western side of the Rock. Trace fossils present (the distinctive traces of marine animals - trails, burrows etc., but bodies of marine animals not usually preserved).

“... a clear representative sequence of raised marine beach ridges from the Holocene period” (Dix *et al.* 1990:71).

"The coastal bench is about 400 m wide near the Opouawe River, and from Te Kaukau Point to the Awhea River. The sediments are largely redeposited gravels from the Aorangi Range, the Rough Hill - Stony Creek area, and from alluvial fans from coastal hills... Holocene marine beach ridges are a particularly obvious feature near White Rocks, east of Te Kaukau Point, and near Pukemuri Stream... Many of the rivers and streams do not flow right to the sea except after heavy rain - even the Opouawe River often has its exit blocked by gravel banks ...“ (Dix *et al.* 1990:71).

See Browne (1987) for further details of geology of Te Kaukau coast.

Biology / Ecology

Dive log notes (C. Duffy):

Location: Barton Point, White Rock **Date:** 13 March 1982

Depth: 9 m **Visibility:** 3 m

Observations: Located the wreck of what I think was the *Delmira*, a 137 ft, 338 ton three masted schnooner that sank in 1896 (sketch of wreck attached).

“This coast retains a high degree of naturalness because of its isolation, despite road access ...”(Dix *et al.* 1990:71).

“The estuaries, being frequently blocked off from the sea, have little wildlife values, but Black-fronted Dotterels (*Charadrius melanops*), a recent colonist to New Zealand, and Pied Stilts (*Himantopus himantopus*) breed on the lower stretches of the Opouawe River and visit the estuaries for some of their feeding ... Common gecko (*Hoplodactylus maculatus*), common skink (*Leiolopisma nigriplantare*) and spotted skink (*L. lineoocelatum*) occur at this site..." (Dix *et al.* 1990:71).

Archaeology / history

“There is a long history of Maori occupation of this site with many pa and Kainga, including named fishing spots and rahui areas (near White Rock), and waiata and legends refer to deep sea fishing voyages, and journeys to Wharekauri (Chathams) from Orio, the main settlement of Hinewaka ... (Dix *et al.* 1990:71).

“This area has many known Maori archaeological sites, with 40 listed on the Historic Places Trust Inventory including 4 pa, many pits, walls, terraces, middens and ovens, and one

dendroglyph. Also 2 urupa are marked on the cadastral map near Oroi Station (Dix *et al.* 1990:71).

Two pits on Whawanui river (White Rock), three pits/ovens, and two midden sites on Opouawe river (Te Kaukau Point). Pa site on Te Kaukau Point. Midden/oven site on coast just to north. And numerous sites to north, particularly surrounding mouth of Oroi stream (CRI S28D Cultural map, 1976). Nine sites (walls, pits, oven) between White Rock and Te Rakauwhakamataku Point (CRI S28C Cultural map, 1976).

The first European settlement of the area was in 1847, when Barton leased a block of land off some of the local Maori ... The “Opua”, shipwrecked near Te Orio Station in 1926, is still visible today ... and two ships, the ‘Lizzie Guy’ (1888) and the ‘Delmira’ (1896) were wrecked at Te Kaukau Point (Dix *et al.* 1990:71).

Wreck of the Delmira lies in shallow water off Te Rakauwhakamataku Point (CRI S28C Human use map, 1976).

Boundaries?

There is an esplanade reserve beginning to north of Te Kaukau Point, along the coastline to ?nearly Te Awaiti (CRI S28D Land Tenure map, 1976).

12. Cape Palliser to Te Kawakawa rocks

"It is a coastline of great contrast - from baking hot oily calm to driven spray and crashing oceanic seas - an inspiring place." G.C. Kelly (1971)

"The local settlers and fishermen of the eastern coast of Palliser Bay are familiar with the stone walls, which are indeed too numerous to be overlooked, and refer to them as 'Maori boundaries' of no particular interest. One person encountered, however, took a more modern view and propounded his theory that they were the result of clearing the ground of stones with bulldozers." G.L. Adkin (1955)

Brief description of site: The most southern point of the North Island, an exposed rugged coast, designated of "national importance" by DoC (Dix *et al.* 1990:68).

Access: approximately 1½ hours from Martinborough (Homer and Moore 1989:62). Take the road to Lake Ferry, turn off about 4 km south of Pirinoa to Cape Palliser. Kupe's Sail is about 4 km past Ngawihi fishing village, across the first ford. Cape Palliser may be reached by driving (if fine) a further 1 km along the road, or walking (15 minutes).

Roading past the eroding cliffs at Whatarangi Bluff is a problem.

Current human uses of area:

Atkinson (1964) suggested that Cape Palliser has potential as a "National Coastline Park". "This strip of coastline is scenically spectacular and includes a wide variety of habitats: rocky headlines, cliffs, screes and fans, streams, a raised beach, and rocky, shingly and sandy shorelines" (Atkinson 1964).

Kelly (1971) noted: "Recreational use of the area is already high and is increasing rapidly, summer campers numbering hundreds."

Kelly (1971), (on behalf of the Director of Botany Division, DSIR), argued for protection for the area, including "permanent zoning for a landscape of outstanding natural beauty, with some kind of scenic easement if necessary to absolutely prevent subdivision, private dwellings and non-pastoral commercial activities except afforestation, and to perpetuate pastoral or forest land-use (except that provision for establishment of scenic (including camping) and scientific reserves would be a useful precaution)."

"The scenery was cited by Hendry (1972) as one of the qualities most liked about the Cape Palliser coastal areas" (Carlin 1980:45). "The terrain rises from sea level to over 900 metres in a short distance and includes rocky peaks, a series of terraces, a rocky coast with rough seas and deep ravines. The nearness of the Aorangi Mountains to the sea, the flat Wairarapa valley farmlands and rolling hills of the eastern Wairarapa means a great variety of vistas are possible in a short distance, some of which are quite dramatic ..." (Carlin 1980:45-46).

Specific scenic features, such as the Putangirua Valley 'Pinnacles' already draw visitors to the area (Carlin 1980:46).

An unpublished Coastal Reserve survey (probably late 1970s) undertaken by the Department of Lands and Survey, and the District Planning Scheme of Featherston County, concluded that many of the coastal headlands in the area were "scenic attractions of local or regional significance" (Carlin 1980:181). Carlin notes that this was based on "rough estimates of the numbers of people who visit the area and the distance they travel", and the "intuitive appeal the areas had for those doing the studies". The Department of Lands and Survey and the Featherston County Council agreed that "taken as a whole ... the coastal lands from the seashore to the first major ridge inland form a regionally important scenic attraction".

"The Cape Palliser area has two main recreational foci; one, the rugged coastal lands which provide opportunities for fishing, good scenic panoramas and isolation from urban life for

campers, day trippers and bach owners; and two, the Aorangi Mountains with their variety of easy tramping opportunities, scenic vistas, natural surroundings and hunting opportunities. Hendry's (1972) study showed that fishing and hunting were the favourite recreational activities of those interviewed and that the distinctive scenery, natural surroundings, feelings of remoteness and privacy were the qualities most liked about the area" Carlin (1980:44).

"Hendry (1972) also listed tramping, walking on the beaches, reading and swimming as the next most popular recreational activities to hunting and fishing. All can be directly related to the mountains or coast, except reading which is a more passive recreation related to isolation and privacy" (Carlin 1980:44-45).

"People walk, fossick, camp and study nature along this coast, and it is a very popular diving and fishing spot" (Dix *et al.* 1990:69). Paua, crayfish, diving and fishing along this coast, water skiing in the bay between Cape Palliser and Te Kawakawa Rocks, fishing boat launching from Ngawi (CRI S28C Human use map, 1976). Good diving site marked by the anchor of the Ben Avon at Cape Palliser. Set netting around Cape Palliser Light, in bay to east of Te Kawakawa Rocks, and south of Ngawi (CRI S28C Human use map, 1976). Seaweed collection along coast, except in area closed to seaweed harvesting within 1 km radius of seal colony at Cape Palliser (CRI S28C Human use map, 1976).

This area is fished by the commercial crayfish fleet based at Ngawi, and also "one of the most popular dive sites in the Wairarapa" (Dix *et al.* 1990:68).

"A crayfish factory is situated about 1 km north of Ngawi). A commercial crayfish fleet is based at Ngawi where about 20 boats are pulled up onto the beach by tractor- or bulldozer-towed cradles... A small pipeline crosses the coast straight out from Ngawi crayfish factory" (Dix *et al.* 1990:69). "Small fishing boats are launched off the beach by tractor- or bulldozer-towed cradles ... this could cause damage to the beach. Some sewage, crayfish waste and refuse dumping occurs along this coast" (Dix *et al.* 1990:68).

Photo of Ngawi in Carlin (1980:47) shows that the settlement has changed much in the last 20 years. In the photo there are fewer houses, no trees or large vegetation, and NO evidence of fishing boats or bulldozers!

Ownership: The cape itself is Maori land (Dix *et al.* 1990:68). All the coastal strip from west of Ngawi to Te Rakauwhakamataku Point is either Maori land, esplanade reserve, recreational reserve, or state forest (for details see CRI S28C Land Tenure map, 1976).

Existing Protection: "National: Kupe's Sail Rock is a DoC Recreational Reserve (6 ha). The Haurangi State Forest Park (19382 ha) adjoins the site and includes the headwaters of many of the larger rivers flowing out to the coast. A Lighthouse Reserve (20 ha) surrounds the Cape Palliser Light. Local Body: Esplanade reserves cover 6 km of coastline in four sections. A private Maori (Makakitahi) Reserve (20 ha) extends from Cape Palliser to Black Rocks - this was designated as a Maori fishing reserve in 1947 and is tapu to Maori people, but this has not been respected by pakeha. Protective Zoning: The 20 km section of coast from Woolshed Stream to Cape Palliser has been closed to commercial paua harvesting since 1972 ... and no commercial seaweed harvesting is permitted within 1 nautical mile of Cape Palliser Lighthouse ..." (Dix *et al.* 1990:68).

Geology / bathymetry

"Cape Palliser is used for educational lessons on geology" (Dix *et al.* 1990:68).

"The sea bed of the coastal areas reflects the same structure as the land with rock of the Mesozoic dominant with small areas of the harder Tertiary forming occasional inshore reefs. The Palliser Bay side ... has comparatively shallow water with a regular sloped sea bed of sand, gravel and boulder beds. The sea bed deposits come from the erosion of the lands nearby and the drowning of the whole lower Wairarapa Valley in the Tertiary ... The south and south-eastern coastal areas are different. The sea bed has a rocky, irregular surface. The general structure is a very narrow continental shelf of a few km width, subject to folding and faulting pressure that parallel those identified on land, falling off very rapidly into the Hikurangi Trench, some of the deepest waters near New Zealand" (Carlin 1980:37).

"Marine cliffs of modern breccias, slump deposits" (CRI S28C Physical and Biological map, 1976). "200 ft sanddune" between Cod Rocks and Waitetuna stream (CRI S28C Physical and Biological map, 1976). "Doleritic dykes in coastal boulders" at the Cape Palliser lighthouse (CRI S28C Physical and Biological map, 1976).

