

PARKS VICTORIA TECHNICAL SERIES

NUMBER 1

Marine Natural Values Study

Victorian Marine National Parks and Sanctuaries

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September 2003

First published 2003

Published by Parks Victoria
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National Library of Australia
Cataloguing-in-publication data

Includes bibliography.
ISSN 1448-4935

Citation

Plummer, A, Morris, L, Blake, S and Ball, D (2003). Marine Natural Values Study, Victorian Marine National Parks and Sanctuaries. Parks Victoria Technical Series No. 1, Parks Victoria, Melbourne.

Printed on environmentally friendly paper

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Executive Summary

The "Marine Natural Values Study – Marine National Parks and Sanctuaries" is an inventory of accessible knowledge about the natural (environmental) values for all 24 of the newly declared Marine National Parks and Sanctuaries in Victoria.

The report's authors, from the Marine & Freshwater Resources Institute (MAFRI) in Queenscliff, drew together environmental information from as diverse sources as scientific papers, Honours theses, published reports and unpublished data collections to compile the Natural Values Study.

Each park (or in some cases each section of a park, e.g., Port Phillip Heads has six diverse sections) has it's own chapter. Each chapter has information gathered together into ten categories:

1. Physical Parameters

Basic physical parameters including size, length of coastline, range of water depth and use of the adjacent catchment.

2. Marine Habitat Classes

Includes descriptions of marine diversity at scales of 1:25 000 to 1:100 000 based on the interim Marine Habitat Classes for the Victorian coastline.

3. Marine Ecological Communities

These descriptions provide a qualitative classification at the ecological community level, giving a broad description of the different assemblages for major habitat types in Marine National Parks and Sanctuaries.

4. Biological Processes

This section lists any areas known to be important spawning, recruitment or nursery grounds within a Marine National Park or Marine Sanctuary and identifies regions known to be subject to highly productive upwellings.

5. Species Distribution Information

This section details what is known about the geographical distributions of species within or near to a Marine National Park or Marine Sanctuary. There are three types of geographical distributions listed:

- Species at, or near their presumed geographic limits and recorded from within a Marine National Park or Marine Sanctuary.
- Species at, or near their presumed geographic limits and have been recorded within a 5 km radius of a Marine National Park or Marine Sanctuary on similar habitat.
- Species restricted to a particular Marine National Park or Marine Sanctuary.

The caution is noted that distribution limits in many cases reflect collection effort and not the actual limit of distribution for species.

6. Shorebirds

This section lists threatened shorebirds that have been recorded since 1980 in each Marine National Park and Marine Sanctuary, as well as identifying their national and state conservation status and including species subject to the international treaties.

7. Marine Mammals

Many marine mammals, mostly whales and seals, are seasonal visitors to Victorian waters and may move through Marine National Parks or Sanctuaries. Others can be resident. This section lists the threatened marine mammals sighted in Victorian coastal waters since 1980.

8. Sites of Geological and Geomorphological Significance

There are many sites of geological Geomorphological Significance adjacent to and within Marine National Parks or Sanctuaries. This section lists these features.

9. Knowledge gaps

This section summarises the level of information available for the main habitat types in each Marine National Park or Marine Sanctuary and notes where there are knowledge gaps.

10. Research

This section contains a list of recent relevant primary research and monitoring programs uncovered in the review process.

Where there is little specific information on a given topic, it is noted in the chapter on the park. There is a great deal of information known about the Victorian marine environment at the broad scale, however at the smaller scales locally there are places in some parts of our coastline where we have knowledge gaps. This report identifies these and helps Parks Victoria to plan future research and monitoring.

A feedback sheet is included in the report in case readers know of any research or monitoring that is relevant for a Marine National Park or Sanctuary that has been missed by this report. The feedback sheet will allow Parks Victoria to update the web-based version of the report as new information arises.

The report contains an extensive glossary and bibliography. There is also a map of the known natural values in each park (or section of park). The maps show known marine habitats and known monitoring/sampling sites as well as known sitings of shorebird and other fauna in and around each park.

Contents

Index of Figures and Tables

FIGURES

TABLES

1.1 Purpose

The primary aim of the Natural Values Study is to identify and describe the natural values associated with the new Marine National Parks and Marine Sanctuaries. The natural values of Victoria's Marine National Parks system incorporate qualities such as diversity and richness, uniqueness, critical habitats, rare and threatened species and productivity (Parks Victoria 2002)

The objectives of this report are:

- To identify and describe broadly available natural values information for Victoria's Marine National Parks system.
- To identify and describe specific natural values information that is available for each individual Marine National Park, including maps of the available spatial data on natural values.
- To provide a summary of any relevant historic or current research projects related to the study of these natural values

1.2 Report Structure and Content

This report initially provides a summary of the natural values information in order to place the Marine National Parks system into a State-wide context. Natural values information is reviewed and maps detailing natural values are presented for each Marine National Park and Marine Sanctuary using a consistent format. Information gaps are also identified for each Marine National Park or Marine Sanctuary.

1.3 State-Wide Context

On November 16th 2002, 13 Marine National Parks and 11 Marine Sanctuaries were gazetted in Victoria (Figure 1). The Marine National Parks and Marine Sanctuaries were established to provide a representative system of protected marine environments that would reflect the outstanding natural values that exist within Victoria. In order to identify representative sites, Victoria's coastal environment was divided into 'bioregions', an approach that was consistent with strategies to provide a national representative system of marine protected areas (IMCRA Technical Group 1998).

In Victoria, five bioregions have been defined following analysis of existing physical and biological data. This analysis aimed to identify regions which were internally homogenous and that differed from adjacent regions (LCC and DCNR 1994). The conceptual model that underlies the bioregion approach recognises that biophysical processes are influential in driving patterns of biological diversity and productivity in the coastal and marine environments (IMCRA Technical Group 1998).

1.3.1 PHYSICAL CONTEXT

Physical processes are important in shaping biological habitats and biodiversity at a range of scales. At a continental scale an important process is the pattern of currents that will impact on the coastal environment. In a summary of the more recent relevant literature O'Hara (2000) describes the Leeuwin Current that arises in the warm Indonesian waters and flows south along the coast of Western Australia in the summer and then east into the Great Australian Bight. From there it is replaced by the warm saline Great Australian Bight Current and then by the weaker Zeehan Current that runs as far east as the western coast of Tasmania. The East Australian Current flows south from the Coral Sea south along the coasts of Queensland and New South Wales. A series of warm water eddies can be pushed further south into eastern Bass Strait.

The main physical processes that were important in defining the bioregions relevant to Victoria are summarised below.

Otway Bioregion

The coastline of the Otway Bioregion is typically high energy with the western region typified by a high deepwater wave energy, attenuated by a steep offshore-nearshore gradient and offshore reefs which provide moderate to low energy conditions. Waters are cold temperate and, in the west of the region, there are localised, regular, cold nutrient-rich coastal upwellings (IMCRA Technical Group 1998).

Central Victoria Bioregion

The Central Victoria bioregion is subject to moderate wave energy. The section from Cape Otway to Point Lonsdale is south east facing and protected from the dominant swell direction, while the easterly section (Point Lonsdale to Wilsons Promontory) faces south west and receives some of the south westerly swell. Seawater temperatures are representative of Bass Strait waters (IMCRA Technical Group 1998).

Flinders Bioregion

The Flinders bioregion is characterised by highly variable wave exposure, especially on Wilsons Promontory where the eastern side is protected from the dominant south-west swell direction. Tidal velocities and amplitudes also vary greatly due to the constricted eastern entrance to Bass Strait (IMCRA Technical Group 1998).

Twofold Shelf Bioregion

Water temperatures in this bioregion reflect the influence of warmer waters brought into Bass Strait by the East Australian Current. Intermittent upwellings occur along parts of the East Gippsland coast. Wave energy is relatively low, particularly on the broader shelf area in the Gippsland Basin (IMCRA Technical Group 1998).

Victorian Embayments Bioregion

The Victorian Embayments are characterised by small size and limited fetch. They have large changes in tidal phase and amplitude relative to the open coast. Large and rapid changes in tidally induced velocities also occur (IMCRA Technical Group 1998). High velocity tidal currents are often associated with a large phase shift of incoming tidal waves in the entrances of the embayments and while there may be additional currents superimposed, these are negligible compared to the tidal velocities (LCC and DCNR 1994).

1.3.2. BIOLOGICAL CONTEXT

The presence and abundance of different species within an assemblage will be determined by a combination of physical, chemical and biological processes that take place on a range of scales. The flora and fauna of the shallow water marine environment of Victoria is considered to be extremely diverse and highly endemic (O'Hara 2000) and this is considered to be the result of a combination of physical and biological processes that have taken place on a large temporal and spatial scale. Before Australia and Antarctica split there was an eastern cool water fauna and a western warm water fauna. The split allowed the western and eastern faunas to mix and since that time the evolution of endemic species in southern Australia has been enhanced by invasions of tropical species and a smaller number of Southern Ocean species arriving by the circumpolar subantarctic currents (O'Hara 2000). Many species are thought to reach the edge of their geographic range within Victoria, with the Central Victoria Bioregion hosting the limit of the eastern or western ranges for a large number of species (see Tables 2.4.4 and 2.14.3).

The main biological information that was important in defining the bioregions relevant to Victoria are summarised below.

Otway Bioregion

The bull kelp *Durvillaea potatorum* typically dominates the intertidal and sublittoral fringe on wave-exposed coasts. Rocky subtidal macroalgal communities tend to be dominated by *Macrocystis angustifolia*, *Phyllospora comosa* and other large brown fucoid species. Fish and plant species-richness is high in the Otway Bioregion (IMCRA Technical Group 1998).

Central Victoria Bioregion

Marine fauna and flora are typically cool temperate species. Sheltered rock platforms are usually covered in a mixed algal assemblage, including various green (e.g. *Codium*, *Caulerpa*), brown (*Cystophora*, *Sargassum*) and red algal species. This assemblage continues into the shallow subtidal (5-20 m) on south east facing coasts such as off Point Lonsdale and the Bunurong. The more exposed coasts tend to be fringed with *Durvillaea* with mixed *Phyllospora* and *Ecklonia* stands occurring on the subtidal reefs. Small beds of the seagrass *Amphibolis antarctica* occur on sandy patches in sheltered locations (IMCRA Technical Group 1998).

Flinders Bioregion

Fish and plant species richness is typically high in the Flinders Bioregion. Warm temperate species that are commonly found in New South Wales are also present in low numbers in the Flinders Bioregion (IMCRA Technical Group 1998).

Twofold Shelf Bioregion

The fauna of this bioregion is generally characterised by distinctive assemblages of reef fish, echinoderms, gastropods and bivalves. The reefs are typically dominated by warm temperate species that are common in New South Wales, such as the urchin *Centrostephanus rodgersii* that grazes heavily on macroalgae on shallow reefs (IMCRA Technical Group 1998).

Victorian Embayments Bioregion

The Victorian bays and estuaries contain a diverse range of biotic assemblages depending on their morphological and hydrological characteristics. Seagrass beds, sandy beaches and rocky reefs fringe the muddy central region of the marine embayment of Port Phillip Bay. Western Port and Corner Inlet are large muddy estuaries with extensive mudflats and seagrass beds. The small narrow estuaries in western Victoria have an impoverished benthic fauna compared to those in the east, which tend to be larger and better wind-mixed (IMCRA Technical Group 1998).

Processes

There are a number of biological and physical processes that interact to have an important influence on the structure and composition on populations and assemblages. It is beyond the scope of this report to consider all of these but we have highlighted a number of processes that are known to be of importance in Victoria's marine environment.

Recruitment

For many marine species, recruitment to a population is dependent on the dispersal of larvae or propagules and this in turn will be affected by an interaction between factors such as currents, the pelagic duration, buoyancy and behaviour of the larvae as well as the availability of a suitable settlement site (LCC and DCNR 1994). For example, certain areas within Port Phillip Bay are known to be important nursery areas for the commercially targeted King George whiting (Jenkins *et al*. 1993a). These areas provide suitable settlement sites for a species with a long larval duration that disperses many hundreds of kilometres and are thought to be of particular importance because of the position of the seagrass beds in relation to the currents (Jenkins *et al*. 1993a).

Other species such as abalone have a short pelagic larval duration and other biological processes such as predation or competition for food or space may determine successful recruitment to the population. For the majority of populations there is little information regarding whether certain areas act as a 'source' or a 'sink' for that population and also how connected populations are across a range of spatial scales.

Productivity

The coastal marine environment of Victoria is naturally low in nutrients but in certain areas there are upwellings of nutrient rich waters that stimulate phytoplankton growth and are highly productive. Areas within the Otway Bioregion in particular, are known to be important feeding grounds for whales and the Southern Right Whale and the Blue Whale can be seen in the west of this bioregion including Discovery Bay Marine National Park. Elevated larval concentrations of a number of fish species have also been recorded from this area and may have been related to the high primary productivity associated with an upwelling event (Neira *et al*. 2000). The main species contributing to these elevated larval abundances were the pilchard (*Sardinops sagax*) and to a lesser extent the jack mackerel (*Trachurus declivis*).

Neira *et al.* (2000) also found elevated larval fish concentrations and a high species diversity in the region of Ninety Mile Beach. They attributed this partly to the abundance of the nearshore rocky reef habitats at Wilsons Promontory, but also to the presence of an inshore anticyclonic eddy, with the prevailing eastward current and the protruding topography of

Wilsons Promontory combining to favour the retention of ichthyoplankton in this area during summer.

Saltmarsh, mangrove, seagrass and muddy sediments tend to be very productive environments and these habitats are restricted to the Victorian Embayment Bioregion. These habitats often have a high amount of organic/detrital matter that supports the growth and turnover of microalgae, meiofauna and macroinvertebrate fauna, which in turn provide food for higher trophic levels such as fish and birds.

Seagrass meadows are habitats for both commercial and recreational fish species. The diversity, biomass and abundance of fish is usually higher in seagrass beds compared with adjacent unvegetated habitats (Jenkins *et al*. 1997). Seagrass meadows serve as nursery areas for juvenile marine fauna by providing food and shelter from predators (Jenkins *et al*. 1997).

Currents can also be very important in the delivery of food. The entrance to the Victorian Embayments are characterised by a diverse and abundant sessile invertebrate assemblage, which is the result of the very high velocity tidal currents delivering planktonic food to these primarily filter feeding assemblages.

Migration

There are a number of birds, fish and marine mammals that migrate vast distances within a year. These migratory species can often be considered to use most, if not all, of Victoria's coastal or nearshore marine areas and may be particularly dependent on certain areas for feeding, resting or breeding.

Habitats

The physical and biological habitat types that are present in each bioregion are also determined by a combination of physical, biological and chemical factors. The Marine and Coastal Special Investigation Descriptive Report (LCC 1993) identified eight main habitat types: intertidal rocky shores, subtidal rocky reefs, seagrass beds, sheltered intertidal flats, sandy beaches, subtidal soft substrates, mangroves and the pelagic environment. All of these broad habitat types are well represented within Victoria's Marine National Park and Sanctuary system. Areas with more than five of these broad habitat types present are considered to have a high diversity of habitats (LCC 1994a).

Each of the different broad habitat types will generally support a different biological assemblage and so areas with a diversity of broad habitat types are likely to have greater overall biodiversity. Within each broad habitat type there may also be a variety of microhabitats such as kelps on subtidal rocky reefs which provide extra structural complexity (e.g. stipe and holdfast) but can also provide shelter, food or a refuge from predation or competition. Similarly, a range of larger physical structures on a subtidal rocky reef such as bommies, crevices, ledges, sinkholes etc provide a variety of microhabitats likely to influence the numbers and types of species present.

Marine Flora and Fauna

The marine flora and fauna in each bioregion will consist of assemblages that may be dominated by the same species. For instance, the bull kelp *Durvillaea potatorum* may dominate in the extremely exposed, shallow reef habitats of the Otway Bioregion and associated species might include the encrusting coralline algae and the molluscs *Turbo undulatus* and *Haliotis rubra* (Parks Victoria 2002). The types and densities of the species present (assemblage structure) might also be determined by a variety of physical and biological factors that are influential on a smaller scale than bioregion, and so assemblage structure might differ between similar habitats within a bioregion. Both the similarities and differences between different ecological assemblages are of interest, although at present, the existing information on smaller scale patterns in assemblage structure is limited.

An important contributing factor to the differences in species composition within and between bioregions is likely to be the geographical limits of a species' range as a result of physical, chemical or biological constraints. Species or assemblages that are unique to an area, such as the dense population of the highly unusual "living-fossil" animals known as brachiopods (*Magellania australis*) which are very rare worldwide, found in the Churchill Marine National Park, are of particular interest. Many other species are endemic to Victoria or reach the edge of their geographical range within Victoria.