"The coastal bench is a narrow unstable strip about 200m wide, with only occasional outcrops of rocky basement. The sediments are largely redeposited gravels of Aorangi Range or alluvial outwash from adjacent raised beaches (up to 300 m above sea level). Many of the rivers and streams do not flow right to the sea, except after heavy rain. Cape Palliser itself is of volcanic origin and over 100 million years old, and the surrounding area is of even older greywake." (Dix *et al.* 1990:68).

“Owing to their greater hardness, ancient volcanic rocks at Cape Palliser, ... jut further out to sea than the greywake which surrounds them” (Homer and Moore 1989:40). “Over 100 million years ago Cape Palliser was the site of a volcanic eruption beneath the sea”. The “pillow lava” can be seen along the shore.

“Unusual volcanics and sandstone (with fossils) occur here in an otherwise greywacke landscape, and are exposed by downfaulting” (Dix *et al.* 1990:68).

“Kupe’s Sail” or “Nga-ra-o-Kupe” is a “huge slab of sandstone” with many fossils, which has been tilted 45 degrees and exposed, as a result of a fault running along the west side (Homer and Moore 1989:44). “Sail Rock ... is a distinctive feature where the only known Tertiary sediments of the area are exposed” (Atkinson 1964).

“Antarctic currents sweep past this eastern area bringing water temperatures seasonally similar to the south of the South Island; the coldest summer temperatures in New Zealand. This factor affects certain recreational activities such as swimming and water skiing greatly” (Carlin 1980:37-38).

For details of geology see Challis (1960) (igneous rocks), Cook (1997) (Kupe's Sail), Homer and Moore (1989), Luo (1992), Matthews (1983) (texture of beaches in Palliser Bay), Moore and Speden (1979), Wellman (1954), Wellman (1962), Wellman and Brodie (1954). Also see: Bates (1967), Handler (1992), Eade (1995), Travers (1998), and McClymont (1998).

Biology / Ecology

Dive log notes (C. Duffy):

Location: Palliser Bay seal colony **Date:** 3 February 1980
Depth: 15 – 21 m **Visibility:** 6 m
Observations: Fish included large blue cod (*Parapercis colias*), a school of blue moki (*Latridopsis ciliaris*) and large schools of telescope fish (*Mendosoma lineatum*) and butterfly perch (*Caesioperca lepidoptera*) around 21 m depth on the seaward side of the seal colony. Kina (*Evechinus chloroticus*) were large and abundant. Small rock lobster (*Jasus edwardsii*) were abundant. Two New Zealand fur seals (*Arctocephalus forsteri*) swam out with us.

Location: 1st point south of wreck of the *Ben Avon*, Palliser Bay
Date: 8 May 1982 **Depth:** 9 m **Visibility:** 3 m
Observations: The reef along the south side of the point consisted of scattered boulders over a clean sand bottom. No sign of the elephant seal (*Mirorunga leonina*) seen earlier in the day. Rock lobster (*Jasus edwardsii*) abundant. Many undersize but also some large females, most of these were in berry. Fish included: large blue moki (*Latridopsis ciliaris*), kahawai (*Arripus trutta*), barracouta (*Thyrsites atun*), rock cod (*Lotella rhacinus*), dwarf scorpion fish (*Scorpaena papillosus*), sand divers (*Limnichthys ?polyactis*). The latter were common in sand around the bases of the boulders in 6 m depth.

Location: Seal colony, Palliser Bay **Date:** 28 August 1984
Depth: 20 m **Visibility:** 12 - 15 m
Observations: Snorkelled out through a large gut beside the rock containing most of the seals. Bottom at 18 m was covered with very large kina (*Evechinus chloroticus*). Fish sparse, included: yelloweyed mullet (*Aldrichetta forsteri*) and large numbers of small brown phase blue cod (*Parapercis colias*).

“The tidal and sub-tidal fauna and flora is outstandingly rich - a few years ago crayfish could be caught by hand at low tide, but this is probably history now” (Kelly 1971).

The bay immediately before the Moana Pacific crayfish factory (near Ngawi) is noted for young paua. Andrew, who works at Moana Pacific, knows the exact site (MAF Fisheries Officer Peter Himona, pers. comm. 2000).

Durvillea (bull-kelp) “confronts the surf” (Morton and Miller 1973:295)

"Site of special wildlife interest" (gull colony) on beach just west of reservoirs, west of Ngawi (CRI S28C Physical and Biological map, 1976).

"Site of special wildlife interest" at Cape Palliser (CRI S28C Physical and Biological map, 1976). Seals (CRI S28C Physical and Biological map, 1976).

Fur seal (*Arctocephalus forsteri*). “The Cape has a growing seal colony, probably the second largest in the Wellington district (more information could be obtained from Mr A.H. Whittaker, [then] Ecology Divn., D.S.I.R.)” (Kelly 1971). “Late in 1991, a new rookery was discovered at Cape Palliser on the southern coast of the North Island, the first North Island record this century” (Dix 1993:1).

“A considerable variety of sea mammals visit the area but not in large numbers. There is currently a NZ fur seal winter resting area at Black Rocks and prehistoric evidence cited in Anderson, A.J. (1973) suggests sea lion, sea elephant and several species of porpoises and whale inhabit the coastal waters from time to time. The rough sea conditions deterred Maori and European exploitation of these mammals though a small whaling station existed at Te Kopi in the mid nineteenth century for a few years" (Carlin 1980:38).

Dix *et al.* (1990:9) “Erosion along this coast, although a natural process, has been accelerated by devegetation in the region, and the resulting increased sedimentation led to the disappearance of sensitive filter-feeding shellfish such as mussels and tuatua from archaeological remains around 1400 AD (12).

In the opinion of Carlin (1980:38): “The inshore coastal ecology has been modified greatly in the past few hundred years. Filter feeding shellfish present in large numbers in prehistoric times (Anderson, A.J. 1973) have all but disappeared as they appear to have been unable to handle increased sediment loads caused by land developments. The surviving shellfish such as paua and rock lobster have been subject to intense exploitation in recent years. The inshore fishery is limited to weed eating species (e.g. butter fish) and the rough nature of the sea and the reefs have served to discourage past and present exploitation. The offshore fishery though subject to severe weather restrictions provides species such as blue cod, gropher and tarakihi in economic numbers."

"On 4 April 1966 Nellies [Giant petrels - *Macronectus giganteus*] were very common just north of Cape Palliser" (Bartle 1974).

“The coastal marine vegetation and micro-fauna has never been studied but one can assume that a full range of species typical of rocky coast in the south of the North Island inhabit the area” (Carlin 1980:38).

Dix *et al.* (1990:13): “Cape Palliser has nationally important stands of two rare plants: .... Rare endemic grass (*Rytidosperma petrosum*) and pingao (*Desmoschoenus spiralis*) can be found on some sand dunes in this area ... The common gecko (*Hoplodactylus maculatus*) and common skink (*Leiolopisma nigriplantare*) have been recorded at this site” (Dix *et al.* 1990:68).

There is “a small ‘subalpine’ florula on Mangatoetoe (2809 ft.). ... Several unusual small plants are also found in the coastal communities” (Kelly 1971).

“... the coastline near Red Rock, Cape Turakirae and Cape Palliser is markedly different floristically from the western Wellington coast and Kapiti Island. The difference lies in the presence of many plants more commonly associated with alpine habitats. Their presence along the south coast may be related to the moisture conditions associated with aspect. ....

Plants of a type more characteristic of alpine areas include *Aciphylla squarrosa*, *Senecio lagopus, S. greyi, Chionochloa beddiei, Hebe parviflora* and *Craspedia uniflora*. The gorge of the Waitatuna stream has a particularly large flora because it has escaped fires" (Atkinson 1964).

"... a very complex climate pattern" is suggested from what records exist (Carlin 1980:28-29).

For ecological and geological details of the Aorangi Ranges see Carlin (1980).

Archaeology / history

"... record of habitation dating back to around 1200 AD making the Cape Palliser area one of the earliest settled areas in New Zealand. There are approximately 200 historic and archaeological sites registered with the Historic Places Trust, mainly along the coastal flats and foreshore and up adjacent stream valleys. Many ... are threatened by current land use practise or accelerated soil erosion. The area's historic feature include early European sites (eg. a whaling station, shipwreck memorials) ..." (Anon. 1980s:8).

"It is thought that these sites are part of a complex of sites stretching along the east coast north to Hawkes Bay where the dominant Maori tribe was said to come from after displacing the earliest group to the South Island" (Carlin 1980:39).

Dix *et al.* (1990:13): "The well-documented pre-history of the area is exceptional (12) and the density of archaeological sites is high compared with the rest of the Wairarapa.

Carlin (1980:41) comments: "It is felt that the earliest inhabitants were a fairly well-fed horticulturally-based society that through time gradually evolved into a more sickly hunting and gathering society that had all but disappeared by the advent of European settlers. This pattern is contrary to the normal world pattern for civilizations.... Many theories can be put forward to explain these changes..."

McKinlay (1979, in Carlin 1980) (then Senior Archaeologist for the New Zealand Historic Places Trust), writes:

"... with regard to the general importance of sites in the Palliser area, it could be said that the sites of the area comprise part of one of the best archaeological landscapes of prehistoric agriculture in New Zealand. They are located in an area now marginal for the cultivation of kumara and other semi-tropical plants, mainly because climate and vegetation have changed significantly since the original period of occupation. Hence sites of the area have a considerable local, and even national importance, for studying the adaptation of prehistoric agriculture to the requirements of a marginal and changing environment.

"However, had the Leach programme and the later work of Mr. B.G. McFadgen concentrated on aspects other than agriculture and changing environments, we might now be basing an appreciation of the significance of the Palliser area archaeological sites on quite different criteria.

"Despite the considerable investment in the Palliser Bay area by the archaeological project under the leadership of Foss and Helen Leach, we still have only a very minimal and somewhat biased record of the archaeological sites in the area. The Leach programme concentrated principally on the coastal fringe and certain of the narrow river valleys. This is not an unusual state of affairs with archaeological records. It is not realistic to expect any survey to cover every part of a large survey area, and in addition, many sites for one reason or another, will not be able to be discovered by field recorders."

"Many sites of former Maori occupation along the coastal strip and up the Makotukutuku and Otakaha valleys" (Dix *et al.* 1990:68).

"... many signs of former Maori settlement with 75 sites in the HPT inventory, including 3 pa sites, 4 burial sites, 19 middens, numerous stone walls and pits, karaka groves, terraces, platforms, stone rows and garden soils" (Dix *et al.* 1990:68).

16 sites (middens, terraces, stone walls, pits, terraces, and karakas) between Cape Palliser and Te Rakauwhakamataku Point, and a pa site at Palliser Lighthouse (CRI S28C Cultural

map, 1976). Numerous sites along the Ngawi coast including "Waiwhero - scene of fierce fighting. N/Hinewaka defeated N/Rua. Te Pou was killed and buried at Ngawi" (CRI S28C Cultural map, 1976).

“European settlement began in the 1840s with Pharazyn and Russell establishing sheep stations on the coast north of Cape Palliser. ... At least seven shipwrecks are known on this coast dating from the ‘Pickwick’ in 1845 to the ‘Quest’ in 1975” (Dix *et al.* 1990:68).

Anchor of Ben Avon at Cape Palliser, wreck of Waitaki "little remaining" at Te Kawakawa Rocks (CRI S28C Human use map, 1976).

Appendix 2.

Annotated Bibliography

of the most relevant publications

* photocopies or partial photocopies are provided

General

***** Bardsley, E. 1977 Cape Palliser to Cape Turnagain: A Bibliography. Miscellaneous Publication 78, NZ Oceanographic Institute, DSIR, Wellington.

An annotated bibliography.

Carlin, W.F. 1980 The Diminishing Natural Landscapes of Rural New Zealand. A Case Study: The Cape Palliser Area, Wairarapa, North Island. Masters Thesis. Joint Centre for Environmental Sciences University of Canterbury and Lincoln College.

A discussion of the various natural and cultural significances of the Cape Palliser area, in the light of the decision-making process necessary for national park assessment. Most discussion centres on the Aorangi range, some relates to the coast. Not well referenced (few references quoted in the text), so I have had to quote from the thesis directly.

Dix, B.; Robertson, H.; McAlpine, G.; Bishop, D.; Brady, J.; Moore, P. 1990 Coastal Resource Inventory, First Order Survey, Wellington Conservancy. Department of Conservation.

The CRI "provides important information on the physical, biological, recreational, cultural, historic, archaeological, human modification, uses, protection and threats to the coast." The volume includes "a brief description of the conservancies' coastal zone, a summary of the conservation values, a list of issues of concern and recommendations for further work. The information is described on site sheets and plotted on maps at a scale of 1:250 000 to give a broad, overall impression of the coastal conservation values within each conservancy." Its "primary mission" is: "To provide information for the maintenance, enhancement and restoration of natural character and qualities of coasts and their sensitive use."

* Pedersen, L. 1974 Bibliography of Scientific Studies of Wellington Harbour. Miscellaneous Publication 56, NZ Oceanographic Institute, DSIR, Wellington.

An annotated bibliography.

Smith, W.M. 1856 Table of distances measured near High Water Mark from the Ferry House, Wairarapa Lake, along the East Coast to Castle Point. *N.Z. Government Gazette (Prov. Wellington)* **3**: 42.

Not seen. According to Bardsley (1977) is "The distances, in miles and chains, between different properties or land marks, taken along the high tide line."

* Barnes, P.M. 1990 Provenance of Cretaceous accretionary wedge sediments: the Mangapokia Formation, Wairarapa, New Zealand. *New Zealand Journal of Geology and Geophysics* **33**: 125-135.

Study area is Te Awaiti.

* Barnes, P.M. and Korsch, R.J. 1990 Structural analysis of a middle Cretaceous accretionary wedge, Wairarapa, New Zealand. *New Zealand Journal of Geology and Geophysics* **33**: 355-375.

Study area is Te Awaiti.

* Barnes, P.M. and Korsch, R.J. 1991 Melange and related structures in Torlesse accretionary wedge, Wairarapa, New Zealand. New Zealand Journal of Geology and Geophysics 34: 517-532.

Study area is Te Awaiti.

Bates, T.E. 1967 The Geology of the Northern Aorangi Range and Part of Palliser Bay Sheet N 165. Unpublished MSc thesis, Victoria University, Wellington.

Study is of part of eastern Palliser Bay. Two groups of rocks - "a basement of Mesozoic greywacke and argillites, and an unconformably overlying group of Upper Tertiary and Pleistocene rocks".

* Browne, G.H. 1987 *In situ* and intrusive sandstone in Amuri facies limestone at Te Kaukau Point, southeast Wairarapa, New Zealand. *New Zealand Journal of Geology and Geophysics* **30**: 363-374.

Discussion of the Teurian (Paleocene) sequence at Te Kaukau Point.

* Challis, G.A. 1960 Igneous Rocks in the Cape Palliser Area. *New Zealand Journal of Geology and Geophysics* **3** :524-542.

Igneous rocks at White Rock and Castlepoint also mentioned.

* Cook, G.K. 1997 The Geology of Kupe’s Sail, Cape Palliser, New Zealand. Unpublished B.Sc. Honours Project, Victoria University.

A study of the geology and fossils of Kupe's Sail, 2 km west of Cape Palliser lighthouse.

Eade, R.E. 1995 Late Quaternary Geology of the Wharekauhau Area, Ocean Beach, Palliser Bay. Unpublished BSc (Hons) thesis, Victoria University, Wellington.

Discussion of geological history, sedimentation, tectonic uplift etc. Late Quaternary sediments - an examination of stratigraphy revealed 7 major sedimentary environments.

Gibb, J.G. 1978 Rates of coastal erosion and accretion in New Zealand. *New Zealand Journal of Marine and Freshwater Research* **12** :429-459.

?Data relating to Wairarapa coast.

* Ghani, M.A. 1978 Late Cenozoic vertical crustal movements in the southern North Island, New Zealand. *New Zealand Journal of Geology and Geophysics* **21**(1): 117-126.

Maps from Arawhata Stream (south of Flat Point) to north of Riversdale. "At most places between 3 km north of Riversdale and Wellington city there are four well preserved marine beaches above the Turakirae marine bench. They have been studied in detail at four areas: Riversdale - Flat Point; Cape Palliser; Ruamahanga Valley; and Bidwill Hill. .... They are best preserved and most extensive in the Riversdale - Flat Point area" (includes Uruti Point). Benches are named "Eparaima marine benches, "each bench consists of a wave-cut surface with beach deposits and loess on it. A stranded shoreline and its marine cliff lie behind it ..."

Handler, M.R. 1992 The Geology of the Mukamuka Area, western Palliser Bay, North Island. Unpublished BSc (Hons) thesis, Victoria University, Wellington.

Sedimentary and volcanic basement rocks exposed in Mukamuka area "are part of the Torlesse terrane, a subduction complex active in the Mesozoic". Quaternary marine and fluvial gravels overlie these.

Homer, L. and Moore, P. 1989 *Reading the Rocks - A Guide to Geological Features of the Wairarapa Coast.* New Zealand Geological Survey DSIR. Landscape Publications Limited, Wellington.

An accessibly written and spectacularly photographed publication for anyone wishing to explore the geology of the Wairarapa coast recreationally. The book includes detailed directions for travellers, and five brief 'Field Guide' cards. After a brief general discussion of geological history, rocks and fossils, the book focuses on 16 sites of particular geological interest, from Cape Turnagain to Turakirae Head. Ten of these sites are relevant to the present study, falling within or near areas for possible marine protection. From north to south, these are: Whakataki, Castlepoint, Uruti Point, Kaiwhata River mouth, Honeycomb Rock, Te Kaukau Point, White Rock, Ngapotiki Fan, Cape Palliser and Kupe's Sail.

* Johnston, M.R. 1973 Geology of Castlepoint headland and reef, Wairarapa, New Zealand. *New Zealand Journal of Geology and Geophysics* **16**: 909-16.

"Castlepoint contains the youngest known pre-Holocene rocks in coastal Wairarapa. .... mudstone and siltstone ... overlain by fossiliferous sandstone and limestone ..." Faulting and folding also discussed. Map of faults (p. 911). Two to three main faults are important in creating the distinctive structure of Castlepoint; these run in parallel, either side of lighthouse, reef and 'castle'.

* King, L.C. 1930 Raised Beaches and other Features of the South-east Coast of the North Island. *Transactions and Proceedings of the New Zealand Institute* **61**(3 and 4).

Describes raised beaches along the whole coastline of Wellington and Wairarapa (including Cape Palliser to Okau - north of Wakataki). Photos.

* King, L.C. 1931 Sulphur springs near Glenburn, east Wairarapa. *New Zealand Journal of Science and Technology* **13**: 38-39.

Map - springs are near the headwaters of the Waikekino Stream. The area is < half an acre, with 30 active centres. The springs are cold, smell of H2S, and have bubbling mud. They occur on a ridge crest, which is unusual. The writer puzzles over the origin of the sulphur, and the absence of any indication of thermal activity in the district.

King, L.C. 1932 Notes on the geology and geomorphology of the coast between Napier and Castlepoint. *Transactions of the New Zealand Institute* **63**: 72-79.

A companion paper to King (1930). Brief with little detail - a description of a walk froma geological point of view. Coastline described as "most disappointing" as there is only one raised terrace.

* Kirk, C.M. 1966 The Petrography of a Redeposited Section in the Manurewa Formation, and some Greensand Dykes from the Mungaroa Limestone, Te Kau Kau Point, S.E. Wairarapa. Unpublished B.Sc. Honours Project, Victoria University.

Discussion of the geology of Te Kaukau point, west of White Rock.

* Kustanowich, S. 1964 The Geology of the Tinui Valley - Castlepoint Region, north-eastern Wairarapa. Unpublished M.Sc. Thesis, Victoria University.

Part II “deals specifically with the geology of Castlepoint”. "A small strip of Plio-Pleistocene sediments ... form[s] Castlerock ... The reef is mainly formed of ... coquina limestone .... The structure of the area is highly complex."

Lewis, K.B. 1973a Erosion and deposition on a tilting continental shelf during Quaternary oscillations of sea level. *New Zealand Journal of Geology and Geophysics* **16**: 281-301.

“Continuous seismic profiles of high resolution were obtained of the continental shelf and upper slope between Napier and Castlepoint, New Zealand. They illustrate the topographic and stratigraphic effects of sea level changes on a tectonically active continental shelf.”

Lewis, K.B. 1973b Sediments on the continental shelf and slope between Napier and Castlepoint, New Zealand. *New Zealand Journal of Marine and Freshwater Research* **7**: 183-208.

“Sediments from the seabed off the eastern side of the North Island, New Zealand, are divided into 12 facies on the basis of grain size and mineralogy of the sand fraction. The facies are grouped into three types; modern detrital sediments, relict detrital sediments, and non-detrital sediments.”

* Luo, X. 1992 Subduction interface and crustal structure in the Cape Palliser region, North Island, New Zealand, from observations of Cape Palliser earthquakes. *New Zealand Journal of Geology and Geophysics* **35**: 491-499.

Seismic data from Cape Palliser - White Rock area.

McClymont, A.F. 1998 An investigation of the Wairarapa Fault at Wharekauhau, Palliser Bay. Unpublished BSc (Hons) thesis, Victoria University, Wellington.

Gravity survey at western Palliser Bay to determine the geometry of the Wharekauhau thrust.

* Moore, P.R. and Speden, I. 1979 Stratigraphy, structure, and inferred environments of deposition of the Early Cretaceous sequence, eastern Wairarapa, New Zealand. *New Zealand Journal of Geology and Geophysics* **22**(4): 417-433.

Describes geology of most of eastern Wairarapa coast, including Cape Palliser, White Rock, Tora, Pahaoa area, Wainuioru area, Riversdale, Castlepoint, and Akitio. “Early Cretaceous rocks in Wairarapa form an almost continuous belt which extends from Akitio ... in the north to White Rock ... in the south .... Key areas have been mapped in detail.”

* Neef, G. 1992 Geology of the Akitio area (1:50 000 metric sheet U25BD, east), northeastern Wairarapa, New Zealand. *New Zealand Journal of Geology and Geophysics* **35**: 533-548.

Study area is Akitio, including Owahanga River.

* Neef, G. 1995 Cretaceous and Cenozoic geology east of the Tainui Fault Complex in northeastern Wairarapa, New Zealand. *New Zealand Journal of Geology and Geophysics* **38**: 375-394.

Study area includes Owahanga and Mataikona.

* Neef, G. 1999 Neogene development of the onland part of the forearc in northern Wairarapa, North Island, New Zealand: a synthesis. *New Zealand Journal of Geology and Geophysics* **42**: 113-135.