Rare and Threatened Species

A number of species that occur in the Marine National Parks and Sanctuaries are listed as threatened under the Flora and Fauna Guarantee Act 1998 and/or the National and Victorian lists of threatened species. The majority of these are shorebirds (see Appendix 4), with the few marine species listed being the larger more mobile species that may pass through the Marine National Parks system (e.g the Great White Shark *Carcharodon carcharias* and Grey Nurse Shark *Carcharias taurus* have both been nominated for listing under the FFG). Species level conservation in marine systems tends to differ from terrestrial systems, as knowledge of the marine systems is far more limited. This makes it difficult to assign species as rare or threatened with any confidence as they may be present in areas that are yet to be surveyed in any detail.

1.4 Natural Values

Natural values are summarised for each Marine National Park and Sanctuary in a consistent format. In view of the large number of sites that had to be addressed, the report focuses on physical parameters, habitats and ecological communities. It was beyond the scope of this project to present exhaustive species lists of all possible taxonomic groups for each Marine National Park and Marine Sanctuary, but rather the project has focussed on the primary marine species found across the State and seeks to highlight the differences in species distributions across the Marine National Parks system. The project also addresses significant and notable marine species that have been identified within each Marine National Park or Marine Sanctuary.

1.4.1. PHYSICAL PARAMETERS

The physical environment plays an important part in determining the habitats and biological environments of the Marine National Parks and Marine Sanctuaries. Basic physical parameters that are influential in each Marine National Park or Marine Sanctuary are summarised in a table format for each Marine National Park or Marine Sanctuary (Table 1.1).

Table 1.1 Physical parameters descriptive table.

Park Name	**Park Name**
Conservation status	Marine National Park or Marine Sanctuary
Biophysical Region	Region defined by IMCRA Technical Group 1998
Size of Park	Area in hectares
Length of coastline	Coastline length in metres
Exposure rating	High/Med/Low
Wave Energy	High/Med/Low
Influential currents	Locally significant currents (*e.g.,* tidal channels or The Rip in Port Phillip Bay)
Tidal variation – springs	Spring tides height range in metres
Tidal variation – neaps	Neap tides height range in metres
Water temp – summer	Average summer surface temperature (°C)
Water temp – winter	Average winter surface temperature (°C)
Depth ranges	Area (hectares) of depth ranges found in each park (*e.g.,* 0-10 m, 10-20 m etc.)
Discharges	Rivers, creeks and stormwater drains discharging into the park
Adjacent catchment	Nearby land-use

Depth information for each Marine National Park was extracted from bathymetry spatial layers held in MAFRI's GIS database for Bass Strait, Port Phillip, Western Port and Corner Inlet. Depth information for the outer coast is based on a 1:250,000 bathymetry layer digitised from charts produced by the Australian Hydrographic Office. Due to the method of hydrographic surveys utilised in producing these maps, there was only limited information for depths less than 20 m and the 10 m depth contour was created by MAFRI by interpolating between the 20 m contour and a 1:250,000 coastline. As a result the depth values for the 0-20 m depth range are approximations and there was no information available for the intertidal zone on the outer coast.

The depth charts for the bay and inlets were produced at a smaller scale (1:10,000 – 1:25,000) and provided a greater level of detail for the shallow depths including reasonably accurate representations of the intertidal zone. As a result the depth ranges for the Marine National Parks and Marine Sanctuaries within the bays are at five metre increments while the outer coast Marine National Parks are in ten metre increments.

Tidal ranges for each Marine National Park were derived from the Victorian Tide Tables produced by the VCA from information supplied by The National Tidal Facility – Flinders University (VCA 2003).

Water temperature ranges for most of the Marine National Parks were derived from NOAA sea surface temperature data analysed by O'Hara (2000). In Port Phillip Bay and Western Port, temperature data was available from the records of the EPA water quality monitoring programs.

The discharges listed are derived from GIS layers which describe major storm-water outlets, creeks and rivers on the landward boundary of the Marine National Parks and Marine Sanctuaries. This section does not describe other potential runoff from non-defined sources.

Adjacent catchment is a general description of the predominant nearby land-use, in the localised area immediately adjacent to the Marine National Park or Marine Sanctuary.

1.4.2. MARINE HABITAT CLASSES

Ferns and Hough (2000) present a system of interim Marine Habitat Classes (MHC) for the Victorian coast. These habitat classes aim to provide a more detailed description of the common habitats in an area than the eight main habitat types defined by the LCC (1993) and so can function as surrogates to describing marine biodiversity at scales of 1:25,000 to 1:100,000 (Ferns and Hough 2000). The habitat classes defined by Ferns and Hough (2000) include both physical and biological attributes as some large, common species (e.g. kelp or seagrass) provide habitat for other species. The MHC attributes are mainly qualitative and represent those features that can be readily observed through aerial and satellite remote sensing techniques and field surveys using underwater divers, videos and benthic grabs.

In order to describe the Marine National Parks we have adopted the MHC definitions for intertidal and subtidal environments presented by Ferns and Hough (2000), but for the purposes of this report the intertidal (Table 1.2) and subtidal habitat attributes (Table 1.3) are presented in a single descriptive MHC table. We have excluded from this table the substratum texture attributes for soft sediment (*e.g.,* degree of ripples, ridges etc) as this level of description is rarely available in the information sources. Reef understorey biota has also been amalgamated with the dominant reef biota as again, available information frequently does not differentiate between dominant and understorey categories. Similarly, the seagrass density category has not been included.

Table 1.2 Interim MHC attributes for intertidal areas (Ferns and Hough 2000).

Description	Intertidal MHC Attributes		
Shoreline category	Dune Beach Platform	Beach / Platform Reef Cliff (steep or inclined)	Lagoon Flat Artificial seawall
Intertidal area/zone	Coastal/Backshore Supralittoral	Littoral Infralittoral fringe	
Substratum type	Bedrock Bedrock (broken) Bedrock/rock Cobble	Boulder/cobble Sand Sand/Gravel Sand/Bedrock	Mud Mud/Sand Artificial structure (ie Concrete/Wood/Metal)
Lithology	Basalt Sandstone Granite		Limestone Calcarenite
Wave Energy/Exposure	Low	Moderate	Moderate – High
Dominant structural biota	Coastal scrub Coastal heath Mangrove Salt marsh Seagrass	Fleshy algae – mixed greens Fleshy algae – mixed browns *Durvillaea* *Hormosira* Turf algae	Coralline algae *Pyura* Mussels Barnacles

Table 1.3 Interim MHCs for sub-tidal reef and sediment substrata across Victoria (Ferns and Hough 2000).

Description	**Sub-tidal MHC Attributes**			
Substratum type	Reef		Sediment	
Substratum relief	Low profile (reef) (<1m high) Heavy (reef) (>1m high)		Flat (sand / mud) Ripples (sand) Gently undulating ridges (sand) Steeply undulating ridges (sand)	
Substratum texture	Solid (not broken into fragments) Broken (boulders/slabs/bommies) Gutters (gutter-like depressions or chutes) Outcrops (reef breaking the surface)		Coarse sand (0.5-1.0 mm) Medium sand (0.25-0.5 mm) Very fine/fine sand (0.125- 0.25 mm)	Muddy Sand Mud/silt (<0.031 mm) Shelly rubble / grit
Substratum consistency	Continuous	Patchy		
Lithology	Basalt Granite	Sandstone	Limestone Calcarenite	
Dominant reef biota	Kelp – *Phyllospora* dominated Kelp – *Macrocystis* dominated Kelp – *Durvillaea* dominated Kelp – *Ecklonia* dominated Kelp – Mixed *Phyllospora* / *Ecklonia* Mixed algae – Brown algae dominated Mixed algae – other		*Cystophora* dominated *Acrocarpia* *Seirococcus* *Amphibolis* *Cystophora* / *Amphibolis* Sessile invertebrates (*e.g.,* sponges)	Red algae Urchin barrens
Reef understorey biota	Encrusting coralline algae Mixed red algae Sessile invertebrates		*Caulerpa* dominated Mixed algae *Plocamium* dominated	
Dominant sediment biota	*Halophila* *Posidonia* *Amphibolis* *Zostera*	*Heterozostera* *Ruppia* Mixed seagrass/algae *Caulerpa* dominated	Mixed *Zostera* /*Posidonia* / *Halophila* Mixed *Posidonia* / *Halophila* Mixed *Zostera* / *Posidonia* Mixed *Zostera* / *Halophila*	
Seagrass density	Sparse	Medium	Dense	

GIS data for marine substrates and seagrass distribution have been used to derive area statements for reef types, bare sediment and seagrass categories. The marine substrate habitat GIS layer for the outer coast (Substrata100) was developed to provide an overview of the shallow marine habitats (reef versus sediment) at a statewide level. The layer consists of data collected by two methods (Landsat TM imagery and hydro-acoustic surveys) and the level of ground-truthing of this remote-sensing information is variable across the State. The current layer therefore varies greatly in its accuracy in depicting the extent of reef systems and depth of habitats represented. Some caution must therefore be applied to the reef area statements provided in the marine habitat tables as they may be either an over or underestimate of the actual reef habitat in the Marine National Park. By contrast, the bay and inlet seagrass layers were generated from high resolution aerial photography (1:10,000) and extensive ground-truthing. However, seagrass displays considerable temporal variation and the area statements presented in the marine habitat tables may vary greatly between years and/or seasons.

1.4.3. MARINE ECOLOGICAL COMMUNITIES

A qualitative "community-level" classification approach has been taken in this report to provide an overview of the larger, more visible and common species at each Marine National Park as an indication of the assemblage characteristics. This provides an output that is consistent with outcomes of the quantitative analysis presented in the Stage 3 report (Ferns and Hough 2000). There will inevitably be a certain amount of overlap with the Marine Habitat Class section as some of the larger, more visible and common species are also attributes of the Marine Habitat Classes (e.g. kelps). The aim of this section is to provide a broad description of the different assemblage types associated with each of the main habitat types defined by the LCC (1993).

1.4.4. BIOLOGICAL PROCESSES

While a suite of interacting processes drives the distributional patterns of marine flora and fauna, we have opted to focus on a small number of important biological processes in this section. Areas known to be important spawning, recruitment or nursery grounds within a Marine National Park or Marine Sanctuary are identified and regions known to be subject to highly productive upwellings have also been highlighted.

1.4.5. SPECIES DISTRIBUTION INFORMATION

To supplement the community level approach described above, species level information has also been incorporated into the report where information was available for particular species groups (e.g. fish, echinoderms, algae, decapods).

Victoria has a high degree of endemism and species that are endemic to Victoria or that have a very restricted distribution have been identified. Many species are thought to reach the limit of their eastern or western geographical range within Victoria, which contributes to the high biodiversity of Victoria's marine system. Where the information is available, species that reach the limit of their geographical distributions within or near to a Marine National Park or Marine Sanctuary have been identified.

In order to be consistent with the scale of information available in one of the primary databases used for this study (Marine Research Group of Victoria), the following definitions were used to identify species at the edge of their geographical distributions:

1. Species that are at, or near (within 20 km) their presumed geographic limits and that have been recorded from within a Marine National Park or Marine Sanctuary.
2. Species that are at, or near (within 20 km) their presumed geographic limits and that are presumed to be present within a Marine National Park or Marine Sanctuary because they have been recorded within a 5 km radius on similar habitat.
3. Species that are thought to be restricted to a particular Marine National Park or Marine Sanctuary (limited number of species only).

A degree of caution should be applied by users of this data. The list of endemics and restricted species is incomplete. Many faunal and floral groups are not known well enough to confidently assert that they are endemic to Victoria. The data on distribution limits in many cases reflects collection effort. For example many species are recorded as finishing at Wilsons Promontory. This may reflect the large number of specimens we have from that particular locality. An intensive survey of the subtidal reefs off the Ninety Mile Beach would undoubtedly increase the range of some species formerly thought to finish at Wilsons Promontory. This is particularly true of many smaller species of algae and invertebrates. For one group (molluscs), the published distribution information is usually imprecise and at the scale of ‘State’ (*e.g.,* Victoria and Tasmania). Most of these species (approximately 450) were omitted from the lists as it is unclear exactly where their distribution limits occur.

Data on the known distributions of 1) endemic species and 2) species with restricted populations within Victoria was compiled from O’Hara & Barmby (2000) and O’Hara (2002). Data for species with distribution limits was initially compiled from published literature of species ranges. This information was then updated with information from the databases of the Museum Victoria, Marine Research Group of Victoria, Marine Science and Ecology, and from O'Hara (O'Hara 2001).

1.4.6. SHOREBIRDS

The Victorian coastal environment represents an important habitat for numerous shorebirds. Amongst the birds likely to be observed in the Marine National Parks system are vagrants from the southern ocean as well as regular visitors feeding in Bass Strait. Shorebirds feeding and roosting on rocky platforms and beaches of the open coast, migratory waders feeding on intertidal flats in bays and inlets and roosting on the shore and mangroves are also likely to be observed. A list of shore and ocean birds observed in Bass Strait with threatened status or subject to international treaties is given in Appendix 4.

A list of threatened shorebirds recorded since 1980 is also provided for each Marine National Park and Marine Sanctuary. This list is based on analysis undertaken by the Arthur Rylah Institute for the Victorian Oil Spill Response Atlas (ARI 1999), the Victorian Threatened Fauna database and the Atlas of Victorian Wildlife. The species tables identify the national and state conservation status of each species (see Appendix 3) and also includes those species subject to the international treaties; Japan Australia Migratory Birds Agreement (JAMBA) and the China Australia Migratory Birds Agreement (CAMBA). As with the marine species records, the records of shorebirds also the level of sampling effort, and further shorebird species may be observed in the parks with further observations.

1.4.7. MARINE MAMMALS

Many marine mammals, mostly species of whales and seals, are seasonal visitors to Victorian waters and may move through areas near to the Marine National Parks at certain times of year. Other species may travel fairly large distances as part of their normal behaviour and so may be seen periodically within or near to Marine National Parks and Marine Sanctuaries. Table 1.4 lists threatened marine mammals sighted in Victorian coastal waters since 1980.

The Australian Fur Seal (*Arctocephalus pusillus*) is a permanent resident of Victorian coastal waters and large breeding colonies are located at Kanowna Island, Lady Julia Percy Island and Seal Rocks, Phillip Island. In addition, seals use rocky reef platforms and islands that are spread along the coast as ‘’haul outs’’ and so have a regular presence in some of the Marine National Parks or Marine Sanctuaries including Wilsons Promontory, Port Phillip Heads, Beware Reef and Marengo Reefs.

The most commonly recorded dolphins in Victorian waters are the common dolphin, *Delphinus delphis*, and 2 morphological forms of the bottlenose dolphin, the inshore bottlenose, *Tursiops aduncus* and the offshore bottlenose, *T. truncatus*. In eastern Australia *T. aduncus* inhabits estuarine and coastal ocean waters to about 30 m, while *T. truncatus* has been identified predominantly in deeper waters and to the edge of the continental shelf (Hale 2002).

Most dolphin research in Victoria has centred on the apparently resident population *of T. aduncus* in Port Phillip Bay. The population is estimated to consist of approximately 80 individuals, with numbers fluctuating due to transient individuals entering and leaving the bay. The dolphins are rarely sighted in the northern half of Port Phillip Bay, preferring instead to remain just inside the entrance to the bay along the stretch from Portsea to Rye. It is thought that the combination of topography, foraging opportunities and food availability is the reason for the dolphins utilising this area (Hale 2002).

Table 1.4 Threatened marine mammal sightings in Bass Strait since 1980 (AVW). See Appendix 4 for threatened status codes and definitions.

Name	Scientific Name	FFG Listed	National Status (EPBC)	State Status (TWV)
Australian Fur Seal	*Arctocephalus pusillus*			Vul
Southern Elephant Seal	*Mirounga leonina*		Vul	
Subantarctic Fur Seal	*Arctocephalus tropicalis*		Vul	
Blue Whale	*Balaenoptera musculus*	L	End	Cen
Humpback Whale	*Megaptera novaeangliae*		Vul	End
Southern Right Whale	*Eubalaena australis*	L	End	Cen

1.4.8. SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

The Victorian coast is characterised by a diverse geology and a number of features have been identified as sites of significance (see Buckley 1993). Minerals and Petroleum Victoria maintains a database of the sites and this dataset was displayed with the Marine National Park boundaries in a GIS to identify sites located within or adjacent to the Marine National Parks. While some significant features such as shore platforms lie within the Marine National Park boundaries, many of the features are located above the high water mark in the coastal cliffs, but where these features are adjacent to the Marine National Park they have also been identified within the report.

1.4.9. KNOWLEDGE GAPS

A variety of information sources were used in the compilation of this report, ranging from quantitative surveys of elements of the marine flora and fauna, to anecdotal reports from local residents. In this section we have summarised the level of information that was available for the main habitat types in the Marine National Park or Marine Sanctuary.