Describes faulting in the eastern Wairarapa, including a “Coastal Block”. Details may be relevant to sites from Akitio to south of Castlepoint.

* Nelson, C.S. 1965 Petrography of the Glauconitic Sandstone and Limestone Strata at Pahaoa, South East Wairarapa. Unpublished B.Sc. Honours Project, Victoria University.

Suggestion that the "glauconitic sandstone and limestone beds at Pahaoa ... [are] turbidity current deposits." Detailed analysis and discussion.

* Nelson, C.S. 1968 Sedimentology of Redeposited Calcareous and Glauconitic Beds at Pahoa, Southeast Wellington. *Transactions of the Royal Society of New Zealand, Geology* **6**(5): 45-62.

Detailed description and analysis of the "glauconitic sandstones and limestones (Kaiwhata Limestone) of Paleocene age" ... "situated on the coast immediately south of the mouth of the Pahaoa River".

* Pick, M.C. 1955 The Geology of the Whareama Area - A Study of Slumping and Redeposition as Applied to the Origin of Alternating Beds. Unpublished M.A. (Honours in Geology) thesis, Victoria University.

Study area extends to coast. Discussion of the Upper Cretaceous and Tertiary beds deposited in the region.

* Pillans, B. 1990 Pleistocene marine terraces in New Zealand: a review. *New Zealand Journal of Geology and Geophysics* **33**: 219-231.

Quotes Ghani (1978), terraces in eastern Wairarapa.

* Rait, G.J. 1985 The Fabric of an Outcrop of Lower Tertiary Melange at Mataikona, Wairarapa. Unpublished B.Sc. Honours Project, Victoria University.

Studied outcrop is coastal rock just to the north of Mataikona River mouth.

* Rishworth, D.E.H. 1953 Geology of Wakapuni - Pahaoa, East Wairarapa. Unpublished M.Sc. Thesis, Victoria University.

Study area reaches coast either side of Pahaoa river mouth. Description of the "structural, stratigraphic, and geomorphic relationships" of this section of Wairarapa geology.

Singh, L.J. 1971 Uplift and tilting of the Oterei Coast, Wairarapa, New Zealand, during the last ten thousand years. In: Collins, B.W. and Fraser, R. (eds.) 'Recent Crustal Movements', *Royal Society of New Zealand Bulletin* **9**: 25-30.

Not seen.

* Sweet, S. 1999 The Structure, Stratigraphy, and Petrology of the Lower Pahaoa River, Eastern Wairarapa, New Zealand. Unpublished B.Sc. Honours Project, Victoria University.

Includes geology of Pahaoa River mouth.

Travers, G. 1998 The Late Cenozoic geology of the Whangimoana Beach Area, South Wairarapa. Unpublished BSc (Hons) thesis, Victoria University, Wellington.

Five sedimentary types distinguished from coastal cliffs at Whangaimoana [differences in spelling are in original] Beach, between settlements of Lake Ferry and Whangaimoana Beach. Depositional environment of each determined.

* van den Heuvel, H.B. 1959 The Geology of the Te Wharau - Flat Point Area, Eastern Wairarapa. Unpublished M.Sc. Thesis, Victoria University.

"The stratigraphy and structure of the Te Wharau - Flat Point area ... is described and illustrated by a map."

* van den Heuvel, H.B. 1960 The Geology of Flat Point Area, Eastern Wairarapa. *New Zealand Journal of Geology and Geophysics* **3**: 309-320.

Stratigraphy and structure of Flat Point Area.

* Waterhouse, J.B. 1955 Geology of the White Rock - Tora Area, South East Wairarapa. Unpublished M.Sc. Thesis, Victoria University.

Area described is approximately Waitutuma Stream (south of White Rock) to Oterei River (north of Awhea/Tora River).

Webby, B.D. and Van den Heuvel, H.B. 1965 Note on Glauconitic Sandstone in the Wairarapa, New Zealand. *New Zealand Journal of Geology and Geophysics* **8**: 81-84.

Suggests that Cretaceous - Teritary glauconitic sandstones near Flat Point are turbidity-current deposits.

* Wellman, H.W.; Brodie, J.W. 1954 A Note on the Geology of Cape Palliser, New Zealand. *New Zealand Journal of Science and Technology, Section B,* **35**(5) :440-450.

Brief examination of basement, faults, greywacke, intrusives, tertiary beds, fossils.

Wellman, H.W. 1962 Holocene of the North Island of New Zealand : a coastal reconnaissance. *Transactions of the Royal Society of New Zealand, Geology* **1**(5): 29-99.

Figure 1 shows the author examined four stretches of coastline between Cape Turnagain and Cape Palliser.

Wellman, H.W. 1971 Holocene tilting and uplift on the White Rocks Coast, Wairarapa, New Zealand. In: Collins, B.W. and Fraser, R. (eds.) 'Recent Crustal Movements', *Royal Society of New Zealand Bulletin* **9**: 211-215.

"Differences in height of Holocene marine beach ridges indicate that three growing folds cross the White Rocks coast : from west to east the Aorangi Anticline, the Opouawe Syncline, and the Adams Anticline."

Wellman, H.W. 1971 Holocene tilting and uplift on the Glenburn Coast, Wairarapa, New Zealand. In: Collins, B.W. and Fraser, R. (eds.) 'Recent Crustal Movements', *Royal Society of New Zealand Bulletin* **9**: 221-223.

Discusses the stretch of coast between Pahaoa River and Flat Point.

Wellman, H.W. and Brodie, J.W. 1954 A note on the geology of Cape Palliser, New Zealand (Sheet N168). *New Zealand Journal of Science and Technology, section B.* **35**: 440-450.

A discussion of the greywackes and faulting of the Cape Palliser region.

* Wellwood, D. 1996 Sedimentary and Stratigraphic Analysis of the Whakataki Formation at Riversdale, Wairarapa. Unpublished B.Sc. Honours project, Victoria University.

Study area is a rock outcrop on the point just south of Riversdale beach, but may also have some relevance to Flat Point, Whareama, Castlepoint, Mataikona and Owahanga.

Oil and Gas Exploration

* Anon. 1994 Exploration News Update - PPLs 38318 and 38323, East Coast Basin, Drilling Consent. *Petroleum Exploration in New Zealand News* **39**: 3.

Brief description of the Regional Council hearing of the drilling application by Amoco New Zealand in the Titihaoa Prospect area. The risk of an oil spill is considered "extremely low".

* Cole, E.R.; Gregg, R.C.; Joyce, P.A.; McManamon, D.J. (eds.) 1992 An Introduction to the Petroleum Geology of New Zealand, New Zealand Petroleum Prospectus.

See Chapter 7: 'The East Coast Basin' (pp. 54-63), and map 'Sedimentary basins of New Zealand' (p. 2).

* Field, B. 1995 Reservoir Potential of the East Coast Oil and Gas Province. *Petroleum Exploration in New Zealand News* 45: 11-19.

"... provides an overview of some of the main potential reservoir units ... and concludes that many ... are possible targets". Includes photo of a geologist using a "portable minipermeameter" on intertidal rocks at Whakataki (p. 16).

* Field, B.; Uruski, C.; Delteil, J. 1995 East Coast Hydrocarbon Potential - An Updated Interpretation. *Petroleum Exploration in New Zealand News* **44**: 10-17.

An introduction to the petroleum geology of the East Coast, including previous work and some recent results from "a large, multidisciplinary team of New Zealand and overseas researchers spanning several years".

* Francis, D. 1992 Oil Seeps and Oil Impregnations in the Dannevirke-Castlepoint Area, Southern East Coast Basin. *Petroleum Exploration in New Zealand News* **34**: 28-32.

Discussion of the importance of the seeps present south of Hawkes Bay for petroleum exploration. Suggests that for several reasons there should be "good prospects" in several areas including "offshore Wairarapa, and parts of onshore Wairarapa".

* Francis, D. 1993 Historic Oil Exploration in the East Coast Basin - Part 1: 1874 to 1932. *Petroleum Exploration in New Zealand News* **38**: 21-27.

See pp. 24-25 for wells drilled off Wairarapa coast.

Francis, D. 1994 Historic Oil Exploration in the East Coast Basin - Part 2: 1932 to 1940. *Petroleum Exploration in New Zealand News* **39**: 22-26.

Focus is on Hawke's Bay and Gisborne areas.

* Francis, D. 1995 Historic Oil Exploration in the East Coast Basin - Part 2: 1940-1994. *Petroleum Exploration in New Zealand News* **45**: 20-27.

Includes map of drill-holes from Castlepoint to East Cape (p.22), and a very brief description of Titihaoa-1 (p. 25).

* Geosearch 1991 In: Petroleum Resources of New Zealand. *Resource Information Report* **10**. Energy and Resources Division, Ministry of Commerce.

See 'East Coast Basin' (pp. 28-35).

Park, J. 1888 On the probably discovery of oil and coal in Wairarapa North County. *New Zealand Geol. Survey Report Geol. Explor. 1887-88,* **19**: 20-24.

Not seen. According to Bardsley (1977), the district under investigation was along the east coast between the Akitio River and the Kaiwhata River and for an average distance inland of 15 miles.

* Uruski, C. 1998 A New Zealand Drilling Failure? Post-mortem on Titihaoa-1, Offshore Wairarapa. *Petroleum Exploration in New Zealand News* **52**: 7-14.

Suggestion that "the Titihaoa structure deserves closer examination" partly due to the "significant volumes of dry gas" that were encountered "at nearly 2000 m depth".

Hydrography *and* Bathymetry

* Barnes, P.M. and Audru, J-C. 1999 Quaternary faulting in the offshore Flaxbourne and Wairarapa Basins, southern Cook Strait, New Zealand. *New Zealand Journal of Geology and Geophysics* 42: 349-367.

“Marine seismic reflection profiles, bathymetric data, and seabed samples reveal the stratigraphy and Quaternary structure of the southern Wairarapa and Flaxbourne Basins in the southeastern Cook Strait and eastern Malborough.”

Bowman, M.J.; Kibblewhite, A.C.; Ash D.E. 1980 M_2 tidal effects in greater Cook Strait, New Zealand. *Journal of Geophysical Reserach* **85**: 2728-2742.

Modelling of tides in Cook Strait, to Cape Palliser. Suggested application for squid fishing vessel locations.

Bowman, M.J.; Kibblewhite, A.C.; Chiswell, S.M.; Murtagh, R.A. 1983 Shelf fronts and tidal stirring in greater Cook Strait, New Zealand. *Oceanologica Acta* **6**(2): 119-129.

Sampling area includes Palliser Bay.

Bowman, M.J.; Kibblewhite, A.C.; Chiswell, S.M.; Murtagh, R.A.; Sanderson, B.G. 1983 Circulation and mixing in greater Cook Strait. *Oceanologica acta* **6**(4): 383-391.

A little data e.g. temperature and salinity, from Palliser Bay and east of Cape Palliser.

Brodie, J.W. 1960 Coastal surface currents around New Zealand. *New Zealand Journal of Geology and Geophysics* **3**: 235-252.

Early work in this subject. Drift card releases show currents through Cook Strait, past Palliser, and along eastern Wairarapa coast.

* Bradford, J.M. and Roberts, P.E. 1978 Distribution of reactive phosphorus and plankton in relation to upwelling and surface circulation around New Zealand. *New Zealand Journal of Marine and Freshwater Research* **12**(1): 1-15.