1.4.10. RESEARCH AND MONITORING

Research is considered to be of high value to the Marine National Park system (Parks Victoria 2002) and a list of recent relevant primary research and monitoring programs uncovered in the review process have been identified. In order to identify as much relevant published research as possible within the time frame of the project, a search was undertaken on two databases (Biological Abstracts – Ovid and Current Contents – ISI) that spanned the years 1980 to the present. Search terms included the names of the Marine National Parks and Marine Sanctuaries as well as names of nearby reefs, headlands, islands, spits, artificial structures and beaches. This search was supplemented by data already uncovered in the review process and discussions with University staff within Victoria. While this search process was by no means exhaustive (particularly for unpublished literature) it should have uncovered the majority of research relevant to the Marine National Parks and Marine Sanctuaries. If you know of research or monitoring, published or unpublished, that is relevant for a Marine National Park or Sanctuary and has been missed by this report, please fill it in on the Feedback Sheet in Appendix 1.

1.5 Information Sources and Databases

A range of information sources were used in the compilation of this report, many of which resulted from the Marine, Coastal and Estuarine Investigation undertaken by the Environment Conservation Council. Published material (listed in the full bibliography at the end of the report), included:

- Internal (DNRE, DSE or DPI) technical reports
- Parks Victoria reports (including management plans for specific areas)
- Consultants reports
- Land Conservation Council reports
- Scientific papers in various journals
- Ph.D, masters and honours theses'
- Recreational guides (diving, fishing etc.)

The above information was supplemented by discussions with people with an intimate knowledge of the various Marine National Parks and Marine Sanctuaries such as community group members, divers, park rangers and scientists.

A number of digital datasets were also available that provided quantitative and descriptive information about habitats and species in and around the Marine National Parks and Marine Sanctuaries. The primary datasets used in this study were as follows:

- DSE, DPI & Parks Victoria Subtidal Marine Monitoring Program (MS Access database produced by Australian Marine Ecology).
- Video, diver and sediment grab sampling sites undertaken for the Environmental Inventory of Victoria's Marine Ecosystems (MS Access database produced by MAFRI).
- MAFRI's Abalone reef monitoring program (MS Access database).

- Museum of Victoria marine species databases.
- Victorian Marine Research Group database.
- Geospatial data outlined below.

Shorebird information presented in the report was largely derived from analysis undertaken by the Arthur Rylah Institute for MAFRI as part of the Oil Spill Response Atlas program (ARI 1999) and through an assessment of information in the Victorian Threatened Fauna database and the Atlas of Victorian Wildlife.

1.6 Geospatial Data and Mapping

This report relied upon existing digital spatial data in a GIS format to assist in determining habitats and depth information at each Marine National Park site. The available spatial layers included:

- Marine National Park and Sanctuary boundary layer (Parks Victoria).
- Marine substrata layer for Victoria's open coast (derived from Landsat imagery and hydro-acoustic mapping by MAFRI).
- Seagrass habitat layers for bays and inlets (Port Phillip, Western Port and Corner Inlet).
- Shoreline coastal type layer (Oil Spill Response Atlas – MAFRI)
- Shorebird habitats and roosts (Oil Spill Response Atlas and DNRE)
- Threatened Fauna point records (DNRE)
- Atlas of Victorian Wildlife point records (DNRE)
- Bathymetry layers for Bass Strait (1:250,000) and bays and inlets (1:25,000) (MAFRI database and sourced from VCA and Australian Hydrographic Office databases).
- Sites of Geological and Geomorphological Sites of Significance layer (Minerals and Petroleum Victoria).

A process of intersecting the Marine National Park boundaries with the marine substrate, seagrass habitat and bathymetry layers was undertaken within the GIS to determine areas of habitats and depth ranges found within each Marine National Park and Marine Sanctuary. It is important to note that issues of spatial and temporal scale, data collection methodologies and variability of the marine and coastal environment place limitations on the precision of the spatial datasets and this is discussed further in the section on data limitations.

The above spatial layers and the point locations of sampling sites identified in the previous section were used to produce a marine and coastal habitats and sampling/monitoring site map and a shorebird and other fauna values map for each Marine National Park and Marine Sanctuary. See Appendix 1 for Marine National Park maps and See Appendix 2 Marine Sanctuary maps.

1.7 Data Formats For Datasets Produced By This Report

The report presents summary information in a tabular format for each Marine National Park and Marine Sanctuary that describes physical parameters, marine habitat classes, biota with distributional limits and threatened fauna (shorebirds and marine mammals).

1.8 Data Limitations

There are a number of limitations to these data sources that are relevant to the Marine National Parks system as a whole and are summarised briefly below.

1. There are very little quantitative data available for all the habitats within the Marine National Park system in Victoria. The majority of the quantitative survey information comes from the subtidal rocky reefs initiated as part of the Environmental Inventory of Victoria's Marine Ecosystems Stage 3 (Ferns and Hough 2000). These surveys were targeted at algae, seagrasses, sessile invertebrates (excluding sponges, ascidians, cnidarians and other minor phyla such as sipunculids) and larger motile invertebrates (O'Hara 2000); or algae, larger benthic invertebrates (non-sessile molluscs, echinoderms and crustaceans) and fish (Edmunds *et al*. 2000). The target groups and the sampling strategies used in these surveys do not provide comprehensive species lists. For example, visual surveys may not provide good estimates of abundance for all fish species (Willis *et al*. 2000) and so there will be consistent biases in the majority of the quantitative information available. There are exceptions to the detail of information available across the Marine National Parks system; quantitative data are available for a range of habitats in Bunurong and Wilsons Promontory, Corner Inlet and Port Phillip Heads Marine National Parks, but other areas are less well known.
2. The pelagic environment has been recognised as one of the eight main habitat types in Victoria (LCC 1993) but as there is very little specific information on this environment we have not addressed this habitat separately in the report.
3. There is a range of material that has been used in collating this report and the sources vary in their age and hence the degrees to which they reflect the current situation. We do

not envisage this to be a major limitation of the report due to the emphasis on common and visible taxa but the user should be aware of it.

4. Identifying endemic or species with restricted ranges is difficult as in many cases the distribution limits are likely to reflect sampling effort. An increased and more even sampling effort across Victoria is likely to result in ‘range extensions’ for many species.
5. The spatial habitat data available for the Marine National Parks and Marine Sanctuaries have been collected at differing scales (*e.g.,* outer coast marine substrates 1:100,000 and bay and inlet seagrass habitats 1:25,000), different time frames and with different mapping techniques which presents some inconsistencies when this data is merged to derive habitat area statements. This situation is further complicated by a lack of a definitive coastline layer and position of the high and low water marks in a GIS format. As a result, the different spatial layers have inconsistent landward boundaries that create “slivers” when the polygons from different layers are overlayed.
6. The extent of the intertidal zone (*i.e.,* high and low water marks) is not accurately defined along the outer coast. Similarly, there is only limited hydrographic survey information for the shallow depths (<15-20 m) along the outer coast.

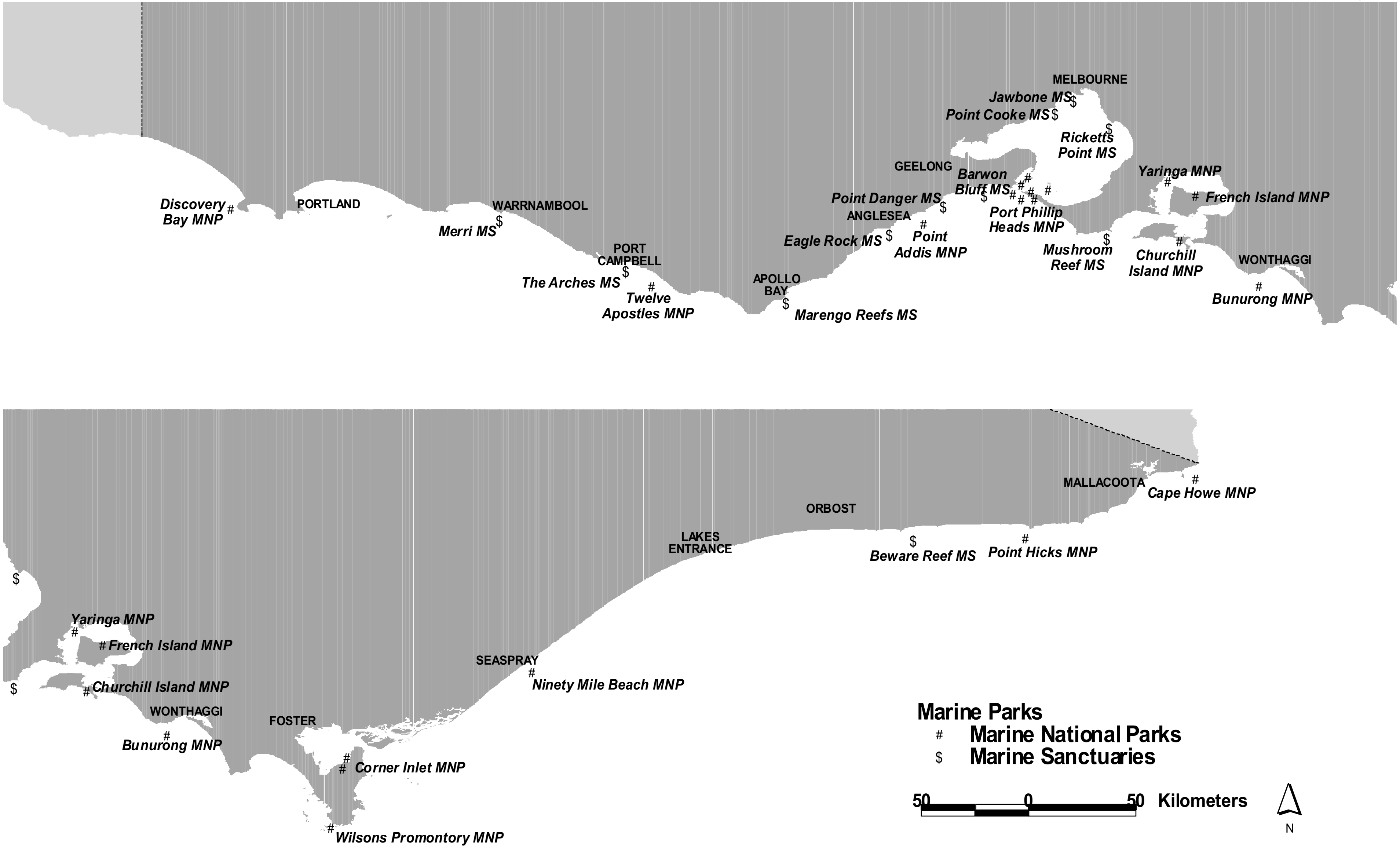

Figure 1.1. Marine National Park and Sanctuary site map.

2.1 Discovery Bay Marine National Park

Discovery Bay Marine National Park is the western most park in Victoria and is representative of the Otway Bioregion. The area is characterised by complex calcarenite formations and contains the largest coastal formation of basalt in western Victoria (Bird 1993). The subtidal calcarenite reefs support a rich diversity of sessile invertebrates including sponges, ascidians, bryozoans and gorgonians. Mobile animals, including blue whales and great white sharks, are also a transient presence in the Marine National Park. Significant populations of abalone and rock lobster are also present.

2.1.1 PHYSICAL PARAMETERS

The Discovery Bay Marine National Park is located about twenty kilometres west of Portland in the western bioregion region of Victoria. The Marine National Park extends about two kilometres along the coastline north of the Blowholes at Cape Duquesne to 1.5 km northwest of Bridgewater Lakes in Descartes Bay and offshore three nautical miles. Between Cape Duquesne to Whites Beach, an area extending 500 m seaward from the high water mark is excluded from the Marine National Park. The Discovery Bay Coastal Park runs along the land adjacent to the Marine National Park from Whites Beach to Blacks Beach.

Table 2.1.1. Physical parameters of the Discovery Bay Marine National Park.

Park Name	**Discovery Bay**
Conservation status	Marine National Park
Biophysical Region	Otway
Size of Park (ha)	2770
Length of coastline (m)	2280
Exposure rating	High
Wave energy	High
Influential currents	None
Tidal variation - springs (m)	0.8
Tidal variation - neaps (m)	0.4
Water temp - summer (°C)	17
Water temp - winter (°C)	14
0 - 10 m (ha)	110
10 - 20 m (ha)	90
20 - 30 m (ha)	440
30 - 40 m (ha)	390
40 - 50 m (ha)	260

50 - 60 m (ha)	660
70 - 80 m (ha)	30
Discharges	None
Adjacent catchment	Coastal Park

2.1.2 MARINE HABITAT CLASSES

Acoustic and video analysis of the Discovery Bay Marine National Park found four distinct subtidal habitat groupings: sand, low-profile calcarenite reef, heavy basalt/calcarenite reef and heavy calcarenite reef (Roob *et al*. 1999). Intertidal habitat classes include sandy beaches and intertidal reef (ECC 2000).

Subtidal calcarenite-capped basalt reefs, which are mostly of low profile with gutters and sunken pits, extend offshore to a depth of about 35 m and solid basalt reefs occur only close inshore in the south-east of Discovery Bay (Roob and Currie 1996). Interspersed with the reefs are large areas of subtidal sand, shell grit, calcarenite rubble and gravel (Roob and Currie 1996). The sediment consists mostly of fine sand with some coarse to very coarse sand with a high carbonate content (ECC 2000). The foreshore is characterised by large cliffs that tower above sandy beach and rock platforms.

Table 2.1.2. Marine Habitat Classes of the Discovery Bay Marine National Park (MAFRI 2003).

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
	Platform
	Beach / Platform
	Cliff
Substratum relief	Low profile reef
	High profile reef
Substratum texture	Broken reef
	Gutters
	Coarse sand
	Fine sand
	Shell rubble / grit
Lithology	Basalt
	Calcarenite
Subtidal reef biota	Kelp - Phyllospora dominated
	Kelp - Durvillaea dominated

	Kelp - Ecklonia dominated
Subtidal reef understorey biota	Mixed algae - brown dominated
	Cystophora
	Sessile invertebrates
Intertidal reef biota	Fleshy algae -mixed browns
	Durvillaea
	Hormosira
	Turf algae
	Coralline algae
	Mussels
	Barnacles
Heavy reef Area (ha)	30
Low Profile Reef Area (ha)	880
Total Reef Area (ha)	820
Sediment Area (ha)	1060
Undefined Area (ha)	850

2.1.3 MARINE ECOLOGICAL COMMUNITIES

No quantitative survey of either invertebrates or fish has been undertaken in the Discovery Bay Marine National Park, however some information can be derived from surveys of nearby areas or incidental reports. The Marine Research Group (MRG) completed a limited checklist of intertidal invertebrates on basalt reefs at nearby Cape Bridgewater and Bridgewater Bay (Handreck and O'Hara 1994a).

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.1.7.

Sandy beach

No records are available of invertebrate, macrophyte or fish fauna associated with sandy beaches.

Intertidal reef

Only qualitative data are available to describe the invertebrates, flora and fish of the intertidal reef within the Marine National Park.

Flora

Neptune's necklace (*Hormosira banksii*) is common along the intertidal rock platforms, along with areas of sea lettuce (*Ulva* sp.) and encrusting red algae. Towards the lower intertidal zone, the bull kelp (*Durvillaea potatorum*), kelp (*Macrocystis angustifolium*), and green algae (*Codium* sp., *Caulerpa* sp.) are also common (P. Arnold pers. comm.).

Freshwater springs on the cliff face support communities of green algae (P. Arnold pers. comm.).

Invertebrate fauna

Observations of the upper intertidal zone found that it is dominated by tube worms (*Galeolaria caespitosa*) and barnacles (*Chthamalus antennatus*), with mussels (*Xenostrobus pulex*) and top shells (*Austrocochlea* sp.) common close to the high tide mark. Very high abundances of the tessellated sea star (*Nectria* sp.) occur in the Marine National Park in the lower intertidal zone (P. Arnold pers. comm.). Other commonly encountered species include the elephant snail (*Scutus antipodes*), cowrie (*Cypraea* sp.), cone shell (*Conus anemone*), urchin (*Holopneustes* sp.), biscuit star (*Tosia australis*), anemones (*Actinia tenebrosa*, *Anthothoe albocincta*, *Phlyctenactis tuberculosa*), hairy stone crab (*Lomis hirta*), decorator crab (*Notomithrax ursus*) and cleft fronted shore crab (*Paragrapsus quadridentatus*). Also occasionally sighted are the blue ringed octopus (*Hapalochlaena maculosa*) and sea tulips (*Pyura gibbosa*) near the lower intertidal (P. Arnold pers. comm.).

A study by the MRG of basalt reefs at Cape Bridgewater approximately five kilometres outside the Marine National Park found a moderately rich but distinctive community of intertidal invertebrates with a diverse range of habitats, orientations and exposures. Numerous molluscs including gastropods, bivalves, chitons and opisthobranchs were present, along with sea stars, brittle stars and sea cucumbers. Crustaceans such as barnacles and crabs and other invertebrates including sea anemones and polychaetes were also found at Cape Bridgewater and Bridgewater Bay (Handreck and O'Hara 1994a).

Fish

A variety of fish live in intertidal pools and shallow subtidal gutters in the rock platform. Common species are Tasmanian blenny (*Parablennius tasmanianus*), cling fish (*Aspasmogaster tasmaniensis*), juvenile sea carp (*Cheilodactylus* sp.) and weedfish including Johntson's (*Heteroclinus johnstoni*), common (*Heteroclinus perspicillatus*) and crested (*Cristiceps australis*) varieties (P. Arnold pers. comm.).

Subtidal reef

No quantitative data are available for the subtidal reef areas within the Discovery Bay Marine National Park but video surveys provide incidental information on invertebrates, macrophtyes and fish.

Flora

Qualitative surveys of flora in and around the Marine National Park have indicated that macrophyte cover varied with depth, but was mostly restricted to areas of calcarenite reef where both red and brown algae were present at sites shallower than 33 m and only red was present at deeper sites (Roob and Currie 1996). In an area adjacent to the Marine National Park a high-profile, high-energy basalt reef at 8 m depth supported medium algal cover dominated by *Phyllospora comosa*, with infrequent specimens of *Macrocystis angustifolia* and *Durvillaea potatorum* (Roob *et al*. 1999). A sparse understorey of crustose coralline algae was also present (Roob *et al*. 1999).

An occasional *Ecklonia radiata* stipe and patches of red algae were present on a sloping basalt wall which dropped 2-3 m onto a coarse sand bottom at 18 m depth near the centre of the Marine National Park (Roob and Currie 1996). Rounded boulders less than half a metre in diameter lay in the sand at the base of the wall and were either bare or lightly covered by encrusting coralline algae (Roob and Currie 1996). The sand bottom was mostly devoid of algal growth, although a dredge survey of fine sand at 18 m found *Caulerpa* sp. (Roob and Currie 1996).

At a depth of 33 m, foliose red and brown algae were present on a broken high-profile calcarenite reef, but were more prevalent in patches of gravel rubble composed of calcarenite and basalt between reef outcrops (Roob and Currie 1996).

By 55 m depth, macroflora was sparse and limited to small clumps of foliose red algae smaller than 15 cm growing on heavily eroded low profile calcarenite with gutters and sunken pits (Roob and Currie 1996).

Invertebrate fauna

All offshore calcarenite reefs in the Park have sessile invertebrate communities (Roob and Currie 1996). A qualitative diver survey of an area of high-profile, high wave-energy basalt reef in 8 m of water in the Discovery Bay Marine National Park found small anemones and encrusting sponges under ledges and crevices along with a seastar species (possibly *Patiriella calcar*) (Roob *et al*. 1999). Most areas of basaltic reef at 18 m were virtually free of encrusting macrofaunal growths, although occasional sponges were observed (Roob and Currie 1996).

Dense communities of sessile invertebrates mainly occur between 33 m and 55 m depth (Roob *et al*. 1999). Extremely diverse sessile invertebrate communities were present with many species of sponge (including *Clathria* sp., *Crella* sp. and *Tethya* sp.), ascidian, bryozoan (including the foliose bryozoan *Orthoscuticella* sp.) and gorgonians represented (Roob and Currie 1996).

At a depth of 50 m, an area of low profile calcarenite bommies above fine sand supported a sparse cover of invertebrates on their upper surface, dominated by bryozoans including the foliose bryozoan *Orthoscuticella* sp. (Roob and Currie 1996). Sponges and gorgonians were also present in smaller numbers, whilst bare-sand patches in between supported no macrofauna at all (Roob and Currie 1996).

A qualitative survey on basalt reef was conducted on nearby Cape Nelson and is summarised in Table 2.1.3.

Table 2.1.3. Subtidal invertebrates on basalt reef at Cape Nelson approximately twenty kilometres east of the Discovery Bay Marine National Park (Tsernjavski 1995).

Scientific name	Common Name
Pentagonaster duebeni	Vermilion sea star
Petricia vernicina	Velvet sea star
Nectria ocellata	Ocellate sea star
Nectria macrobrachia	Large plated sea star
Plectaster decanus	Mosaic sea star
Coscinasterias calamaria	Eleven armed sea star
Heliocidaris erythrogramma	Common sea urchin
Comanthus trichoptera	Common feather star
Ophiodissa australis	Hydroid
Sertularia hycrocarpa	Sea fern
Halpteris campanula	Delicate feather hydroid
Anthothoe albocincta	White striped anemone
Corynactis australis	Jewel anemone
Culicia sp.	Cup coral
Sabellastarte sp.	Feather duster worm
Filograna implexa	Tangled tube worm
Sycon gelatinosum	Many lobed sponge
Haliclona sp.	Sand sponge
Tethya sp.	Golf ball sponge

Phyllospongia caliciformis	
Dendrilla rosea	Rose sponge
Clathria sp.	Orange sponge
Triphyllozoon sp.	Lace bryozoan
Orthoscuticella ventricosa	Soft orange bryozoan

Fish

Limited records of fish are available from within the Marine National Park, but a qualitative diver survey of a high-energy shallow (8 m) subtidal high profile reef found dominant species to be the saddle wrasse (*Notolabrus fucicola*). Sea sweep (*Scorpis aequipinnis*) and southern sea carp (*Aplodactylus arctidens*) were also observed (Roob *et al*. 1999).

Very high abundances of juvenile sea sweep (*S. aequipinnis*) congregate in shallow subtidal gutters in the near-shore rock platform during November (P. Arnold pers. comm.). Also observed in shallow waters in the Marine National Park are moonlighters (*Tilodon sexfasciatum*), magpie perch (*Cheilodactylus nigripes*), zebra fish (*Girella zebra*), yelloweye mullet (*Aldrichetta forsteri*) and painted dragonets (*Eocallionymus papilio*) (P. Arnold pers. comm.).

Subtidal soft sediment

No quantitative data are available for the subtidal soft sediment areas within the Discovery Bay Marine National Park but video surveys indicate that subtidal soft sediments are very sparsely covered by invertebrates and macrophytes (Roob and Currie 1996).

Flora

No macroalgae were observed on areas of subtidal soft sediment, although occasional patches of foliose red algae were present on small patches of low profile reef surrounded by soft sediment (Roob and Currie 1996).

Invertebrate fauna

Mobile and sessile invertebrates are largely absent from most subtidal soft sediment areas of the Marine National Park.

At a depth of 55 m an area of loosely-packed coarse-sand with troughs containing shell grit and calcarenite rubble supported occasional bryozoans and sponges anchored to the sediments (Roob and Currie 1996).

Fish

No records of fish are available for the subtidal soft sediment areas of the Marine National Park. A video survey of an area just outside the Park boundary on calcarenite reef which continues into the Park, found a species of skate, which was possibly the white spotted skate *Raja cerva* or the Melbourne skate *Raja whitleyi* (Roob *et al*. 1999).

2.1.4 BIOLOGICAL PROCESSES

The Discovery Bay Marine National Park is known to be part of an important feeding ground for whales including the Southern Right Whale and the Blue Whale. Elevated larval concentrations of a number of fish species have also been recorded from this area and may have been related to the high primary productivity associated with an upwelling event (Neira *et al*. 2000). The main species contributing to these elevated larval abundances were the pilchard (*Sardinops sagax*) and to a lesser extent the jack mackerel (*Trahurus declivis*).

2.1.5 SPECIES DISTRIBUTION INFORMATION

Species of algae and marine invertebrates that are thought to have their distributional limits at or near the Discovery Bay Marine National Park, but not necessarily recorded from directly within the Park are listed in Table 2.1.4. The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

Table 2.1.4. Biota with distributional limits located at or near the Discovery Bay Marine National Park. (PW – presumed to be at or near western limit in the Marine National Park, PE – presumed to be at or near eastern limit in the Marine National Park, RE – eastern limit recorded in Marine National Park).

Phylum	Family	Species	Common name	Category
Chlorophyta	Palmellaceae	*Palmoclathrus stipitatus*	Green algae	RE
Crustacea	Alpheidae	*Athanopsis australis*	Shrimp	PW
Echinodermata	Asteriidae	*Smilasterias multipara*	Seastar	PW
Phaeophyta	Chordariaceae	*Chordaria cladosiphon*	Brown algae	PW
Rhodophyta	Ceramiaceae	*Ceramium monacanthum*	Red algae	PE
Rhodophyta	Ceramiaceae	*Ptilocladia vestita*	Red algae	PE
Rhodophyta	Gigartinaceae	*Gigartina densa*	Red algae	PE
Rhodophyta	Sarcodiaceae	*Trematocarpus concinnus*	Red algae	PE
Rhodophyta	Liagoraceae	*Helminthocladia beaugleholei*	Red algae	PE

2.1.6 SHOREBIRDS

Relatively few records of threatened bird species sightings are available within the boundaries of the Discovery Bay Marine National Park. However several species have been recorded in close vicinity to the Marine National Park and are listed in Table 2.1.5. Species generally recorded in Bass Strait are listed in Appendix 4.

Hooded Plovers have been sighted along the Discovery Bay shoreline and they may forage along the intertidal shoreline between Blacks Beach and Whites Beach. Hooded Plover nesting sites have been recorded in nearby Bridgewater Bay (M. Weston pers. comm.).

A study by the Australasian Wader Studies Group (Watkins 1993) recorded 560 Sanderling in the Discovery Bay Coastal Park, a species of international importance. Whether any of these sightings were in the area defined by the Marine National Park is unclear.

Other species to have been recorded within the boundaries of the Marine National Park include the Sub Antarctic Penguin, Erect Crested Penguin and Royal Penguin (P. Arnold pers. comm.).

2.1.7 MARINE MAMMALS

The only record for threatened marine mammals within the Discovery Bay Marine National Park is a Southern Elephant Seal (AVW). However, as there is a non-breeding haul out site for up to about 650 Australian Fur Seals at Cape Bridgewater (1997 estimate) then it is likely that seals will be present in the Marine National Park at times. Sightings of Humpback Whales, Southern Right Whale and Blue Whale are also recorded in the vicinity of the Discovery Bay Marine National Park .

Table 2.1.5. Threatened shorebird records from Discovery Bay Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year (TWV)
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		2001
Blue Petrel	*Halobaena caerulea*		Vul			1982
Caspian Tern	*Sterna caspia*	L		Vul	CJ	2001
Common Diving-Petrel	*Pelecanoides urinatrix*			LR		1980
Crested Tern	*Sterna bergii*			LR		1992
Gull-billed Tern	*Sterna nilotica*	L		End		1980
Hooded Plover	*Thinornis rubricollis*	L		End		1992
Pacific Gull	*Larus pacificus*			LR		1980

Table 2.1.6. Threatened marine mammal records from Discovery Bay Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Blue Whale	*Balaenoptera musculus*	L	End	CEn		1999
Humpback Whale	*Megaptera novaeangliae*		Vul	End		1993
Southern Elephant Seal	*Mirounga leonina*		Vul			1997
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1983
Australian Fur Seal	*Arctocephalus pusillus*			Vul		

Table 2.1.7. Selection of some animals and plants that may be found in the Discovery Bay Marine National Park.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Phyllospora comosa, Macrocystis angustifolia,*
Invertebrates	anemones	*Actinia tenebrosa, Anthothoe albocincta, Phlyctenactis*
	tube worm	*Galeolaria caespitosa*
	barnacle	*Chthamalus antennatus*
	mussel	*Xenostrobus pulex*
	top shell	*Austrocochlea* sp.
	tessellated sea star	*Nectria* sp.
	elephant snail	*Scutus antipodes*
	cowrie	*Cypraea* sp.
	cone shell	*Conus anemone*
	urchin	*Holopneustes* sp.
	biscuit star	*Tosia australis*
	hairy stone crab	*Lomis hirta*
	decorator crab	*Notomithrax ursus*
	cleft fronted shore crab	*Paragrapsus quadridentatus*
Fish	saddle wrasse	*Notolabrus fucicola*
	sea sweep	*Scorpis aequipinnis*
	southern sea carp	*Aplodactylus arctidens*
	moonlighters	*Tilodon sexfasciatum*
	magpie perch	*Cheilodactylus nigripes*
	zebra fish	*Girella zebra*
	yelloweye mullet	*Aldrichetta forsteri*
	painted dragonets	*Eocallionymus papilio*

2.1.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Discovery Bay Marine National Park are listed below (MPV database and Buckley 1993):

- Cape Duquesne, (State significance): Calcarenite cliff with caves and blowholes overlying basalt.

2.1.9 KNOWLEDGE GAPS

No quantitative data are available for the subtidal or intertidal reefs or soft sediment habitat classes within the Discovery Bay Marine National Park. A combination of video and diver surveys and anecdotal reports from nearby residents provided information on invertebrates, macrophtyes and fish in the Marine National Park.

2.1.10 RESEARCH

Author	Project	Notes
(Neira *et al.*. 2000)	Spawning and larval recruitment processes of commercially important species in coastal waters off Victoria 1997-1998	
(Roob and Currie 1996)	Marine and Coastal Special Investigation Offshore Survey of Selected Areas	

2.2 Twelve Apostles Marine National Park

The Twelve Apostles Marine National Park is representative of the Otway Bioregion and is characterised by rugged cliffs and the famous rock stacks that lend their name to the Marine National Park. The Marine National Park contains calcarenite reef supporting the highest diversity of intertidal and subtidal invertebrates found on that rock type in Victoria (Handreck and O'Hara 1994a).

2.2.1 PHYSICAL PARAMETERS

The Twelve Apostles Marine National Park is located about seven kilometres east of Port Campbell and extends along approximately 16 kilometres of coastline from east of Broken Head to Pebble Point to an offshore limit of three nautical miles. Two areas are excluded from the Park extending 100 m seaward from the high water mark at Gibsons Steps and between Point Ronald to Rivernook.

Table 2.2.1. Physical parameters of the Twelve Apostles Marine National Park.

Park Name	Twelve Apostles
Conservation status	Marine National Park
Biophysical Region	Otway
Length of coastline (km)	16.470
Size of Park (ha)	7500
Exposure rating	High
Wave Energy	High
Influential currents	None
Tidal variation – springs (m)	0.90
Tidal variation – neaps (m)	0.30
Water temp – summer (°C)	17.00
Water temp – winter (°C)	13.50
0 - 10 m (ha)	690
10 - 20 m (ha)	660
20 - 30 m (ha)	1290
30 - 40 m (ha)	1410
40 - 50 m (ha)	1670
50 - 60 m (ha)	1820
Discharges	Gellibrand River and Sherbrook River discharges 600 m north of the western boundary
Adjacent catchment	Agricultural

2.2.2 MARINE HABITAT CLASSES

The Twelve Apostles Marine National Park is a high-energy coastline. Acoustic and video analysis recognised four distinct habitat classes: low- and high-profile calcarenite reef, high-profile basalt/calcarenite reef and subtidal soft sediments (Roob *et al*. 1999). The major intertidal habitat classes are sandy beaches and intertidal reef (ECC 2000).

The area is famous for large spectacular coastal calcarenite cliffs and stacks. The Marine National Park contains a range of coastal orientations and microhabitats on calcarenite, mudstone and sandstone rock types. Reef habitat types range from rocky platforms with shallow fissures, gutters or small rounded boulders, to areas of heavy reef containing steeply sloping ridges with narrow crevasses or wide sand-filled gutters. Subtidal soft sediments exist away from the coast and consist of predominantly fine sand with some medium or coarse sand and shell rubble (ECC 2000).

Calcarenite reef extends approximately three kilometres offshore in the western and central regions of the Marine National Park, but less than one kilometre offshore in the eastern region, with most of the remaining area composed of subtidal soft sediment (Roob and Currie 1996) (Figure A1.2a)

Table 2.2.2. Marine Habitat Classes of Twelve Apostles Marine National Park.

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
	Platform
	Beach / Platform
	Cliff
Substratum relief	Low profile reef
	High profile reef
Substratum texture	Solid reef
	Broken reef
	Gutters
	Outcrops
	Coarse sand
	Medium sand
	Fine sand
	Shell rubble / grit
Lithology	Sandstone
	Limestone
	Calcarenite

Subtidal reef biota	Kelp - Ecklonia dominated
Subtidal reef understorey biota	Mixed algae - brown dominated
	Cystophora
	Acrocarpia
	Sessile invertebrates
	Caulerpa
Intertidal reef biota	Durvillaea
	Turf algae
	Coralline algae
Heavy reef Area (ha)	860
Low Profile Reef Area (ha)	200
Total Reef Area (ha)	1060
Sediment Area (ha)	2500
Undefined Area (ha)	3980

2.2.3 MARINE ECOLOGICAL COMMUNITIES

No specific survey of fish has been undertaken in the Twelve Apostles Marine National Park, and only limited data are available on invertebrates and macrophytes. However some information can be derived from surveys of nearby coastline. The Marine Research Group has conducted surveys of intertidal invertebrates between Childers Cove and Gibsons Steps which includes the Marine National Park area and found the highest species richness index on calcarenite reefs in Victoria (Handreck and O'Hara 1994a).

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.2.5.

Sandy beach

No data are available for invertebrate, macrophyte or fish fauna associated with sandy beaches.