Effect of hydrology on plankton growth. Maps of primary productivity of sea around New Zealand (Wairarapa coast included, but no more detail here than for any other part).

Bye, J.A.T. and Heath, R.A. 1975 The New Zealand semi-diurnal tide. *Journal of Marine Research* **33**: 423-442.

Some measurements taken at Castlepoint.

* Carter, L. 1987 Geological Hazards and their Impact on Submarine Structures in Cook Strait, New Zealand. *8th Australasian Conference on Coastal and Ocean Engineering* 87/17: 410-414.

Description of "highly active geological and hydraulic processes operating" in Cook Strait, and the "real or potential hazard" to man-made submarine structures.

* Carter, L. 1992 Acoustical characterisation of seafloor sediments and its relationship to active sedimentary processes in Cook Strait, New Zealand. *New Zealand Journal of Geology and Geophysics* **35**: 289-300.

Cook Strait "is a highly active sedimentary environment". Some sampling in western Palliser Bay, but not particularly relevant to eastern Palliser Bay or Wairarapa coast.

NB. Some other papers by Carter and colleagues (Carter and Lewis 1995, Carter, Lewis and Davey 1988, Proctor and Carter 1989), and van der Lingen, Swanson and Muir (1992), are included in the photocopied material because I was given them. These focus on Cook Strait, including its geological history, and are not particularly relevant to the Wairarapa coast.

* Chiswell, S.M. 2000 The Wairarapa Coastal Current. *New Zealand Journal of Marine and Freshwater Research* **34**: 303-315.

“A new name is proposed for the relatively cool, fresh, northwards-directed flow along the Wairarapa coast of New Zealand. ... This current has previously been known as the Canterbury Current or as an extension of the Southland Current, but because of its source and location, a better name is the Wairarapa Coastal Current. One-month-long current meter records made off the Wairarapa coast show flow continuously to the north

during February 1998. Volume transports within the Wairarapa Coastal Current in February 1998 were c. 1.6 Sv off Cape Palliser, diminishing northwards as the current becomes entrained into the East Cape Current."

Gilmour, A.E. 1960 Currents in Cook Strait. *New Zealand Journal of Geology and Geophysics* **3**(3): 410-431.

Sampling only in "the narrows" of Cook Strait, between the western part of the southern North Island, and Arapawa Island in the Marlborough Sounds. Not relevant to Palliser.

* Griffiths, G.A. and Glasby, G.P. 1985 Input of River-derived Sediment to the New Zealand Continental Shelf: I. Mass. *Estuarine, Coastal and Shelf Science* **21**: 773-787.

"The input of river-borne sediments to the New Zealand continental shelf has been calculated for all the major rivers and basins in New Zealand" ... including those of the Wairarapa coast. Tables and maps.

Heath, R.A. 1969 Drift card observations of currents in the central New Zealand region. *New Zealand Journal of Marine and Freshwater Research* **3**(1): 3-12.

Early work in this subject. Drift card recovery area includes Palliser and eastern Wairarapa coast to Castlepoint.

Heath, R.A. 1971 Hydrology and Circulation in Central and Southern Cook Strait, New Zealand. *Journal of Marine and Freshwater Research* **5**(1): 178-199).

Sampling station positions include Palliser Bay and south-east of Cape Palliser.

* Heath, R.A. 1975 Oceanic Circulation off the East Coast of New Zealand. *Oceanographic Institute Memoir* No. **55**. New Zealand Department of Scientific and Industrial Research, Wellington. 80 pp.

Detailed discussion of all currents which influence this area, and a more detailed diagram than is common. The geostrophic method was used.

Heath, R.A. 1986 In which direction is the mean flow through Cook Strait, New Zealand - evidence of 1 to 4 week variability? *New Zealand Journal of Marine and Freshwater Research* **20**: 119-137.

Measurements taken between Wellington and the Malborough Sounds. References to other similar, earlier papers.

Lewis, K.B. 1973 Sediments on the continental shelf and slope between Napier and Castlepoint, New Zealand. New Zealand Journal of Marine and Freshwater Research 7(3): 183-208.

Very detailed. Includes maps (without place-names!). Description of sediment types. The finest sediments are near the shore.

* Matthews, E.R. 1983 Wave disturbance and texture of beaches in Palliser Bay, southern North Island, New Zealand. *New Zealand Journal of Geology and Geophysics* **26**: 197-212.

Measurements of the disturbance of beach sediments. Marked differences revealed between the head of the bay, and the more sheltered eastern side of the bay. An interesting, detailed and technical paper, but no discussion of implications for beach biology.

Murtagh, R.A. 1983 Summer nutrients in greater Cook Strait, New Zealand. MS thesis, Marine Sciences Resources Center, State University, New York, Stony Brook.

Not seen.

* Pantin, H.M. 1963 Submarine morphology east of the North Island, New Zealand. *New Zealand DSIR Bulletin* **149**. 43 pp.

Descriptions of coastal geology and submarine morphology - Cape Palliser to Poverty Bay. Includes photos, maps, and seismic profiles.

Marine Biology

* Adams, N.M. 1972 The marine algae of the Wellington area. A list of species. *Records of the Dominion Museum, Wellington* **8**(4): 43-98.

A species list, including "locality, occurrence and habitat". Records from “the west, south and east coasts of the southern part of the North Island, New Zealand, between Lat. 40 degrees 50’ S, and Lat 42 degrees 56’ S...” The northern latitude is just north of Castlepoint. Has some comments about near-shore bathymetry (p. 47), included above in Site List.

* Bartle,J.A. 1965 Report on Planktonic and Sea-Bird Observations. *Castlepoint Survey, first report, Biological Society, Victoria University of Wellington.* pp. 21-26.

Three days of observation of bird life, and one day study of plankton, including analysis of plankton species present.

* Bartle,J.A. 1965 November sea-bird observations from Castlepoint. *Castlepoint Survey, second report, Biological Society, Victoria University of Wellington.* pp. 30-31

Observations of petrel movements made during a four-day period. A "significantly different pattern from mid-winter could be seen".

Bartle, J.A. 1974 Sea-birds of eastern Cook Strait, New Zealand, in autumn. *Notornis* **21**: 135-166.

Study area includes whole Wairarapa coast and Cook Strait as a unit, and species distributions within that area not distinguished. Nellies (Giant petrels - *Macronectus giganteus*) common along the eastern coast of the North Island.

Bartle, J.A. 1972 The distribution and abundance of euphausiids in Cook Strait. Unpublished MSc thesis, Victoria University, Wellington. 169 pp.

Figure 2.1 (between pp. 11 and 12) shows plankton station positions - three offshore between Cape Palliser and Honeycomb Rock.

Bartle, J.A. 1976 Euphausiids of Cook Strait: a transitional fauna? *New Zealand Journal of Marine and Freshwater Research* **10**: 559-576.

Eleven species found and described. A fauna with "pronounced subantarctic affinities". Includes positions of plankton stations in Cook Strait, western Palliser Bay, and three off the Wairarapa coast between Palliser and Honeycomb Rock.

* Bartle, J.A. and Roberts, P.E. 1965 Castlepoint plankton studies. *Castlepoint Survey, second report, Biological Society, Victoria University of Wellington.* pp. 32-34.

Six samples were taken using a nylon net towed behind a rowboat. A marked increase in coelenterates compared with winter populations.

* Bartle, J.A. and Williams, P. 1965 Species list of birds of the Castlepoint area. *Castlepoint Survey, first report, Biological Society, Victoria University of Wellington.* p. 20.

List of 26 native birds and 12 introduced birds (including 20 sea and shore birds and 18 land birds, 14 passerine birds and 24 non-passerine birds, 4 native passerines and 10 introduced passerines), from the Castlepoint region.

Booth, J.D. 1979 Settlement of the rock lobster, *Jasus edwardsii* (Decapoda: Palinuridae), at Castlepoint, New Zealand. *New Zealand Journal of Marine and Freshwater Research* **13**(3): 395-406.

Monitoring done 1974-77. Describes occurrence of puerulus and post-puerulus stages on shore and moored collectors. Main period of settlement Dec-July, with peaks in Jan-Feb and April-June. Was conducted partly to trial types of puerulus collectors.

* Booth, J.D. 1994 *Jasus* edwardsii larval recruitment off the east coat of New Zealand. *Crustaceana* **66**(3):295-317.

This paper expands on Booth and Stewart (1992), and discusses seasonal settlement patterns in *Jasus edwardsii* larvae.

* Booth, J.D. and Stewart, R.A. 1992 Distribution of phyllosoma larvae of the red rock lobster *Jasus edwardsii* off the east coast of New Zealand in relation to the oceanography. In: Hancock, D.A. (ed.) *Larval biology, proceedings no. 15, Australian Society for Fish Biology Workshop.* Australian Government Publishing Service, Canberra.

Plankton samples were taken during 1987-88 along the east coast of New Zealand, south of East Cape. Phyllosomas of *Jasus edwardsii* "were much more abundant off the North Island than off the South Island. .... The high abundance of phyllosomas off the south-east of the North Island is probably of considerable significance to the fishery, contributing not only to high puerulus settlement in the region, but possibly also leading to juvenile migrations to other areas."

Bradford, J.M. 1978 Summer distribution of the pelagic copepod *Centropages aucklandicus* in New Zealand waters. *New Zealand Journal of Marine and Freshwater Research* **12**(3): 287-91.

Records this species off Cape Palliser (see distribution map p. 289).

* Braggins, J.E. and Neal, E. 1965 The Algae. *Castlepoint Survey, first report, Biological Society, Victoria University of Wellington.* pp. 34-37.

Qualitative studies of algae in two transects on the Castlepoint - Mataikona coast. Description of zonation, and comparison of transects. Includes a marine algae species list, compiled from the two transects, and also Castlepoint Beach Drift, and the Mataikona River Mouth Drift. Zonation diagrams for each transect, and rock pool profiles (three unnumbered pages).

* Braggins, J.E.; Ritchie, L.D.; Neal, B.C.M. 1965 The algal communities of a rocky shore section near Castlepoint. *Castlepoint Survey, second report.* Biological Society, Victoria University of Wellington. pp. 35-39.

"... elucidates further the ecological position of marine algae, especially during the summer months". Three transects. Three zonation charts (on unnumbered pages).

Castle, P.H.J. and Robertson, D.A. 1974 Early life history of the Congrid eels *Gnathophis habenatus* and *G. incognitus* in New Zealand waters. *New Zealand Journal of marine and Freshwater Research* **8**: 95-110.

Larvae of both species occur off Castlepoint throughout most of the year.

* Chang, F.H. 1999 *Gymnodinium brevisulcatum* sp. Nov. (Gymnodiniales, Dinophyceae), a new species isolated from the 1998 summer toxic bloom in Wellington Harbour, New Zealand. *Phycologia* **38**(5): 377-384.

Mentions distribution of this highly toxic algae along the Wairarapa coast (records at Cape Palliser, Riversdale, Castlepoint and Mataikona). Toxins produced by this microalgae kill “a large variety of micro- and macroalgae, invertebrates and vertebrates” and cause severe human respiratory distress and other symptoms. During mid-January 1998 “large mumbers of dead tuna, striped marlin, broad bill swordfish, sea urchins, starfish, and abalone washed up on the shore between Castle Point and Palliser Bay. More than 200 people at Riversdale, Castle Point, and Mataikona were reported to suffer from respiratory distress.”