Intertidal reef

Invertebrate fauna

The intertidal zone in the Twelve Apostles Marine National Park is very narrow due to the steep calcarenite cliffs of the area. A study by the MRG of the reefs at Gibsons Steps and the Twelve Apostles found a medium species richness, which contributed significantly to the high species richness of the area from Childers Cove to Gibsons Steps (Handreck and O'Hara 1994a). Numerous molluscs including gastropods, bivalves, chitons and opisthobranchs were present along with echinoderms including sea stars, brittle stars and sea urchins. Crustaceans such as barnacles and crabs and other invertebrates including sea anemones and polychaetes were also found with a total of 63 species recorded altogether (Handreck and O'Hara 1994a).

No data are available on intertidal macrophytes or fish in the Marine National Park.

Subtidal reef

No quantitative data are available for the subtidal reef areas within the Twelve Apostles Marine National Park, but video and diver reports provide incidental information on invertebrates, macrophtyes and fish.

Flora

Extremely diverse red, brown and green algae cover existed at 7 m depth on heavy calcarenite reef with sharp steeply sloping ridges and narrow crevasses (Roob and Currie 1996). On deeper (22 m) heavy calcarenite reefs with wide sand-filled gutters, the rock surface was dominated by a moderately dense *Ecklonia radiata* cover with a diverse understorey of red algae including *Sonderophycus* sp. (Roob and Currie 1996).

At several low profile calcarenite reef platforms with reef gutters between 30 m and 39 m, foliose red algae covered 30% of the available substrate, with much of the remainder covered by encrusting coralline algae (Roob and Currie 1996). No macrophytes were observed on deeper reefs.

Up to one kilometre offshore at Moonlight Head to the east of the Marine National Park, dense algal communities dominated by brown macroalgae were common with *Ecklonia radiata* as the dominant species with an understorey of small foliose red and brown algae (Roob *et al*. 1999).

Invertebrate fauna

At low profile calcarenite reefs at various depths (22 m, 30 m and 39 m), macrofauna were generally absent with only occasional solitary ascidians or sponges observed (Roob and Currie 1996). Sessile invertebrate epifauna was less common in waters shallower than 30 m (Roob *et al*. 1999) probably due to the greater effect of wave surge and sediment movement at shallower depths (G. Parry pers. comm.). Low profile calcarenite reefs that had shallow fissures and some raised spurs at a depth of 56 m were dominated by sessile invertebrates, with foliose bryozoans (including *Orthoscuticella* sp.), and many species of sponge the most conspicuous component (Roob and Currie 1996).

At Moonlight Head to the east of the Marine National Park, deep offshore reefs were dominated by sponges along with some stalked (possibly *Pyura spinifera*) and non-stalked ascidians, bryozoans (*Celleporaria* sp), brittle stars and sea whips (Roob *et al*. 1999).

Fish

Submersible video deployments at Moonlight Head adjacent to the Marine National Park found the blue throated wrasse *Notolabrus tetricus* on heavy basalt reef with patches of coarse sand at a depth of 37 m (Roob *et al*. 1999). It is likely that the fish exists at both Moonlight Head reefs and in the Twelve Apostles Marine National Park.

Subtidal soft sediment

Very little data are available for subtidal soft sediment communities, however observations made from submersible video deployments in the Marine National Park suggest that most areas are sandy and have no attached macroflora or macrofauna (Roob and Currie 1996). No data exists relating to fish fauna associated with subtidal in this area.

2.2.4 BIOLOGICAL PROCESSES

Biological processes occurring in the Twelve Apostles Marine National Park are unknown.

2.2.5 SPECIES DISTRIBUTION INFORMATION

The brittle star *Ophiacantha heterotyla* is presumed to be at or near its western distributional limit in the Twelve Apostles Marine National Park. No other species are recorded as having distributional limits near the area (O'Hara pers. comm.). The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

2.2.6 SHOREBIRDS

Threatened shorebird species recorded in and around the Twelve Apostles Marine National Park are listed in Table 2.2.3. A Hooded Plover nesting site is located at Clifton Beach and a Short-tailed Shearwater nesting site located on Muttonbird Island.

Up to 1,000 breeding pairs of Little Penguins are known to nest along the coast between the Twelve Apostles and London Bridge. They can be seen travelling through and feeding in the Marine National Park .

An area of regionally significant marsh and swamp is present at the Gellibrand River and it is probable that many of the species recorded here would forage on the intertidal shoreline of the Marine National Park . The banks of the estuary mouth are described as being wader habitat.

2.2.7 MARINE MAMMALS

Sightings of Southern Right Whales in the Marine National Park are restricted to an area in the north west, around Muttonbird Island. Australian Fur Seals have also been observed in the Marine National Park (Park Notes).

Table 2.2.3. Threatened shorebird records from Twelve Apostles Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Blue Petrel	*Halobaena caerulea*		Vul			1990
Hooded Plover	*Thinornis rubricollis*	L		End		1991
Little Egret	*Egretta garzetta*	L		CEn		1989
Wandering Albatross	*Diomedea exulans*		Vul	CEn	J	1998

Table 2.2.4. Threatened marine mammal records from Twelve Apostles Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1993
Australian Fur Seal	*Arctocephalus pusillus*			Vul		

Table 2.2.5. Selection of some animals and plants that may be found in the Twelve Apostles Marine National Park.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	kelp	*Ecklonia radiata*
	red algae	*Sonderophycus sp.*
Invertebrates	bryozoans	*Orthoscuticella sp., Celleporaria sp.*
Fish	blue throated wrasse	*Notolabrus tetricus*

2.2.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to the Twelve Apostles Marine National Park are listed below (MPV database and Buckley 1993):

- Gibsons Steps, Port Campbell, (Regional/Local Significance): Exposes the gradational contact between Miocene Gellibrand Marl and the overlying Port Campbell Limestone.
- The Twelve Apostles, (National Significance): Series of high rock stacks in Miocene Port Campbell Limestone is a spectacular feature of the coastline.
- Pebble Point, Princetown, (Regional/Local Significance): Palaeocene Pebble Point Formation, Lower Cretaceous Otway Group, Palaeocene-Eocene Pember Mudstone.
- Point Ronald to Point Margaret, Princetown, (Regional/Local Significance): Otway Group, Tertiary Wangerrip Group, Pebble Point Formation, Pember Mudstone & Dilwyn Formation.
- Clifton Beach, Princetown, (Regional/Local Significance): Gradational contact between the Clifton Formation and the overlying Gellibrand Marl is exposed at this site.
- Point Ronald, Princetown, (Regional/Local Significance): Spectacular cliff exposures of Pleistocene dune limestone. Overlain by parabolic cliff-top dunes.
- Loch Ard Gorge Area, Port Campbell, (State significance): Series of vertical cliffs, with promontories, narrow gorges and stacks. Two caves. The Blowhole and Broken Head.
- Port Campbell National Park, (National Significance): The Port Campbell National Park is a narrow strip of coastal land running 60 km from Cape Otway to Peterborough. Features coastal erosion processes and karst topography.

2.2.9 KNOWLEDGE GAPS

No quantitative data are available for the subtidal or intertidal reefs or soft sediment habitat classes within the Twelve Apostles Marine National Park. A combination of video and diver surveys and anecdotal reports from nearby residents provided information on invertebrates, macrophtyes and fish in the Marine National Park. Intertidal reefs within the Marine National Park are very poorly known.

2.2.10 RESEARCH

No research was found relating specifically to this Marine National Park.

2.3 Point Addis Marine National Park

The Point Addis Marine National Park is representative of the Central Victoria Bioregion and includes sandy beaches, intertidal and subtidal reefs with a variety of profiles and subtidal soft sediments. The coastline has areas of both high and moderate exposure to wave energy. Point Addis and Ingoldsby Reef off Anglesea are popular diving and snorkelling destinations and feature a diverse range of marine invertebrate, fish and macrophyte biota. Beanland (1985) found 114 species of algae at Ingoldsby Reef and the MRG recorded 75 intertidal invertebrate species from Point Addis (Handreck and O'Hara 1994a).

2.3.1 PHYSICAL PARAMETERS

The Point Addis Marine National Park extends along nine kilometres of coastline east of Anglesea from Elimatta Road to the west of Bells Beach and to three nautical miles offshore. The Point Addis Marine National Park is a medium to high-energy coastline.

Table 2.3.1. Physical parameters of the Point Addis Marine National Park.

Park Name	Point Addis
Conservation status	Marine National Park
Biophysical Region	Central Victoria
Size of Park (ha)	4600
Length of coastline (km)	8.967
Exposure rating	High
Wave Energy	High
Influential currents	None
Tidal variation - springs (m)	1.7
Tidal variation - neaps (m)	0.9
Water temp - summer (°C)	17.5
Water temp - winter (°C)	13.5
0 - 10 m (ha)	650
10 - 20 m (ha)	690
20 - 30 m (ha)	800
30 - 40 m (ha)	760
40 - 50 m (ha)	990
50 - 60 m (ha)	650
Discharges	8 intermittent creeks
Adjacent catchment	Agricultural, Urban

2.3.2 MARINE HABITAT CLASSES

The major habitat classes are sandy beaches, subtidal soft sand sediments, seagrass, intertidal reef and subtidal reef. The calcarenite reef areas are complex and either solid low profile reef or broken reef with rounded cobbles. The reef is surrounded by subtidal soft sediments which consist of a mixture of fine and medium sand with some coarse sand with silt, shell and rubble (ECC 2000). Sand, calcarenite cobble and low profile reef are common to around two kilometres offshore on western edge of the Marine National Park, but reefs are absent on the eastern boundary. Coarse sand and shell rubble are common offshore in depths greater than 39 m (Roob and Currie 1996; Roob and O'Hara 1996).

Table 2.3.2. Marine Habitat Classes of Point Addis Marine National Park.

Marine Habitat Class	Attributes
Shoreline category	Beach
	Platform
	Beach / Platform
	Cliff
Substratum relief	Low profile reef
	High profile reef
Substratum texture	Broken reef
	Outcrops
	Coarse sand
	Fine sand
	Shell rubble / grit
Lithology	Calcarenite
Subtidal reef biota	Kelp - Ecklonia dominated
Subtidal reef understorey biota	Mixed algae - brown dominated
	Mixed algae - other
	Sessile invertebrates
	Red algae dominated
	Caulerpa
Subtidal sediment biota	Amphibolis
Intertidal reef biota	Durvillaea
	Hormosira
	Turf algae
	Coralline algae
	Pyura
	Mussels
	Barnacles

Heavy reef Area (ha)	160
Low Profile Reef Area (ha)	490
Total Reef Area (ha)	650
Sediment Area (ha)	1790
Undefined Area (ha)	2130

2.3.3 MARINE ECOLOGICAL COMMUNITIES

A number of surveys have been conducted in the Point Addis Marine National Park, although none of these focused on the sandy beaches and there is little data available on fish species present in any of the habitats. The MRG conducted some presence/absence surveys of intertidal invertebrates at Point Addis (Handreck and O'Hara 1994a), O'Hara (2000) made some qualitative descriptions of invertebrates and macrophytes and Porter (1997) carried out qualitative survey of Ingoldsby Reef. Subtidal acoustic and video surveys by Roob *et al*. (1996; 1996) recorded macrophytes, invertebrates and classified substratum type. Beanland (1985) investigated the marine benthic algae at Ingoldsby Reef in the Marine National Park.

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.3.5.

Sandy beach

No records of invertebrates, macrophytes or fish are available for sandy beaches at Point Addis Marine National Park or any nearby areas.

Intertidal reef

Flora

The intertidal habitat at Ingoldsby Reef was dominated by *Hormosira banksii*, *Laurencia shepherdi* and *Neogoniolithon finitum* with *Cystophora moniliformis*, *Sargassum* sp. *Caulerpa brownii*, *C. vesiculifera* and *Plocamium preissianum* present in rock pools (Beanland 1985).

Invertebrate fauna

Qualitative surveys by the MRG of Point Addis (Handreck and O'Hara 1994a) and Ingoldsby Reef by Porter (1997), found an intertidal invertebrate community of moderate species richness. Numerous molluscs including gastropods, bivalves, chitons, cephalopods and opisthobranchs were present along with echinoderms including seven species of sea star and two sea urchins. Crustaceans such as barnacles and crabs and other invertebrates including three sea anemones and polychaetes were also present at Point Addis (Handreck and O'Hara 1994a).

Fish

No records of intertidal fish are available.

Subtidal reef

Subtidal reef exists throughout most of the Marine National Park (Figure A1.3a). Only Ingoldsby Reef (Figure A1.3a) has been recently surveyed qualitatively and the information in this section is derived from a survey by Porter (1997), (Beanland 1985) and (Roob and Currie 1996; Roob and O'Hara 1996).

Ingoldsby Reef lies in about 10 metres of water approximately two kilometres from the shoreline and is 240 metres long and 40 metres wide and contains both intertidal and subtidal calcarenite reef.

Flora

Algal composition changes with depth at Point Addis Marine National Park. The dominant macrophyte on the shallow subtidal reef between 11 - 13 m is the kelp (*Phyllospora comosa*) with some other brown (*Acrocarpia paniculata*, *Ecklonia radiata* and *Seirococcus axillaris*) and red algae also present (O'Hara 2000; Porter 1997). By 24 m depth there is a thick canopy of *Ecklonia radiata* and at 30 m depth near the centre of the Marine National Park, encrusting coralline algae dominates most upper surfaces, with only occasional *Ecklonia radiata* individuals present (Roob and Currie 1996; Roob and O'Hara 1996)

Cystophora moniliformis dominates exposed vertical subtidal reef at Ingoldsby Reef with *Caulerpa flexilis* and *Ecklonia radiata* dominant on sheltered faces (Porter 1997). Smooth coralline algae was also present on the vertical slopes of Ingoldsby Reef along with three non-calcified reds (*Melanthalia obtusa*, *Plocamium preissianum* and red turf species) (Porter 1997).

Near the edge of the reef adjacent to subtidal sand sediments *Amphibolis* seagrass beds are common with associated brown (*Sargassum*, *Cystophora*, *Zonaria*) and green (*Caulerpa*) algae (O’Hara 2000).

Invertebrate fauna

Overhangs at Ingoldsby Reef are dominated by ascidians, gorgonians, hydroids and sponges whilst eroded, low profile reefs support a diverse range of sponges, with some bryozoans, colonial ascidians, green lipped (*Haliotis laevigata*) and black lipped abalone (*Haliotis rubra*) and rock lobster (*Jasus edwardsii*) (Porter 1997).

Some ascidians (*Pyura stolonifera*) and solitary sponges (*Crella* sp.) occur infrequently in a cobbled subtidal reef near the centre of the Marine National Park at a depth of 30 m (Roob and Currie 1996; Roob and O'Hara 1996).

Fish

Dominant Subtidal reef fish include devil fish (*Paraplesiops meleagris*), horseshoe leatherjackets (*Meuschenia hippocrepis*), yellow-tailed kingfish (*Seriola lalandi*) and common sea dragons (*Phyllopteryx taeniolatus*) (Porter 1997).

Seagrass

No quantitative data are available for the seagrass areas within the Point Addis Marine National Park, but diver records provide incidental information on invertebrates, macrophtyes and fish.

Flora

Seagrass (*Amphibolis antarctica*) beds are common at the edge of the subtidal reef between 1-2 m and continue to a depth of approximately 6 m. Large brown, green and red algae are interspersed amongst the seagrass, including 4 m long *Cystophora retorta*, 2 m long *C. moniliformis*, *Sargassum paradoxa*, *S. sonderi*, *Zonaria* spp, *Caulerpa flexilis*, *C. scalpelliformis* and *Nizymenia australis*. The seagrass also supported more than 10 algal epiphytes, including *Dictyopteris muelleri*, *Mychodea hamata*, other red algae and corallines (O’Hara 2000).

Invertebrate fauna

Numerous sessile invertebrates live epizootically on the stems and of fronds *Amphibolis antarctica* in the Marine National Park. Dominant species included large colonies of *Amathia woodsii* (bryozoan), *Stereotheca elongata*, and *Amphisbetia minima* (hydroids). Additionally, the bryozoan *Electra flagellum*, which is obligate on *Amphibolis* stems, was common, while *Electra pilosa* was present on the tips of *Cystophora* fronds. Sponges and ascidians were not common (O’Hara 2000).

Motile invertebrates were numerically dominated by epiphytic micro-molluscs including *Musculus nanus*, *Macrozafra atkinsoni*, *Pseudamycla dermestoidea*, *Micromytilus crenatuliferus*, *Notomytilus rubra*, *Stenochiton cymodocealis* and *Asteracmea stowae*. The last two species are restricted to *Amphibolis* seagrass. There were four species of sea spiders (*Pycnogonida*). Relatively few species of polychaetes, echinoderms or crustaceans were collected. Small decorator (*majid*) crabs were common amongst the bryozoans (O'Hara 2000).

Fish

No records of fish assemblages associated with the seagrass at Point Addis were found.

Unvegetated subtidal sediment

Flora

This habitat class is defined by its absence of macrophytes, but occasional stipes of *Ecklonia radiata* along with tufts of foliose red algae were present at 30 m depth and all surveyed sites shallower than this comprised of subtidal reef (Roob and Currie 1996). No algae were observed deeper than 39 m, although occasional stands of foliose red algae were present on flat areas of subtidal soft sediment not sculpted by wave action (Roob and Currie 1996).