* Chang, F.H.; Chiswell, S.M.; Uddstrom, M.J. 2001 Occurrence and distribution of *Karenia brevisulcata* during the 1998 summer toxic outbreaks on the central east coast of New Zealand. *Phycologia* **40.**

Further discussion of *Gymnodinium brevisulcatum* (new name = *Karenia brevisulcata*) along the Wairarapa coast, its development and ecological effects.

Other papers by Chang are in press.

Childerhouse, S. and Gales, N. 1998 Historical and modern distribution and abundance of the New Zealand sea lion *Phocarctos hookeri. New Zealand Journal of Zoology* **25**: 1-16.

Two archaeological sites with sea lion remains, in eastern Palliser Bay, near Cape Palliser.

* Chiswell, S.M. and Booth, J.D. 1999 Rock lobster *Jasus edwardsii* larval retention by the Wairarapa Eddy off New Zealand. *Marine Ecology Progress Series* **183**: 227-240.

Contrasts the distribution of mid- and late-stage larvae and pueruli off the Wairarapa coast, and discusses developmental reasons for distribution and the influences of currents.

* Chiswell, S.M. and Roemmich, D. 1998 The East Cape Current and two eddies: a mechanism for larval retention? *New Zealand Journal of Marine and Freshwater Research* **32**: 385-397.

“... we develop a statistical picture of likely retention times for passive drifters. Drifters can get retained in one or other of two permanent eddies: the East Cape and Wairarapa Eddies, and retention within the system can be as high as 3-3 years ... If weak-swimming larvae such as rock lobster larvae behave as passive drifters, retention and recirculation within the eddies may provide a mechanism allowing them to survive within the system long enough to recruit as juvenile lobsters.”

* Cooper, R.D. 1965 A note on an investigation into the Cumacea of Castlepoint. *Castlepoint Survey, second report. Biological Society, Victoria University of Wellington.* p. 45.

A note on species obtained by a trawl and by light trapping.

* Cooper, R.D.; Briant, A.; Roberts, P.E. 1965 Some animal communities of an exposed midlittoral section, from the coast near Castlepoint. *Castlepoint Survey, second report. Biological Society, Victoria University of Wellington.* pp. 40-42 and 10 unnumbered pages of diagrams.

Two transects, detailed description, zonation and other diagrams.

Cometti, R. and Morton, J. 1985 *Margins of the Sea - Exploring New Zealand's Coastline.* Hodder and Stoughton, Auckland.

A brief description for a popular audience of 38 sites of interest along the New Zealand coastline. Includes a one page description of Castlepoint, with a painting of the area by Cometti, on the facing page.

Crawford, D.A. 1947 A Phytoplankton Season in Cook Strait. New Zealand Science Congress. *Royal Society of New Zealand* **77**(5): 173-175.

Table of seasonal occurrences. Does not say where study / collection was done. No mention of Wairarapa.

Crawley, M.C. and Wilson, G.J. 1976 The Natural History and Behaviour of the New Zealand Fur Seal (*Arctocephalus forsteri*). *Tuatara* **22**(1): 1-29.

Map shows a seal rookery / hauling-ground at Cape Palliser.

* Dell, R.K. 1955 A record of *Latreillopsis petterdi* Grant (Crustacea, Brachyura) from New Zealand, with notes on some other species of Crustacea. *Records of the Dominion Museum, Wellington* **2**: 147-149.

Describes a specimen of the crab *L. petterdi* from off Cape Palliser. Records the crab *Ibacus alticrenatus* from off Castlepoint.

De L. Main, W. 1974 Distribution and Ecology of *Nectocarcinus antarcticus* and *N. bennetti* (Brachyura: Portunidae) in the New Zealand region. *New Zealand Journal of Marine and Freshwater Research* **8**(1): 15-38.

Monitoring around Cape Palliser (*N. antarcticus* present), and up east coast (neither species present).

Dix, B. 1993 A new record this century of a breeding colony in the North Island for the New Zealand fur seal *Arctocephalus forsteri. Journal of the Royal Society of New Zealand* **23**(1) :1-4.

"Late in 1991, a new rookery was discovered at Cape Palliser on the southern coast of the North Island, the first North Island record this century."

* Duffy, C. unpub. 2000 Biological observations made on Wairarapa reefs: dive log notes.

These observations included in Site List.

* Duffy, C. unpub. 2001 Notes from Interviews with Wairarapa Fishermen (in 1987).

Excerpts included in Site List.

* Fraser. B.; Hughey, K.G.; Pearson, P. 1987 An ecological assessment of seaweed harvesting from beaches of the Wairarapa coastline. Wildlife Service Report, Christchurch. 35 pp.

Describes ecology of *Pterocladia* spp. Study area from Ngawi to Cape Kidnappers, but concentrating on the beaches within several kilometres of Tora Bay. Includes effect of harvesting on birds and invertebrates, and significance in coastal communities - energy recycling etc. Socio-economic considerations. Considerable detail throughout. Includes recommendations. Photos.

Gurr, L. 1974 Gulls and skuas. *New Zealand Nature Heritage* **2**(24): 660-667.

Several breeding colonies of red-billed gulls are shown on the southeast Wairarapa coast. Includes description of species, biology, and distribution map, but the scale of the latter is too small to be helpful.

* Hay, C.H. 1990 The distribution of *Macrocystis* (Phaeophyta: Laminariales) as a biological indicator of cool sea surface temperature, with special reference to New Zealand waters. *Journal of the Royal Society of New Zealand* **20**(4): 313-336.

Discusses relationship between *Macrocystis pyrifera* and water temperature. "The northern limit of *Macrocystis* along the Wairarapa Coast is not known precisely, but is somewhere between Castle Point and Cape Turnagain, probably just north of Castle Point. In this region mean monthly isotheres are 18-19 degrees C (Garner and Ridgway, 1962)".

James, P.J. 1994 Feeding preferences of juvenile rock lobster (*Jasus edwardsii*), feeding on the two mussels *Perna canaliculus* and *Mytilus galloprovincialis* and observations on feeding behaviour. Unpublished BSc (Hons) thesis, Victoria University, Wellington.

Rock lobsters were collected as pueruli from Castlepoint.

Kensler, C.B. 1966 Ecological notes on the marine crayfish *Jasus edwardsii* (Hutton) : Puerulus and post-puerulus stages. *New Zealand Marine Sciences Newsletter* **8**: 32-34.

The specimens were collected from Castlepoint where they were found in large numbers under rocks in the intertidal zone. "It seems certain that puerulus and post-puerulus stages invade the intertidal region at Castlepoint throughout the entire year".

Kensler, C.B. 1967 The Distribution of Spiny Lobsters in New Zealand Waters (Crustacea: Decapoda: Palinuridae). New Zealand Journal of Marine and Freshwater Research **1**: 412-420.

A few immature specimens of *Janus verreauxi* have been taken at Castlepoint, but no mature specimens found south of Table Cape. *J. edwardsii* is present all along the Wairarapa coast.

Laing, D. and Wallis, G. 1965 The Sandy Shore. *Castlepoint Survey, first report, Biological Society, Victoria University of Wellington.* pp. 31-32.

Includes maps, graphs and line drawings of species parts (on five unnumbered pages). Sampled area situated to the north of Castle Rock, by the Castlepoint settlement. Transects, and trench transects were used. Animals found were amphipods, isopods, polychaetes, one insect, one crustacean, and one mollusc.

* Lesser, J.H.R. 1978 Phyllosoma larvae of *Jasus edwardsii* (Hutton) (Crustacea: Decapoda: Palinuridae) and their distribution off the east coast of the North Island, New Zealand. *New Zealand Journal of Marine and Freshwater Research* **12**: 357-70.

"Eleven [larval] stages are recognised from specimens captured in plankton samples collected along a transect extending 185 km east of Castlepoint". Development, mortality, depth, and influence of currents discussed.

McCann, C. 1969 First southern hemisphere record of the Platylepadine barnacle *Stomatolepas elegans* (Costa) and notes on the host *Dermochelys coriacea* (Linne). *New Zealand Journal of Marine and Freshwater Research* **3**: 152-158.

Describes epizoic barnacles from the “wrists” of a young female leatherback turtle found stranded at the mouth of the Whareama River.

McDowall, R.M. and Robertson, D.A. 1975 Occurrence of galaxiid larvae and juveniles in the sea. *New Zealand Journal of Marine and Freshwater Research* **9**: 1-9.

Figure 3 (p.7) indicates several records off the Wairarapa coast.

Mills, J.A.; Shaw, P.W. 1980 The influence of age on laying date, clutch size, and egg size of the white-fronted tern, *Sterna striata. New Zealand Journal of Zoology* **7**: 147-153.

A colony recorded at Cape Palliser, but study is focused on Kaikoura. 125 chicks banded on "Palliser Spit", 1958-1977.

* Morton, J. and Miller, M. 1973 *The New Zealand Sea Shore*. Collins, Auckland.

See pages 336-343. Includes detailed description of marine biology of Castlepoint (including diagram p. 342-343). Also detailed discussion of changing distribution of organisms along Wairarapa coast (see especially chart p. 339).

Pande, A. 1994 Genetic Variation in the Greenshell Mussel, *Perna canaliculus*, around New Zealand. Unpublished BSc (Hons) thesis, Victoria University, Wellington.

Quotes Smith (1988) who sampled mussels at Castlepoint.

Paulin, C. and Roberts, C. 1992 The Rockpool Fishes of New Zealand. Museum of New Zealand. ISBN 0-908-953-01-1.

Described by Chris Paulin as "an incomplete snapshot" of inshore coastal fishes. Includes distribution data, some of which is relevant to the Wairarapa coast.

Petherick, C. 1987 Preliminary paua survey of the Wairarapa Coast. Central Fisheries Management Area Internal Report 87/2. Ministry of Fisheries.

Not seen. Missing from NIWA library.

Ponder, W.F. 1967 Polymorphism and geographical variation in the gastropod genus *Buccinulum. New Zealand Marine Science Newsletter* **10**: 53.

Buccinulum vittatum colensoi is found from East Cape to Castlepoint and south of this *B.v.littorinoides* is found.

Quigley, B. 1988 Behavioural and Morphological Aspects of feeding in the puerulus stage of the red rock lobster *Jasus edwardsii.* Unpublished BSc (Hons) thesis, Victoria University, Wellington.

Pueruli used were captured on collectors sited at Castlepoint and Gisbourne.

* Ritchie, L.D. 1965 Castlepoint Fish Survey. *Castlepoint Survey, first report, Biological Society, Victoria University of Wellington.* pp. 27-30.

A survey of fish made with particular reference to shoaling behaviour of predominantly surface fishes, and feeding and habitat studies of predominantly bottom feeding fishes. Four stations chosen, which give great variation in habitat. Main methods for gathering information were seine net and direct observation using SCUBA. Includes ecological comments and some analysis of fish parasites.

* Roberts, P.E. and Cooper, R.D. 1965 The Intertidal Animals. *Castlepoint Survey, first report, Biological Society, Victoria University of Wellington.* pp. 38-41, and 6 unnumbered pages.

Description of intertidal animals found in two transects on the Castlepoint to Mataikona coast. Distribution diagrams on 6 unnumbered pages. Species list of the intertidal animals, including 2 Nemerteans, 1 Sipunculid, 15 Polychaetes, 1 Planarian, 4 Actinia, 5 Echinoderms, 38 Crustacea, 48 Mollusca, and 3 Pisces.

Smith, P.J. 1988 Biochemical-genetic variation in the green-lipped mussel, *Perna canaliculus,* around New Zealand and possible implications for mussel farming. *New Zealand Journal of Marine and Freshwater Research* **22**: 85-90.

Castlepoint was one location sampled.

Stidolph, R.H.D. 1973 Plumages of variable oystercatchers. *Notornis* **20**: 311-313.

Includes five sites on the eastern Wairarapa coast, and two on the south Wairarapa coast. "Black birds are much more dominant in the Wairarapa East Coast than on the Manawatu West Coast".

Stidolph, R.H.D. 1974 Decline of pipit in Wairarapa. *Notornis* **21**: 79-80.

The pipit, *Anthus novaeseelandiae* was once widespread in the east coast country and on the ocean beaches, but has declined severely since about 1950, probably because of the increase in roads, traffic and roadside spraying. "After being one of the commonest native birds in the Wairarapa countryside the Pipit now is one of the scarcest". In 1920-29 it was widespread "in the swampy pastures around Wairarapa Lake and on the ocean beaches" ...

Stidolph, R.H.D. and Cunningham, J.M. 1947 Birds at Whareama, east coast, Wairarapa. *New Zealand Bird Notes* **2**: 82.

A brief note listing the species seen on one visit. It is “not a good estuary for waders” (see Site List for details).

Town, J.C. 1979 Distribution and Dispersal of the Genus *Astrostole* Fisher, 1923 (Echinodermata: Asteroidea). *New Zealand Journal of the Royal Society of New Zealand* **9**(4): 385-395.

A. scabra recorded from sites around NZ including Mataikona and Cape Palliser (p. 388).

Ichthyology

* Annala, J.H. and Sullivan, K.J. 2000 Report from the Mid-Year Fishery Assessment Plenary, November 2000: stock assessments and yield estimates. Ministry of Fisheries.

Includes: Terms of Reference for Fishery Assessment Working Groups, Rock Lobster Working Group Membership, a Guide to Biological Reference Points for 2000 Fishery Assessment Meetings, and extensive details of the Rock Lobster fishery (including both *Jasus edwardsii* and *J. verreauxi*).

Cade, R; Johnston, A.; Greening, J. 1984 Target trawling for alfonsino (*Beryx splendens*) and the consequential impact on the bluenose (*Hyperoglyphe antarctica*) line fishery off the east coast of the North Island. *Fishing gear unit, internal report* **1**, 22 pp. (Unpublished report held by Ministry of Fisheries, Nelson).

Not seen.

Horn, P.L. 1988 Age and growth of bluenose, *Hyperoglyphe antarctica* (Pisces: Stromateoidei) from the lower east coast, North Island, New Zealand. *New Zealand Journal of Marine and Freshwater Research* **22**(3): 369-378.

Study area from Ranfurly Bank (East Cape) to Palliser Bank (west of Cape Palliser).

Horn, P.L. and Hurst, R.J. 1999 Age and stock structure of gemfish (*Rexea solandri*) in New Zealand waters. Australian Journal of Marine and Freshwater Research 50: 103-15.

"Age determination of gemfish by counting hyaline zones in otoliths was validated by following the progression of modes in length-frequency distribution and the progression of strong and weak year classes in age-frequency distributions. ... Two gemfish stocks are indicated on the basis of patterns of year class strengths, trends in commercial landings and likely spawning areas; one off the east and north of the North Island, [including the Wairarapa coast,] and another off the west and south of the South Island..."

Horn, P.L. and Massey, B.R. 1989 Biology and abundance of alfonsino (*Beryx splendens*) and bluenose (*Hyperoglyphe antarctica*) off the lower east coast, North Island, New Zealand. *New Zealand Fisheries technical report* **15**.

Main aim was to determine sustainable yields. Biology and behaviour researched. Alfonsino in New Zealand are generally found at a depth of 200-1000 m. Bluenose are found at a depth of 10-500 m.

Hurst, R.J. and Bayley, N.W. 1989 Movements and possible stock relationships of the New Zealand barracouta, *Thrysites atun*, from tag returns. *New Zealand Journal of Marine and Freshwater Research* **23**(1): 105-111.

A map (p. 107) shows east coast of North Island (but not including Cape Palliser) as the "later winter-spring spawning" area.

Massey, B.R. and Horn, P.L. 1990 Growth and age structure of alfonsino (*Beryx splendens*) from the lower east coast, North Island, New Zealand. *New Zealand Journal of Marine and Freshwater Research* **24**(1): 121-136.

Commercial landings were sampled from the Palliser Bank (west of Cape Palliser), Tuaheni High, and Paoanui Ridge (both north of Cape Turnagain), to describe growth, and determine age composition. Recruitment occurs at age 5 on Palliser Bank. Palliser Bank is characterised by small, young fish - c. 13% are less than or equal to 10 years old.

Mehl, J.A.P. 1968 Studies on the Barracouta *Thrysites atun* (Euphrasen) in eastern Cook Strait Region of New Zealand. Unpublished MSc thesis, Victoria University, Wellington.

Barracouta for food study came from Castlepoint, Tora, Cape Palliser, and Cook Strait (pp. 7-8).

Mehl, J.A.P. 1969 Food of barracouta (Teleostei: Gempylidae) in eastern Cook Strait. *New Zealand Journal of Marine and Freshwater Research* **3**: 389-394.

Sampling area includes Wairarapa coast - Palliser Bay to Castlepoint.

Mehl, J.A. 1971 Spawning and length-weight of barracouta (Teleostei: Gempylidae) from eastern Cook Strait. *New Zealand Journal of Marine and Freshwater Research* **5**(2): 300-317.

Sampling area includes Wairarapa coast - Palliser Bay to Castlepoint.

Murdoch, R.C. and Chapman, B.E. 1989 Occurrence of hoki (*Macruronus novaezelandiae*) eggs and larvae in eastern Cook Strait. *New Zealand Journal of Marine and Freshwater Research* **23**(1): 61-67.

The presence of plantonic eggs and larvae are recorded for the first time in Cook Strait, and in relatively large numbers. The suggestion is that seafloor canyons in eastern Cook Strait (Nicholson, Wairarapa (western Palliser Bay), and Cook Strait Canyons) are likely spawning areas.

Paulin, C.D. 1979 New Zealand roughies (Pisces: Berycomorphii: Trachichthyidae). *New Zealand Journal of Zoology* **6**: 69-76.

Hoplostethus mediterraneus caught from < 500 m depth, eastern Wairarapa.

Hoplostethus atlanticus caught from > 500 m depth, eastern Wairarapa.

Paratrachichthys trailli caught from < 500 m depth, eastern Wairarapa.

Richie, L.D. 1969 Aspects of the biology of the butterfish *Coridodax pullus* (Forster). Unpublished MSc thesis, Victoria University, Wellington.

Catches in gill nets around Wellington, including western Palliser Bay.

Roberts, P.E. 1980 Surface distribution of albacore tuna, *Thunnus alalunga* Bonnaterre, in relation to the Subtropical Convergence Zone east of New Zealand. *New Zealand Journal of Marine and Freshwater Research* **14**(4): 373-380.

Some tuna caught off eastern Wairarapa coast.

Vooren, C.M. 1975 Nursery grounds of tarakihi (Teleostei : Cheilodactylidae) around New Zealand. *New Zealand Journal of Marine and Freshwater Research* **9**: 121-158.

Castlepoint is one of the areas where the tarakihi is regularly recorded.

Terrestrial Biology

Druce, A.P. Various dates. Floras compiled from observation of the following areas: Cape Palliser, Pahaoa Gorge Taipos (sea-level to 1500 feet); Wairarapa Taipos (sea-level to 2000 feet); the Aorangi Range; Mount Percy; and Castlepoint. Unpublished but widely circulated.

Gaskin, D.E. 1964 Lepidoptera recorded at Castlepoint, Wairarapa, in December, 1963. Records of the Dominion Museum, Wellington 5(3): 7-10.

Five habitat types were defined and sampled, and a list included of numbers of each species caught in each habitat.

Given, D.R. 1972 The infra-specific taxonomy of *Celmisia spectabiiis* Hook. F. (Compositae: Astereae). *New Zealand Journal of Botany* **10**: 180-194.

Castlepoint is the type locality of *Celmisia spectabilis* var. *lanceolata*, which is found along the southeast Wairarapa coast from Cape Palliser to north of Castlepoint.

* Hill, R.D. 1963 Vegetation of the Southern Wairarapa in the Mid-19th Century. *Tuatara* **2**(3) :83-89.

A brief but detailed account of archival records in an attempt to reconstruct the vegetation pattern of the Wairarapa “on the eve of settlement in 1843”. The only point on the coast mentioned is Castlepoint, but a map drawn from an 1853 “sketch survey” shows that the entire coastline was devoid of forest by that time.

Mason, R. 1950 Some new plant records for Wellington province. *Bulletin of Wellington Botanical Society* **23**: 22.

Records *Celmisia spectabilis* and *Sophora tetraptera*, the large-leaved kowhai, from Castlepoint.

Milne, R. and Sawyer, J. draft, 2000 Coastal dune vegetation in Wellington Conservancy - Current status and future management. Department of Conservation Report, Wellington.

Consideration of coastal dune vegetation in the Wellington region by the mapping of five representative species: *Austrofestuca littoralis* (sand tussock), *Desmoschoenus spiralis* (pingao), *Spinifex sericeus* (spinifex), *Coprosma acerosa* (sand coprosma), and *Pimelea arenaria* (sand daphne). The focus is on protection and restoration, and key sites for the management of coastal dune vegetation identified and discussed. Those on the eastern Wairarapa coast are: Uruti Point, Flat Point, Castlepoint Scenic Reserve, and Pahaoa Scientific Reserve. The report includes a list of indigenous plant species associated with coastal dune vegetation in Wellington Conservancy, a list of native and exotic bird species associated with coastal dunes, a list of adventive plant species with the potential to become dune pests, and names and addresses of people and agencies involved in protection and recovery of coastal dune vegetation in the conservancy.

Park, G.N. 1965 The Vegetation of the Castlepoint Area. *Castlepoint Survey, first report, Victoria University of Wellington.*

Park, G.N. 1967 The vegetation and flora of Castlepoint and Cape Turnagain. *Bulletin of Wellington Botanical Society* **34**: 6-18.

A detailed, illustrated discussion, with a list of vascular plants indigenous to either or both regions.

Park, G.N. and Williams, P.A. 1965 *Senecio compactus* at Castlepoint. *Castlepoint Survey, first report, Victoria University of Wellington.*

Park, G.N. and Williams, P.A. 1965 Notes on the Vegetation of the Mount Percy Area, Eastern Wairarapa and an unnamed species of *Senecio*. *Castlepoint Survey, first report, Victoria University of Wellington.*

Wardle, J. 1967 Vegetation of the Aorangi Range, southern Wairarapa. *New Zealand Journal of Botany* **5**: 22-48.

An extensive survey of the area immediately inland from Cape Palliser, extending east as far as the Opouawe River.

Archaeology / History

* Adkin, G.L. 1955 Archaeological evidence of former native occupation of eastern Palliser Bay, *JPS* **64**: 450-80.