Invertebrate fauna

Dense clumps of invertebrates covering up to 30% of the substrate were observed at a depth of 49 m on coarse sand flats. Observed fauna included numerous sponges, bryozoans (including *Orthoscuticella* sp.), ascidians and hydroids (Roob and Currie 1996). At sites of 39 m and 30 m depth, sessile invertebrates were sparse with solitary erect sponges (including *Crella* sp.), foliose bryozoans and infrequent ascidian clumps (*Pyura* sp.) observed (Roob and Currie 1996). Sites shallower than 24 m had few or no attached macrofaunal species (Roob and Currie 1996).

Fish

Ling (possibly *Genypterus tigerinus*) were observed at a depth of 49 m on a coarse sand flat bottom, in a clump of sessile invertebrates composed of sponges, with some hydroid, ascidians and bryozoans (Roob and Currie 1996). It is likely that these sessile invertebrate aggregations harbour other species of fish, although none were observed in the limited video surveys (Roob and Currie 1996).

2.3.4 BIOLOGICAL PROCESSES

Biological processes occurring in the Marine National Park are unknown.

2.3.5 SPECIES DISTRIBUTION INFORMATION

Scotts weedfish (*Heteroclinus* sp) is thought to be at or near its western distributional limit and the brown algae (*Asteronema ferruginea*) is thought to be at or near its eastern distributional limit in the Point Addis Marine National Park. The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

2.3.6 SHOREBIRDS

The list of threatened bird species recorded in and around the Point Addis Marine National Park is shown in Table 2.3.3. An area of state significant shorebird habitat is present along the shore at this Marine National Park, running from Anglesea River to Bones Road, Winki Pop, but is related to terrestrial species.

To the west of the park is the regionally significant Anglesea River estuary. This area contains remnant salt marsh habitat and is visited irregularly by migratory waders.

2.3.7 MARINE MAMMALS

Southern Right Whales have been recorded within the Marine National Park boundaries, with Blue Whales also being observed outside of the park. Australian Fur Seals occur in the Marine National Park and have been recorded outside the boundaries.

Table 2.3.3. Threatened shorebird records from Point Addis Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		1989
Crested Tern	*Sterna bergii*			LR		1998
Great Egret	*Ardea alba*	L		End	CJ	1980
Hooded Plover	*Thinornis rubricollis*	L		End		1986
Intermediate Egret	*Ardea intermedia*	L		CEn		1980
Little Egret	*Egretta garzetta*	L		CEn		1980
Pied Cormorant	*Phalacrocorax varius*			LR		1980
Sooty Albatross	*Phoebetria fusca*	L	Vul			1994
White-faced Storm-Petrel	*Pelagodroma marina*			Vul		1989

Table 2.3.4. Threatened marine mammal records from Point Addis Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australian Fur Seal	*Arctocephalus pusillus*			Vul		1990
Blue Whale	*Balaenoptera musculus*	L	End	CEn		1995
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1982

Table 2.3.5. Selection of some animals and plants that may be found in the Point Addis Marine National Park.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Phyllospora comosa, Acrocarpia paniculata, Ecklonia radiata, Seirococcus axillaris, Cystophora moniliformis, Sargassum* sp., *Hormosira banksii*
	green alga	*Caulerpa brownii, C. vesiculifera C. flexilis*
	red algae	*Laurencia shepherdi*, *Neogoniolithon finitum, Plocamium preissianum, Melanthalia obtusa*
	seagrass	*Amphibolis antarctica*
Fish	common sea dragons	*Phyllopteryx taeniolatus*
	devil fish	*Paraplesiops meleagris*
	horseshoe leatherjackets	*Meuschenia hippocrepis*
	yellow-tailed kingfish	*Seriola lalandi*

2.3.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Point Addis Marine National Park are listed below (MPV database and Buckley 1993):

- Bells Headland, (Regional/Local Significance): Provides excellent exposure of Jan Juc formation, overlain by Point Addis Limestone Member, overlain by Puebla Formation.
- Point Addis, (State significance): Type locality for the Point Addis Limestone Member. Demons Bluff formation, Puebla Formation.
- Demons Bluff to Black Rock, (State significance): The Demons Bluff coastal cliffs are the type locality of the Anglesea Member of the Demons Bluff Formation. A stretch of receding cliffs between Black Rock and Demons Bluff formation. To the east is a

landslip area backed by an upper cliff with breakaway pinnacles and a promontory of ferruginous sandstone and conglomerates at Black Rock

- Rocky Point, Torquay, (Regional/Local Significance): Good exposure of Puebla and Point Addis Limestone.

2.3.9 KNOWLEDGE GAPS

Very little quantitative data are available on the subtidal or intertidal reefs of Point Addis Marine National Park, although some qualitative data are available. Subtidal soft sediment and sandy beach habitat classes within the Point Addis Marine National Park are poorly known with information in this report derived from a combination of video and diver surveys and anecdotal reports. Seagrass is comparatively well studied in comparison.

2.3.10 RESEARCH

Author	Project	Notes
Beanland	Studies on the marine benthic algal communities at Ingoldsby reef Anglesea, Victoria	Masters Thesis
Porter, C.	Ecology and the management of intertidal areas of the Surf Coast Shire	Deakin and ARC ongoing project
(Francis)	Mechanisms of sex change in blue throat wrasse	Ongoing Honours project
(Metcalfe)	Effects of fishing mortality on demography of blue throat wrasse	Ongoing Honours project
(O'Hara 2000)	Faunal and floral assemblages associated with rocky reefs along the Victoria coast	
(Klemke 1993)	Life history variation in the bryozoan Mucropetraliella elleri (MacGillivray)	PhD thesis

2.4 Port Phillip Heads Marine National Park – Point Lonsdale

The Point Lonsdale section of the Port Phillip Heads Marine National Park is situated on the opposite side of The Heads to Point Nepean. The large tidal currents have resulted in the development of a huge diversity of sessile invertebrates on both sides of The Rip, which contribute to the spectacular deep water scenery comprising cliffs, caverns, rocky reef walls, sponge gardens and kelp beds which are considered exceptional by divers.

2.4.1 PHYSICAL PARAMETER

The Point Lonsdale section of the Marine National Park is situated at the entrance to The Heads and is backed by dunes on the Bass Strait side and by the village of Point Lonsdale on the Port Phillip Bay side of the Marine National Park. The strong currents of The Rip provide a high-energy environment. There are no major freshwater inputs into the Point Lonsdale Marine National Park other than local storm water discharges.

Table 2.4.1. Physical parameters of the Port Phillip Heads Marine National Park – Point Lonsdale.

Park Name	**Port Phillip Heads - Pt. Lonsdale**
Conservation status	Marine National Park
Biophysical Region	Victorian Embayments and Central Victoria
Size of Park (ha)	400
Length of coastline (m)	2823
Exposure rating	High/moderate
Wave Energy	Moderate
Influential currents	The Rip
Tidal variation - springs (m)	1.2
Tidal variation - neaps (m)	0.6
Water temp - summer (°C)	17.5
Water temp - winter (°C)	13.5
Intertidal (ha)	30
0 - 2 m (ha)	50
2 - 5 m (ha)	120
5 - 10 m (ha)	140
10 - 15 m (ha)	20
15 - 20 m (ha)	4
20 - 30 m (ha)	4
30 - 40 m (ha)	10

40 - 50 m (ha)	10
50 - 60 m (ha)	10
60 - 70 m (ha)	1
Discharges	None
Adjacent catchment	Urban, Agricultural

2.4.2 MARINE HABITAT CLASSES

There is a wide diversity of different habitat types contained within the Point Lonsdale section of the Port Phillip Heads Marine National Park. These include rocky intertidal platforms with associated tide pools, subtidal reef with a range of microhabitats such as surge channels, cliffs, bommies, ledges and holes (Figure 1.4a). Subtidal soft sediment, exposed and semi exposed sandy beaches and dense areas of *Amphibolis* seagrass habitat are also present in the Marine National Park. While not within the Marine National Park boundaries, sand dunes back the Bass Strait shoreline of the Marine National Park.

Table 2.4.2. Marine Habitat Classes for Port Phillip Heads Marine National Park – Point Lonsdale (Bird 1993; Blake and Ball 2001a).

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
	Platform
	Beach / Platform
	Cliff
	Artificial seawall
Substratum relief	Low profile reef
	High profile reef
Substratum texture	Broken reef
	Gutters
	Outcrops
	Artificial structure - pier
Lithology	Sandstone
	Calcarenite
Subtidal reef biota	Kelp - Phyllospora dominated
	Kelp - Macrocystis dominated
	Kelp - Durvillaea dominated
	Kelp - Ecklonia dominated
	Kelp - mixed Phyllospora / Ecklonia
Understorey reef biota	Cystophora

	Acrocarpia
	Cystophora / Amphibolis
	Sessile invertebrates
	Red algae dominated
Subtidal soft sediment biota	Amphibolis
	Zostera
	Heterozostera
	Seagrass
Intertidal reef biota	Durvillaea
	Hormosira
	Coralline algae
	Mussels
Amphibolis Dominant Seagrass Area (ha)	36.9
Amphibolis Dominant Seagrass & Macroalgae Area (ha)	15.3
Heavy reef Area (ha)	15.6
Macroalgae on Reef Area (ha)	198.6
Total Reef Area (ha)	214.1
Zostera/Heterozostera Dominant Seagrass & Macroalgae Area (ha)	0.7
Sediment Area (ha)	21.8
Undefined Area (ha)	109.5

2.4.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.4.7.

Intertidal rocky reef

Flora

Tolmer (2002) undertook a detailed survey of marine macroalgal diversity on Lighthouse Reef (the extensive platform on The Rip side of Point Lonsdale) and described four biologically different zones. This survey recorded a total of 118 species with 53 red algal species, 48 brown algal species and 16 green algal species – an algal assemblage that was considered species-rich although there are few such detailed macroalgal surveys available with which to compare these figures.

The first zone coincided with the upper intertidal and was sparsely vegetated, with wave splash supporting desiccation resistant algae and lichens. The second zone coincided with the mid intertidal and was dominated by the brown algae *Hormosira banksii*, *Scytosiphon lomentaria*, *Notheia anomala*, the red algae *Corallina officinalis*, *Capreolia implexa* and *Diplocladia patersonis* and the green algae *Ulva rigida*. A third outer reef zone was dominated by the green sea lettuce *Ulva rigida* as well as *Cladophora dalmatica*, the brown algae, neptune's necklace (*H. banksii*) and the red algae *Polysiphonia scopulorum*, *P. dicepens*, *P. infestans*, *Gelidium crinale*, *Ceramium flaccidum*, *Laurencia tumida* and *Corallina officinalis*. An outer reef zone with numerous potholes supported mainly *H. banksii*, *C. officinalis* and *Cladophora prolifera*.

Tolmer (2002) also examined a large rockpool (a fourth biological zone) which supporting an overstorey of large brown algae, primarily *Ecklonia radiata*, *Sargassum vestitum* and several *Cystophora* species. The intermediate understorey was dominated by fleshy or articulated coralline algae such as *Ballia callitricha*, *Phacelocarpus peperocarpos* and *Amphiroa anceps* and there was also a basement layer of prostrate reds including *Peyssonnelia novaehollandiae* and calcified encrusting Corallinaceae.

The seagrass *Amphibolis antarctica* occupied the outer reef pools and was host to a number of macroalgal epiphytes (Tolmer 2002).

The deep undercuts of the Lighthouse Reef are another feature seldom found on Victoria's open coast. The lowered light intensities of these habitats seem to promote a unique flora in which algal species typical of deeper waters grow at very shallow depths (Bitans 1999). A previously unreported species of the genus *Palmophyllum* (provisionally described as a new species *Palmophyllum incrustans*) has been reported from this habitat (Bitans 1999).

Tolmer (2002) also highlighted a number of species recorded from Lighthouse Reef at Point Lonsdale that she considered to be of particular interest and we have summarised that information in Table 2.4.3.

Table 2.4.3. Algal species considered to be of particular interest by Tolmer (2002).

Species Name	Reason for interest
Asperococcus compressus	Previously recorded at only 2 other locations in Australia, Williamstown and Flinders
Sphacelaria spuria	Previously only recorded at type location in Brighton but has not been recorded there for over 100 years
Scytothamnus australis	Widespread in Tasmania but only sporadic occurrence in Victoria and New South Wales
Herposiphonia calothrix	First time collected from Victoria – usually found in Western and South Australia
Tiffanellia cymodoceae	The Point Lonsdale collection of this species as an epiphyte on *Cladophora prolifera* represents a substantial eastward zone extension and a new host record.

Gredgaria maugeana	The Point Lonsdale collection represents a western range extension and the first record of this species from an intertidal habitat.
Griffithsia elegans	Collected from a rockpool at 19 cm depth, while all previous records have come from 6 – 30 m depth.
Notheia anomala	This species is virtually an obligate epiphyte on *H. banksii* but is very rarely found epiphytic on *Xiphonophora chondrophylla* as it was in a rockpool at Point Lonsdale.

Invertebrate fauna

The intertidal reef platforms at Point Lonsdale are considered to have the highest invertebrate diversity of any calcarenite reef in Victoria (Handreck and O'Hara 1994a). The reef has a similar faunal assemblage to that found at Point Nepean. The upper eulittoral zone is dominated by littorinid snails, barnacles and the gastropods *Cellana tramoserica*, *Siphonaria diemenensis* and *S. zelandica* (Porter 1999). The mid eulittoral has a very dominant mollusc fauna with abundant *Bembicium nanum*, *Siphonaria zelandica*, *S. diemenensis*, *Cellana tramoserica*, *Patelloida alticostata*, *Austrocochlea* spp. *Turbo undulata* and *Cominella lineolata* (Porter 1999). The low eulittoral zone is primarily dominated by the gastropods *Austrocochlea* spp. *Turbo undulata* and *Thais orbita* (Porter 1999) .

Fish

No information was found regarding the fish species that use the intertidal at Point Lonsdale.

Subtidal rocky reef

Flora

Surveys conducted on the Bass Strait coastline near Point Lonsdale have recorded assemblages dominated by *Phyllospora comosa*, *Ecklonia radiata* and *Cystophora retorta* with *Acrocarpia paniculata*, *Carpoglossum confluens* and *Cystophora platylobium* also abundant. An understorey of fleshy red algae was also recorded with species including *Pterocladia lucida*, *Melanthalia obtusata*, *Plocamium* spp. and *Phacelocarpus peperocarpos* (Edmunds *et al.*2000). Within Port Phillip Bay, in Lonsdale Bight, the most visible macrophytes include the brown algal species *Cystophora moniliformis*, *Cystophora* spp., *Ecklonia radiata*, *Phyllospora comosa* and *Sargassum* spp. and the green algal species *Caulerpa flexilis*, *Caulerpa* spp. *Cladophora* sp. *Codium fragilis* and *Ulva* spp. (MSE 1997). An understorey of fleshy and coralline red algae is common but in low abundance although there is usually a high cover of encrusting coralline algae. *Durvillaea* is present in the exposed regions of the shallow sub-littoral zone (Edmunds *et al*. 2000).

The channel between the main rock platform and the outer reef contains a small forest of giant kelp (*Macrocystis angustifolia*), a species which is showing signs of decline along the south east coast of Australia (Porter 1997) (Park Notes).

Invertebrate fauna

There are several reef sites within the Point Lonsdale section of the Marine National Park, such as The Lonsdale Wall, that are considered excellent dive sites and this is, in part, because of the diverse and colourful sessile invertebrate assemblages. The invertebrates recorded include a variety of sponges, abundant hydrozoa species, gorgonians, soft corals, jewel anemones, yellow zooanthids, the stony coral *Culicia* spp., numerous lace, encrusting and bushy bryozoan species and compound and colonial ascidians (Porter 1997). Non-sessile invertebrates are also common and nudibranchs (including Verco's nudibranch *Tambja verconis* which feeds almost exclusively on the bryozoan *Bugula dentata*) have been recorded as well as the sea stars *Petricia* sp., *Nectria macrobrachia, N. ocellata*, *Echinaster archystatus* and *Plecaster decanus* and the feather stars *Comanthus trichoptera* (Porter 1997).

Fish

Dominant species for the Point Lonsdale section of the Marine National Park are the wrasse (*Notolabrus tetricus*, *N. fucicola* and *Pictilabrus laticlavius*) the herring cale *Odax cyanomelas*, the sea sweep *Scorpis aequipinnis*, the magpie perch *Cheilodactylus nigripes*, the six spined leatherjacket *Meuschenia freycineti*, the scaly fin *Parma victoriae* and the sea carp *Aplodactylus arctidens* (Edmunds *et al*. 2000).

The fish assemblage at The Lonsdale Wall site is considered to be very diverse with a total of 43 species recorded in one study and up to 27 species recorded on a single dive (Porter 1997).