Discusses a variety of things including: geology and geolomorphology, ethnographic references, place names, stone walls, coastal camping and cooking sites, lookouts, cultivated ground, "Putangirua 'Maori Camp'", and the identity of the early inhabitants of Palliser Bay.

Bagnall, A.G. 1976 *Wairarapa - an historical excursion*. Masterton, Hedley's Bookshop Ltd., for the Masterton Trust Lands Trust.

A detailed historical description of the exploration, settlement and development of the Wairarapa by Europeans, and their interactions with the Maori people of the area, including details about Maori settlement patterns and quotes about the area from Maori people. In Chapter 3, Bagnall describes the coastal journeys made by several of the first European explorers. Some interesting details which mention things marine are quoted above.

Barrow, T. 1959 An archaic type of Maori hei-tiki from the Wairarapa east coast. *New Zealand Archaeological Association Newsletter* **2**(4) Wellington issue.

Discussion of the significance of the unsusual shape of this hei-tiki. Suggestion that it seems "more related to Marquesan stone hei-tiki than to the conventional nephrite forms of classic Maori culture".

Bannister, C. 1940 *Early History of the Wairarapa.* Masterton. 152 pp.

Not seen. According to Bardsley (1977) includes descriptions of the coast from Wellington to Masterton.

Bradbury, E. (ed.) 1924 *The settlement and development of the Wairarapa New Zealand. Early history, industries and resources. Scenic attractions. Illustrated with recent photographs.* Bradbury's Illustrated Series 10, Bradbury, Auckland. 160 pp.

Included here for its reference to katipo spiders in the sand at Castlepoint.

Cairns, K. date unknown A dissertation on the identification of deep straight-sided drilled holes found in artifacts from the early neolithic phase of the New Zealand Prehistoric Settlement Period. ?Unpublished - draft copy held by Toni Atkinson.

Suggests that "a time span of as little as 100 years could be considered adequate for dispersal of the artifact forms figured from Society Islands, Marquesas, Chatham Islands and Castlepoint" (p. 31).

Castlepoint Historical Committee 1965 *Early Castlepoint - First Years in a Pioneer Settlement.* Masterton Printing Co. Ltd., Masterton.

A compilation of writing (1848-1948) about the Castlepoint settlement, some writing by early settlers or explorers. Nothing about the coast or marine life, except the scenery, and Colenso's (1843) comment (quoted above) that there were "some hundreds" of crayfish hung up to dry at the Maori fishing settlement.

* Davis, S. 1957 Evidence of Maori occupation in the Castlepoint area. *J Polynesian Society* **66**: 199-203.

Includes details of a hangi discovered.

Fearon, K.J. 1980 *Te Wharau - a history which traces the origins of the various properties from the Kourarau Hill to the coast, and covers the general development of the district.* Netherton Grange Publications, Masterton.

An interesting historical account, including amusing anecdotes, of the Te Wharau area. Includes the story of coastal stations - Flat Point, Glenburn etc., and contains a few comments (quoted above) about the beginnings of commercial crayfishing in the area.

Leach, B.F. 1976 Prehistoric communities in Palliser Bay, New Zealand. PhD thesis, Otago University.

Not seen.

* Leach, B.F. 1983 The prehistory of the southern Wairarapa. *J Royal Society New Zealand* **11**(1) :11-33.

Mentions rock for implements from Tora and White Rock, and importance of fish, crayfish and "rocky shore shellfish" in Palliser Bay. "The latter only occur in isolated patches at headlands but can be present in large numbers" (p. 13). Also mentions eels.

Leach, H.M. 1976 Horticulture in Prehistoric New Zealand. PhD thesis, Otago University.

Not seen.

Leach, H.M. 19779 an Analysis of an Open-air Workshop in Palliser Bay. *New Zealand Journal of Archaeology* **1**: 139-151.

Washpool Walls site (does not state where this is). Includes suggestion that some worked stone came from White Rock - Oroi - Tora area (p. 142).

Leach, B.F. and Leach, H.M. 1969 Archaeology in the Wairarapa. Anthropology Department, University of Otago.

Description of the Palliser Bay research programme, 1969-70.

Leach, B.F. and H.M. (Eds.) 1979 Prehistoric man in Palliser Bay. *National Museum of New Zealand Bulletin* **21**.

Not seen.

Leach, F.; Davidson, J. and Wallace, R. 1999 The Form and Construction of the Makotukutuku House, a Pre-European Dwelling in Palliser Bay, NZ. *New Zealand Journal of Archaeology* **21**: 87-117.

Situated 2.3 km inland - Makotukutuku Valley.

Prickett, K.E. 1975 The prehistoric exploitation and knowledge of geological resources in Southern Wairarapa. Unpublished M.A. thesis, Anthropology, University of Otago.

Not seen.

Geography / Current Human Use

Bradstock, M. and Luxton, D. 1984 Agar Seaweed; Biology, Harvesting and Resource Management. *Fishdex* **27**, New Zealand Ministry of Agriculture and Fisheries, Wellington.

Includes a brief description of *Pterocladia lucida* and *capillacea* (= *pimata*). "Both species occur over most of New Zealand - on the east coast, south as far as Kaikoura. .... in tide pools, or the lower shore, and beyond low tide mark". Most of the harvest comes from the North Island. The Wairarapa is a major collection area.

Field, K.D. and Holton, A.L. 1985 Honeycomb Rock area: history and present use. MAF Unpublished Report. 17 pp.

Not seen. Not in MAF, DOC, NIWA or AGRESEARCH libraries.

** Fraser. B.; Hughey, K.G.; Pearson, P. 1987 An ecological assessment of seaweed harvesting from beaches of the Wairarapa coastline. Wildlife Service Report, Christchurch. 35 pp.

Describes ecology of *Pterocladia* spp. Study area from Ngawi to Cape Kidnappers, but concentrating on the beaches within several kilometres of Tora Bay. Includes effect of harvesting on birds and invertebrates, and significance in coastal communities - energy recycling etc. Socio-economic considerations. Considerable detail throughout. Includes recommendations. Photos.

**** Copy in Marine Biology folder.**

Hendry, I.S. 1972 Palliser Bay: A Study of the Population, Recreation and Housing Dynamics of the Six Bach Settlements at Palliser Bay. Unpublished BA thesis, Geography Department, Victoria University.

Describes six bach settlements, from Western Lake to Ngawi, including population demographics, recreational activities, and housing.

Bach-owners complained that Palliser Bay was being "fished out" by commercial fishermen and overseas vessels. Sea fishing (with a set line or net) was the most popular recreational pastime at all settlements. 88% of Ngawi population crayfished.

Levine, H. 1984 Controlling Access: Forms of "Territoriality" in Three New Zealand Crayfishing Villages. *Ethnology* **23**(2): 88-99.

Crayfishing provides a context for addressing "issues about explanatory models and the nature of territoriality". "Manifestations of access control" discussed in three NZ fishing communities: Ngawhi (southern Wairarapa coast), Motunau Beach, and Stewart Island.

Describes how the Ngawhi fishermen "regulate competition" particularly by "keeping new fishermen from moving into the community", and granting each other "de facto usufructory rights to patches currently being fished".

Suggests that "fishermen in Ngawhi have been able to regulate access more than Stewart Islanders because ecological conditions allow them to do this, but their informal management methods operate in a social context which does not make it necessary to aggressively define and defend patches. The men view themselves as friendly competitors who have known each other for a long time."

Seconi, L.G. 1972 Riversdale - A Study in Recreational Geography. Unpublished B.A. Honours Project.

Includes description of the setting, people, development of the settlement. Describes recreational activities, including fishing from beach and rocks. Crayfishing is a strong attraction - pots on rocks at either end.

Wairarapa: Resources of a Region 1978 A Wairarapa Regional Development Council Publication.

Not seen.

Marine or Coastal Reserve Proposals

Atkinson, I.A.E. 1964 Letter to Associate-Professor J.T. Salmon, Department of Zoology, Victoria University of Wellington.

Written in response to an earlier letter of Salmon's, and arguing that "Of the three localities mentioned [Red Rocks, Cape Turakirae, Cape Palliser], it would appear that Cape Palliser offers the greatest potential as a "National Coastline Park".

Kelly, G.C. 1966 Proposal for a reserve at Castlepoint, Wellington Land District. Unpublished report prepared by Botany Division, DSIR, for Department of Lands and Survey, Wellington. 21 pp.

Maps, illustrated, plant and bird lists. Proposes a reserve of 216 acres "to preserve the very popular scenic attractions of Castlepoint ... from 'development' ..." Describes the terrestrial biology and geology, and a variety of matters necessary for the establishment and administration of a reserve. Makes comments (included above) about seabird nesting sites, and the presence of "two possibly new species of bristle-worms".

Kelly, G.C. 1971 Cape Palliser. Letter to Associate Director of National Parks and Reserves, Lands and Survey, on behalf of the Director of Botany Division, DSIR.

Argues for protection of the coastal area of Cape Palliser. Mentions the scenic value of the place, and briefly describes the biology, including commenting on the marine biology (quoted above).

* Peterson, C. Various dates. Various unpublished letters, and Letters to the Editor of the *Wairarapa Times Age.*

Chris Peterson advocates a "marine reserve" somewhere on the Wairarapa coast, but does not specify a site.

Stevenson, M.L.; Field, K.D.; Holton, A.L.; Baxter, A.S.; Henriques, P.R. 1987 Regional Background Discussion Paper on Areas to be investigated for proposed marine protected areas in the Central Fishery Management Area.

Unpublished document. Copies in the NIWA and Wellington Regional Council library.

The only site discussed which is relevant to the literature review is Honeycomb Rock. Has detail about the general bathymetry and hydrography of Central FMA, and the history, physical environment (marine topography and geology), biological environment (terrestrial and marine) and present use (commercial fishing and recreation) of the Honeycomb Rock area. I have quoted all relevant detail above (except for details of the marine environment, none of which are specific to Honeycomb Rock).

Turner, G.A. and Carlin, W.F. 1975 Coastal Reserves Investigation and Proposals: Report on Masterton County. Department of Lands and Survey, Wellington. 35 pp.

Not seen. In DoC Wellington Conservancy Library. 333.917 099 343 NEW Cloth binding, substantial.

Turner, G.A.; Carlin, W.F.; Neeson, M.P. 1985 Coastal Reserves Investigation and Proposals: Featherston County. Department of Lands and Survey, Wellington. 51 pp.

Not seen.

Turner, G.A.; Carlin, W.A.; Kimber, W.A.; Dobbie, B.J. 1983 Coastal Reserves Investigation and Proposals: Report on Dannevirke County. Department of Lands and Survey, Wellington. 30 pp.

Not seen.

NB. Bill Carlin says there's also a 'South Wairarapa County' one of these.

Unknown author(s) probably 1980s Preliminary National Park Assessment - Cape Palliser.

Content similar to Carlin (1980) but in brief form. Marine biology not mentioned. Conclusion (p. 19) that “The Cape Palliser area does not contain scenery or features that could individually or collectively be judged to be “so beautiful or unique that their preservation is in the national interest .... [But] The Cape Palliser area could possibly be considered suitable for a National Park if it is considered desirable to have an area representative of the south of the North Island in National Park status .... regionally important natural features and areas outside the Forest Park require some protective status”.