Amphibolis seagrass community

Flora

A recent survey found *Amphibolis antarctica* to occur in dense patches within the Point Lonsdale section of the Marine National Park, but also found it to be growing on the sediments amongst areas of broken reef and mixed with species of macroalgae (Blake and Ball 2001).

Invertebrate fauna

There is no data on the invertebrate fauna associated with the *Amphibolis* seagrass beds in this area.

Fish

There is no data on the fish communities associated with the *Amphibolis* seagrass beds in this area.

Unvegetated subtidal soft sediment

Invertebrate fauna

No information exists relating to the soft sediment invertebrate fauna on the Bass Strait side of Port Phillip Bay. The nearest available information is from a sample taken at 40 m depth to the east of Point Nepean (Section 2.9.3). Within Port Phillip Bay the nearest soft sediment information comes from the 1971 survey where 0.1 m^{-2} grab samples were taken east of Queenscliff. In this survey they found an average of 34 species per sample and 40.6 individuals per sample. The two most common species were a haustoriid amphipod and the polychaete *Lumbrinereis latreilli* (MMBW and FWD 1973).

Fish

There is little direct information regarding fish assemblages in the soft sediment environments of the Point Lonsdale section of the Marine National Park. The soft sediment environs are likely to provide important habitat and feeding areas for several important commercial and recreational species of fish such as King George whiting, flounder, flathead, mullet, salmon and snapper.

2.4.4 BIOLOGICAL PROCESSES

Biological processes occurring in the Marine National Park are unknown.

2.4.5 SPECIES DISTRIBUTION INFORMATION

Species of algae, fish and invertebrates that are thought to have their distributional limits located in the Port Phillip Heads Marine National Park are listed in Table 2.4.4. The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

Table 2.4.4 Biota with distributional limits located at or near the Port Phillip Heads Marine National Park.

(PW – presumed to be at or near western limit in the Marine National Park, PE – presumed to be at or near eastern limit in the Marine National Park, RE – eastern limit recorded in Marine National Park, RW – western limit recorded in Marine National Park, PB – the only record in Victoria, P – presumed present).

Phylum	Family	Species	Common name	Category
Chlorophyta	Caulerpaceae	*Caulerpa cliftonii*	Green algae	RE
Chlorophyta	Udoteaceae	*Avrainvillea clavatiramea*	Green algae	PE
Chlorophyta	Udoteaceae	*Callipsygma wilsonis*	Green algae	PE
Chlorophyta	Codiaceae	*Codium perriniae*	Green algae	PE
Chlorophyta	Bryopsidaceae	*Bryopsis macraildii*	Green algae	RE
Chordata	Berycidae	*Centroberyx gerrardi*	Red snapper	PE
Chordata	Trachichthyidae	*Optivus sp*	Violet roughy	PW
Chordata	Cheilodactylidae	*Cheilodactylus fuscus*	Red morwong	RW
Chordata	Clinidae	*Heteroclinus mammoratus*	Short tassel weedfish	RN
Chordata	Clinidae	*Heteroclinus nasutus*	Large nose weedfish	RW
Chordata	Clinidae	*Heteroclinus sp*	Longtail weedfish	PW
Chordata	Clinidae	*Heteroclinus sp*	Milwards weedfish	PE
Chordata	Gobiidae	*Nesogobius hinsbyi*	Orangespotted goby	PN
Chordata	Gobiidae	*Nesogobius sp*	Opalescent sandgoby	P
Chordata	Gobiidae	*Nesogobius sp*	Sicklefin goby	PE
Chordata	Gobiidae	*Nesogobius sp*	Speckled goby	PW
Chordata	Gobiidae	*Nesogobius sp*	Threadfin sandgoby	PE
Chordata	Labridae	*Notolabrus parilus*	Orangespotted wrasse	PE
Chordata	Leptoscopidae	*Crapatalus munroi*	Pink sandfish	RN
Chordata	Pentacerotidae	*Parazanclistus hutchinsi*	Short boarfish	PE
Chordata	Pentacerotidae	*Paristiopterus labiosus*	Giant boarfish	PW
Chordata	Serranidae	*Lepidoperca pulchellus*	Eastern orange roughy	PW
Chordata	Serranidae	*Othos dentex*	Harlequin fish	PE
Chordata	Tripterygiidae	*Apopterygion alta*	Tasselated threefin	RN
Crustacea	Galatheidae	*Munida subrugosa*		RW
Crustacea	Rhynchocinetidae	*Rhynchocinetes kuiteri*	Shrimp	PE
Crustacea	Callianassidae	*Eucalliax tooradin*	Ghost shrimp	RW
Echinodermata	Comasteridae	*Comatulella brachiolata*	Feather star	PE
Echinodermata	Brissidae	*Eupatagus valenciennesii*	Sea urchin	PW
Echinodermata	Phyllophoridae	*Thyone nigra*	Sea cucumber	PE
Mollusca	Anabathridae	*Pisinna nitida*	Marine snail	PW
Mollusca	Costellariidae	*Vexillum (Costellaria) pellucidum*	Marine snail	PE

Mollusca	Eatoniellidae	*Eatoniella victoriae*	Marine snail	PW
Mollusca	Fissurellidae	*Diodora lineata*	Marine snail	PW
Mollusca	Naticidae	*Natica shorehami*	Marine snail	PW
Mollusca	Trochidae	*Fossarina patula*	Marine snail	PW
Mollusca	Acanthochitonidae	*Bassethullia glypta*	Chiton	PB
Mollusca	Acanthochitonidae	*Leptoplax wilsoni*	Chiton	PE
Mollusca	Ischnochitonidae	*Ischnochiton contractus*	Chiton	PE
Mollusca	Ischnochitonidae	*Ischnochiton torri*	Chiton	PE
Mollusca	Ischnochitonidae	*Ischnochiton wilsoni*	Chiton	PE
Phaeophyta	Chordariaceae	*Tinocladia australis*	Brown algae	PE
Phaeophyta	Elachistaceae	*Elachista claytoniae*	Brown algae	P
Phaeophyta	Dictyotaceae	*Dilophus robustus*	Brown algae	PE
Phaeophyta	Dictyotaceae	*Homoeostrichus canaliculatus*	Brown algae	PE
Phaeophyta	Cystoseiraceae	*Cystophora cuspidata*	Brown algae	PE
Phaeophyta	Cystoseiraceae	*Cystophora cymodoceae*	Brown algae	PE
Phaeophyta	Cystoseiraceae	*Cystophora racemosa*	Brown algae	RE
Phaeophyta	Seirococcaceae	*Scytothalia dorycarpa*	Brown algae	RE
Phaeophyta	Sphacelariaceae	*Sphacelaria bracteata*	Brown algae	PE
Phaeophyta	Sporochnaceae	*Nereia lophocladia*	Brown algae	P
Phaeophyta	Sporochnaceae	*Sporochnus apodus*	Brown algae	PE
Rhodophyta	Ceramiaceae	*Acrothamniopsis eliseae*	Red algae	RE
Rhodophyta	Ceramiaceae	*Ballia ballioides*	Red algae	PE
Rhodophyta	Ceramiaceae	*Callithamnion caulescens*	Red algae	PE
Rhodophyta	Ceramiaceae	*Callithamnion pinnatum*	Red algae	PE
Rhodophyta	Ceramiaceae	*Ceramium repens*	Red algae	PE
Rhodophyta	Ceramiaceae	*Crouania mucosa*	Red algae	PE
Rhodophyta	Ceramiaceae	*Dasythamniella dasyura*	Red algae	PE
Rhodophyta	Ceramiaceae	*Dasythamniella wollastoniana*	Red algae	PE
Rhodophyta	Ceramiaceae	*Diapse ptilota*	Red algae	PE
Rhodophyta	Ceramiaceae	*Drewiana nitella*	Red algae	PE
Rhodophyta	Ceramiaceae	*Elisiella arbuscula*	Red algae	PE
Rhodophyta	Ceramiaceae	*Elisiella dispar*	Red algae	RE
Rhodophyta	Ceramiaceae	*Griffithsia pulvinata*	Red algae	PE
Rhodophyta	Ceramiaceae	*Gymnothamnion nigresens*	Red algae	PE
Rhodophyta	Ceramiaceae	*Hirsutithallia angustata*	Red algae	PE
Rhodophyta	Ceramiaceae	*Hirsutithallia formosa*	Red algae	PE
Rhodophyta	Ceramiaceae	*Hirsutithallia laricina*	Red algae	PE
Rhodophyta	Ceramiaceae	*Involucrana meredithiana*	Red algae	PE

Rhodophyta	Ceramiaceae	*Macrothamnion acanthophorum*	Red algae	PE
Rhodophyta	Ceramiaceae	*Macrothamnion pectenellum*	Red algae	PW
Rhodophyta	Ceramiaceae	*Macrothamnion pellucidum*	Red algae	PE
Rhodophyta	Ceramiaceae	*Macrothamnion secundum*	Red algae	PE
Rhodophyta	Ceramiaceae	*Perichelia glomulifera*	Red algae	PE
Rhodophyta	Ceramiaceae	*Ptilocladia pulchra*	Red algae	RE
Rhodophyta	Ceramiaceae	*Rhodocallis elegans*	Red algae	PE
Rhodophyta	Ceramiaceae	*Shepleya wattsii*	Red algae	RE
Rhodophyta	Ceramiaceae	*Trithamnion eubryanii*	Red algae	RE
Rhodophyta	Ceramiaceae	*Wollastoniella myriophylloides*	Red algae	RE
Rhodophyta	Dasyaceae	*Heterosiphonia Lawrenciana*	Red algae	PE
Rhodophyta	Corallinaceae	*Lithothamnion indicum*	Red algae	PW
Rhodophyta	Gelidiaceae	*Gelidiella mimima*	Red algae	RE
Rhodophyta	Acrotylaceae	*Amphiplexia hymenocladioides*	Red algae	PE
Rhodophyta	Areschougiaceae	*Melanema dumosum*	Red algae	RE
Rhodophyta	Cystocloniaceae	*Erythranaena ceramioides*	Red algae	PE
Rhodophyta	Gigartinaceae	*Gigartina muelleriana*	Red algae	PE
Rhodophyta	Gigartinaceae	*Gigartina pinnata*	Red algae	PE
Rhodophyta	Gigartinaceae	*Gigartina wahliae*	Red algae	PE
Rhodophyta	Halymeniaceae	*Cryptonemia digitata*	Red algae	PE
Rhodophyta	Halymeniaceae	*Cryptonemia nitophylloides*	Red algae	PW
Rhodophyta	Halymeniaceae	*Cryptonemia wilsoni*	Red algae	PW
Rhodophyta	Kallymeniaceae	*Cirrulicarpus nanus*	Red algae	PE
Rhodophyta	Kallymeniaceae	*Hormophora australasica*	Red algae	PE
Rhodophyta	Nemastomataceae	*Adelophycus corneus*	Red algae	RE
Rhodophyta	Nizymeniaceae	*Stenocladia australis*	Red algae	PE
Rhodophyta	Nizymeniaceae	*Stenocladia furcata*	Red algae	PE
Rhodophyta	Phacelocarpaceae	*Phacelocarpus complanatus*	Red algae	PE
Rhodophyta	Phyllophoraceae	*Ahnfeltiopsis fastigiata*	Red algae	RW
Rhodophyta	Sarcodiaceae	*Sarcoidia marginata*	Red algae	PE
Rhodophyta	Gracilariaceae	*Curdiea crassa*	Red algae	RW
Rhodophyta	Liagoraceae	*Liagora codii*	Red algae	PE
Rhodophyta	Rhodymeniaceae	*Erythrymenia minuta*	Red algae	PE
Rhodophyta	Rhodymeniaceae	*Faucheopsis cronata*	Red algae	PE
Rhodophyta	Rhodymeniaceae	*Webervanbossea splachnoides*	Red algae	PE

2.4.6 SHOREBIRDS

The rocky shore and reef platforms along the Point Lonsdale coast represent State significant feeding habitats for many shorebird species. Table 2.4.5 lists threatened shorebird species recorded within the Point Lonsdale site.

Hooded Plovers nest directly on beaches along the open coast above high water mark or on adjacent sand dunes. The nesting season is unpredictable but typically occurs from Aug - April. They lay eggs from Aug - March, with hatching from Sept - March and young are present from Oct – April (M. Weston *pers. comm.*).

Little Penguins enter Port Phillip Bay to feed all year round, but mainly from June – Sept and may be observed in this area.

2.4.7 MARINE MAMMALS

Records from the AVW show sightings of both Australian Fur Seals and Southern Right Whales along the open coast side of the Point Lonsdale site.

Table 2.4.5. Threatened shorebird records from Port Phillip Heads Marine National Park – Point Lonsdale and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		2000
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		2000
Caspian Tern	*Sterna caspia*	L		Vul	CJ	2000
Crested Tern	*Sterna bergii*			LR		2000
Eastern Curlew	*Numenius madagascariensis*			LR	CJ	2000
Fairy Tern	*Sterna nereis*	L		Vul		2000
Grey-headed Albatross	*Thalassarche chrysostoma*		Vul			1985
Northern Giant-Petrel	*Macronectes halli*		Vul	End		1986
Pacific Gull	*Larus pacificus*			LR		2000
Pied Cormorant	*Phalacrocorax varius*			LR		2000
Pomarine Jaeger	*Stercorarius pomarinus*			Ins	CJ	1984
Shy Albatross	*Diomedea cauta*		Vul			2000
Southern Giant-Petrel	*Macronectes giganteus*		End	End		1985
Wandering Albatross	*Diomedea exulans*		Vul	CEn	J	1984

Table 2.4.6. Threatened marine mammal records from Port Phillip Heads Marine National Park – Point Lonsdale and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australian Fur Seal	*Arctocephalus pusillus*			Vul		1991
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1986

Table 2.4.7. Selection of some animals and plants that may be found in the Port Phillip Heads Marine National Park – Point Lonsdale.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Hormosira banksii*, *Scytosiphon lomentaria*, *Notheia anomala*, *Ecklonia radiata*, *Sargassum vestitum, Phyllospora comosa*, *Cystophora retorta, Acrocarpia paniculata*, *Carpoglossum confluens, Cystophora platylobium*, *Cystophora moniliformis*, *Sargassum* spp.
	green algae	*Ulva rigida*, *Caulerpa flexilis*, *Caulerpa* spp. *Cladophora dalmatica*, *Cladophora prolifera*, *Codium fragilis*, *Cladophora* spp. and *Ulva* spp.
	red algae	*Corallina officinalis*, *Capreolia implexa* and *Diplocladia patersonis*, *Polysiphonia scopulorum*, *P. dicepens*, *P. infestans*, *Gelidium crinale*, *Ceramium flaccidum*, *Laurencia tumida*
Invertebrates	gastropods	*Austrocochlea* spp. *Turbo undulata, Thais orbita*, *Bembicium nanum*, *Cominella lineolata.*
	limpet gastropods	*Cellana tramoserica*, *Siphonaria diemenensis Siphonaria zelandica*, *Patelloida alticostata*
Fish	magpie perch	*Cheilodactylus nigripes*
	herring cale	*Odax cyanomelas*
	scaly fin	*Parma victoriae*
	sea carp	*Aplodactylus arctidens*
	sea sweep	*Scorpis aequipinnis*
	seagrass	*Amphibolis antarctica*
	six spined leatherjacket	*Meuschenia freycineti*
	wrasse	*Notolabrus tetricus*, *N. fucicola* and *Pictilabrus laticlavius*

2.4.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Port Phillip Heads Marine National Park - Point Lonsdale are listed below (MPV database and Buckley 1993):

- Point Lonsdale Lighthouse - Calcarenite Beds, (Regional/Local Significance): Broad shore platforms cut in Pleistocene dune calcarenite extend from rugged cliffs exposing lithified dune structures, calcrete horizons and ancient soils. There are well developed abrasion ramps and outlying patches of flat platform and the weathering features include lapies and pitted rock surfaces.
- Point Lonsdale - Calcarenite Complex, (Regional/Local Significance): Pleistocene calcareous dune sequences.

2.4.9 KNOWLEDGE GAPS

The main knowledge gaps for the Point Lonsdale section of the Marine National Park relate to the soft sediment environments, including the *Amphibolis* habitat and the use of the intertidal rocky reef habitat by fish.

2.4.10 RESEARCH

This has been a major collecting site for the Department of Botany, University of Melbourne for many years. More specific research is detailed in the following table.

Author	Project	Notes
(Lindsay)	Reef fish recruitment inside and outside of marine parks.	Upcoming honours project
(Scarpaci)	The ecology and behaviour of the bottlenose dolphin Tursiops truncatus in Port Phillip Bay, Victoria, Australia.	Ongoing project
(Francis)	Mechanisms of sex change in blue throat wrasse.	Ongoing Honours thesis
(Metcalfe)	Effects of fishing mortality on demography of blue throat wrasse.	Ongoing Honours thesis
(Tolmer 2002)	Biodiversity survey of macroalgae at Lighthouse Reef, Point Lonsdale, Victoria.	Honours thesis
(Hale 2002)	Interactions Between Vessels and Dolphins in Port Phillip Bay. Final Report, Sept 2002.	
(Edmunds *et al.*. 2000)	Marine biogeography of Central Victoria and Flinders bioregions - a preliminary analysis of reef flora and fauna.	Ongoing monitoring program
(Scarpaci *et al.*. 2000)	The bottlenose dolphin (Tursiops truncatus) in the Southern end of Port Phillip Bay: behavioural characteristics in spring and summer.	

(Zuccarello *et al.*. 2000)	Molecular phylogeny of Rhodochaete parvula (Bangiophycidae, Rhodophyta).	
(Bitans 1999)	A new species of marine green algae from Port Phillip Heads.	Honours thesis
(Porter 1999)	Evaluation of the effectiveness of marine protected areas in temperate waters of Australasia.	PhD thesis
(MSE 1997)	Report on Seabed Survey of the Lonsdale Bight.	Once off monitoring data
(Stevens and West 1997b)	Investigation of school and gummy shark nursery areas in south eastern Australia.	
(Gibson 1994)	Reproduction in Cladostephus spongiosus in southern Australia (Spacelariales, Phaeophyceae).	
(Guiry and Womersley 1992)	Geliiella minima new species rhodophyta from Victoria Australia. Implications for the generic classifications of the Gelidiaceae.	

2.5 Port Phillip Heads Marine National Park – Swan Bay

Swan Bay is a shallow embayment characterised by extensive seagrass beds, which represent an important nursery area for a number of fish species including King George whiting (*Sillaginodes punctata*). Swan Bay also features extensive intertidal sand flats that support significant populations of shorebirds and is recognised as an internationally significant wetland under the Ramsar convention (Port Phillip Bay Ramsar Site).

2.5.1 PHYSICAL PARAMETERS

Swan Bay is located immediately north of Queenscliff on the south-western shores of Port Phillip Bay and is a shallow embayment partly separated from Port Phillip Bay by spits and barrier islands. Water enters Port Phillip Bay through Port Phillip Heads in a narrow area known as The Rip, where tidal currents are very strong, before entering Swan Bay where tidal currents are greatly reduced and tidal amplitude is less than 1 metre. The surrounding catchment is primarily grazing or viticulture with some urban and foreshore reserve areas. The previously intermittent southern connection between Swan Bay and Port Phillip Bay is now permanently open and known locally as Queenscliff Creek or the cut.

Table 2.5.1. Physical parameters of the Port Phillip Heads Marine National Park – Swan Bay.

Park Name	Port Phillip Heads - Swan Bay
Conservation status	Marine National Park
Biophysical Region	Victorian Embayments
Size of Park (ha)	2094
Length of coastline (m)	20954
Exposure rating	Low
Wave Energy	Low
Influential currents	The Rip
Tidal variation – springs (m)	0.8
Tidal variation – neaps (m)	0.2
Water temp – summer (°C)	20.5
Water temp – winter (°C)	11.2
Intertidal (ha)	1219
0 - 2 m (ha)	874
2 - 5 m (ha)	1
Discharges	Yarram Creek and intermittent creeks
Adjacent catchment	Agricultural

2.5.2 MARINE HABITAT CLASSES

The Swan Bay section of the Port Phillip Heads Marine National Park is a sheltered, soft sediment environment. The most notable habitats in Swan Bay are the extensive seagrass beds, sheltered intertidal flats and the subtidal soft substrates. The Marine National Park boundary is fringed by salt marsh and sand dunes are also present on the eastern edge of Swan Bay.

Table 2.5.2. Marine Habitat Classes for Port Phillip Heads Marine National Park – Swan Bay (Bird 1993; Blake and Ball 2001a).

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
Substratum texture	Fine sand
	Muddy sand
Lithology	Calcarenite
Subtidal soft sediment biota	Zostera
	Heterozostera
	Mixed seagrass/algae
Dominant intertidal sediment biota	Saltmarsh
	Seagrass
Macroalgae Area (ha)	306.6
Zostera/Heterozostera Dominant Seagrass (ha)	386.8
Zostera/Heterozostera Dominant Seagrass & Macroalgae Area (ha)	1266.5
Sediment Area (ha)	124.6
Salt Marsh Area (ha)	9.2
Land Area (ha)	0.1

2.5.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.5.4.

Saltmarsh

Flora

The most recent descriptions of saltmarsh (Department of Conservation and Environment 1991) identify beaded glasswort, *Sarcocornia quinqueflora*, creeping brookweed, *Samolus repens* and *Hemichroa pentandra* to be common on the shoreline. On the western side of Swan Bay the saltpans have been described as supporting a *Halosarcia halocnemoides*

(Grey Glasswort) community. This species is thought to be able to withstand prolonged periods of hyper-salinity.

Invertebrate fauna

An ongoing project at sites in the saltmarsh just outside the Marine National Park boundaries has recorded the shrimp (*Macrobrachium* sp.), gammaridean amphipods, harpacticoid copepods, turtellid and trochid gastropods, bivalves, polychaetes, nematodes, marine mites as well as terrestrial insects and arachnids. A pygmy squid (Idiosepiidae) has also been recorded during this study (Crinall unpublished FRDC data).

Fish

The same study (Crinall, unpublished FRDC data) has recorded the following taxa from saltmarsh sites in Swan Bay; the hardyheads (Atherinidae), long-finned goby (*Favonigobius lateralis*), yellow-eye mullet (*Aldrichetta forsteri*), King George whiting (*Sillaginodes punctata*), weedfish (Clinidae) and a galaxid.

Seagrass

Flora

The majority of Swan Bay has some seagrass coverage (Blake and Ball 2001a) with small areas dominated by undefined algae. The southern half of Swan Bay is dominated by sparse beds of *Zostera/Heterozostera* with associated filamentous algae. In the most recent survey (Blake and Ball 2001) the northern half of Swan Bay had a medium to dense cover of *Zostera / Heterozostera* with less associated filamentous algae. *Halophila australis* was also recorded mixed with *Heterozostera tasmanica* in deeper water around the Swan Bay jetty area. The seagrass *Lepilaena* has also been recorded in Swan Bay (Longmore *et al*. 2001).

Invertebrate fauna

A study of the infauna associated with intertidal seagrass beds in Swan Bay found that large numbers of relatively few species dominated the community. Corophiid amphipods plus *Allorchestes compressa*, were the dominant crustacea while the polychaete fauna was dominated by capitellids, the nereid *Ceratonereis pseudoerythraeensis* and the orbinid *Scoloplos cylindrifer* (Denning *et al*. 1986). A more recent study describing the invertebrate fauna associated with the seagrass *Heterozostera* found that the invertebrate communities in Swan Bay differed to nearby sites in Port Phillip Bay. In Swan Bay gastropod and bivalve molluscs, tanaids and epibenthic harpacticoids dominated the macrofauna (Bird and Jenkins 1999).

Fish

The seagrass assemblages in Swan Bay tend to be dominated by large numbers of the spotted pipefish, *Stigmatopora argus* (Jenkins *et al*. 1993a; Saunders 1997) with other species of pipefish (*Vanacampus phillipi*) also well represented. Other dominant species include the hardyhead (*Leptatherina presbyteroides*), the bridled leather jacket (*Acanthaluteres spilomelanurus*), the spot-shoulder weed fish (*Heteroclinus perspicillatus*) and the cobbler (*Gymnapistes marmoratus*). A number of commercially important species have also been shown to utilise this habitat as a nursery area and larger individuals of certain species have been recorded as well. Swan Bay is known to be a particularly important nursery area for King George whiting (*Sillaginodes punctata*), but adult rock whiting (*Haletta semifasciata*), six spined leather jacket (*Meuschenia freycineti*), and yellow-eye mullet (*Aldrichetta forsteri*) have also been collected in significant numbers in this habitat (Jenkins *et al.*1993; Jenkins *et al.* 1997).

Unvegetated intertidal sediment

Flora

This habitat class is defined by its absence of macrophytes.

Invertebrate fauna

There have been very few surveys of the invertebrate fauna of unvegetated soft sediments in Swan Bay. The available information has found the intertidal and shallow subtidal communities to be dominated by oligochaete and polychaete worms (Capitellidae, Syllidae, Nereidae, Spionidae), bivalve (Montacutidae, Erycinidae) and gastropod (*Salinator fragilis*, Potamididae) molluscs and a less dominant amphipod fauna (Morris and Keough In Press; Parry *et al*. 2001). Parry *et al.*(2001) recorded a total of 67 species from their survey in the shallow subtidal, while Morris and Keough (In Press) recorded a total of 32 species from the mid-intertidal.

Fish

Fish surveys in Swan Bay found similar species on bare patches interspersed with seagrass as on seagrass patches (Jenkins *et al.* 1993; Jenkins *et al.* 1997). The hardyheads (Atherinidae) were more abundant in bare patches and juvenile King George whiting (*Sillaginodes punctata*) and greenback flounder (*Rhombosolea tapirina*) were also recorded in high numbers in bare areas. The banjo ray *Trygonorrhina fasciata* is also commonly observed in Swan Bay (Park Notes) and gummy sharks (*Mustelus antarcticus*), black bream and rock flathead (*Platycephalus laevigatus*) are also common (T. Walker pers comm.).

2.5.4 BIOLOGICAL PROCESSES

Swan Bay is known to be an important nursery area for a number of different fish species. The extensive seagrass beds produce greater amounts of detritus than the adjacent coasts in Port Phillip Bay and this is thought to lead to a more productive environment in Swan Bay. Larvae of King George whiting (*Sillaginodes punctata*) have been found to enter Port Phillip Bay in a late post-larval stage, spawning apparently taking place in Bass Strait at some distance to the west. Juvenile Flounder (*Rhombosolea tapirina*) have also been found to feed and develop in Swan Bay (Jenkins *et al*. 1993b; Shaw and Jenkins 1992; Thompson 1990). Although larval supply to Swan Bay and adjacent areas in Port Phillip Bay appears to be similar, greater numbers of post-settlement larvae are recorded in Swan Bay. This has been attributed to the position of seagrass beds in relation to the currents and so seagrass beds in Swan Bay are considered critical for *S. punctata* post-larvae (Jenkins *et al.*1993).

2.5.5 SPECIES DISTRIBUTION INFORMATION

For distributional limits of algae, invertebrate and fish species in the Port Phillip Heads Marine National Park, refer to Table 2.4.4.

2.5.6 SHOREBIRDS

Swan Bay is an internationally significant shorebird habitat and combined with Mud Islands, is the second ranked shorebird site in Victoria after Corner Inlet (Watkins 1987). Swan Bay is listed under the Ramsar Convention and is on the Register of the National Estate. Peak numbers of migratory waders occur in the summer months. Table 2.5.3 lists threatened shorebird species recorded within the Swan Bay site.

Waders feed throughout Swan Bay's intertidal flats with major feeding areas located along the northern shore, in Stingaree Bight and between Swan Island and Duck Island. The flats around the northern shore and Stingaree Bight are of particular importance as feeding grounds and assembly points for waders on a rising tide, and as major roost sites on neap tides (numbers feeding reaching 5 - 10,000 birds) (C. Minton pers. comm.). Assembled birds at the northern shore flats disperse to roost on Mud Islands, Sand Island and the western shore of Swan Bay (C. Minton, pers. comm.). Major wader high tide roosting sites are present on Sand Island Spit, Sand Island and around Stingaree Bight. Peak numbers occur from September/October to March (1 - 4,000 birds). Minor roosts are present along the western shore of Swan Bay, at Edwards Point, Swan Point and Swan Island.

2.5.7 MARINE MAMMALS

No records of threatened marine mammal sightings for Swan Bay are listed in the AVW and being relatively shallow, it is unlikely that whales, dolphins or seals would normally enter this area. Dolphins do feed along the Queenscliff coast on squid and other prey, but are not often seen there (Hale 2002). Southern Right Whales have been observed approximately 600 m outside the Queenscliff cutting entrance to Swan Bay (AVW).

Table 2.5.3. Threatened shorebird records from Port Phillip Heads Marine National Park – Swan Bay and surrounds (AVW and listed references).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV / Reference
Australasian Gannet	*Morus serrator*			Vul		Emison *et al.* 1987
Bar-tailed Godwit	*Limosa lapponica*				CJ	Emison *et al.* 1987
Black-tailed Godwit	*Limosa limosa*				CJ	ARI 1999
Broad-billed Sandpiper	*Limicola falcinellus*				CJ	ARI 1999
Brolga	*Grus rubicunda*	L		Vul		1998
Caspian Tern	*Sterna caspia*	L		Vul	CJ	1992
Common Greenshank	*Tringa nebularia*				CJ	Emison *et al.* 1987
Common Sandpiper	*Actitis hypoleucos*				CJ	ARI 1999
Common Tern	*Sterna hirundo*				CJ	Watkins 1993
Crested Tern	*Sterna bergii*			LR		2001
Curlew Sandpiper	*Calidris ferruginea*				CJ	Emison *et al.* 1987
Eastern Curlew	*Numenius madagascariensis*			LR	CJ	1989
Fairy Tern	*Sterna nereis*	L		Vul		1992
Great Egret	*Ardea alba*	L		End	CJ	ARI 1999
Great Knot	*Calidris tenuirostris*				CJ	ARI 1999
Greater Sand Plover	*Charadrius leschenaultii*				CJ	ARI 1999
Grey Plover	*Pluvialis squatarola*				CJ	ARI 1999
Grey-tailed Tattler	*Heteroscelus brevipes*				CJ	ARI 1999
Kelp Gull	*Larus dominicanus*			CEn		ARI 1999
Latham's Snipe	*Gallinago hardwickii*				CJ	ARI 1999
Lesser Sand Plover	*Charadrius mongolus*				CJ	ARI 1999
Lewin's Rail	*Rallus pectoralis*			End		ARI 1999
Little Egret	*Egretta garzetta*	L		CEn		1999
Little Tern	*Sterna albifrons*	L	End	Vul	CJ	2001
Marsh Sandpiper	*Tringa stagnatilis*				CJ	ARI 1999
Musk Duck	*Biziura lobata*			Vul		1989
Orange-bellied Parrot	*Neophema chrysogaster*	L	End	CEn		1989
Pacific Golden Plover	*Pluvialis fulva*				CJ	ARI 1999
Pacific Gull	*Larus pacificus*			LR		1989
Pectoral Sandpiper	*Calidris melanotos*			Ins	J	ARI 1999
Pied Cormorant	*Phalacrocorax varius*			LR		1992
Red Knot	*Calidris canutus*				CJ	ARI 1999
Red-necked Stint	*Calidris ruficollis*				CJ	Emison *et al.* 1987

Royal Spoonbill	*Platalea regia*			Vul		1992
Ruddy Turnstone	*Arenaria interpres*				CJ	Emison *et al.* 1987
Sanderling	*Calidris alba*				CJ	ARI 1999
Sharp-tailed Sandpiper	*Calidris acuminata*				CJ	Emison *et al.* 1987
Terek Sandpiper	*Xenus cinereus*				CJ	ARI 1999
Whimbrel	*Numenius phaeopus*				CJ	ARI 1999
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	L		End	C	Emison *et al.* 1987

Table 2.5.4. Selection of some animals and plants that may be found in the Port Phillip Heads Marine National Park – Swan Bay.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	**Scientific name**
Flora	seagrass	*Halophila australis, Heterozostera tasmanica, Lepilaena* sp.
Invertebrates	nereid	*Ceratonereis pseudoerythraeensis*
	oligochaete worm	Capitellidae, Syllidae, Nereidae, Spionidae
	orbinid	*Scoloplos cylindrifer*
Fish	adult rock whiting	*Haletta semifasciata*
	amphipod	*Allorchestes compressa*
	gastropod	*Salinator fragilis*
	polychaete worm	Montacutidae, Erycinidae
	capitellids	Capitellidae
	banjo ray	*Trygonorrhina fasciata*
	bivalves	Bivalvia
	bridled leather jacket	*Acanthaluteres spilomelanurus*
	cobbler	*Gymnapistes marmoratus*
	greenback flounder	*Rhombosolea tapirina*
	gummy sharks	*Mustelus antarcticus*
	hardyhead	*Leptatherina presbyteroides*
	King George whiting	*Sillaginodes punctata*
	long-finned goby	*Favonigobius lateralis*
	pipefish	*Vanacampus phillipi*
	rock flathead	*Platycephalus laevigatus*
	six spined leather jacket	*Meuschenia freycineti*
	spot-shoulder weed fish	*Heteroclinus perspicillatus*
	spotted pipefish	*Stigmatopora argus*
	weedfish	Clinidae
	yellow-eye mullet	*Aldrichetta forsteri*

2.5.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Port Phillip Heads Marine National Park - Swan Bay are listed below (MPV database and Buckley 1993):

- Swan Bay - Tidal flat, (Regional/Local Significance): Low energy, fine grained shell rich depositional environment.
- Swan Bay - Embayment infill and delta, (Regional/Local Significance): Swan Bay is a shallow tidal bay bordered by salt marshes & partly isolated from Port Phillip Bay by sand spits. Prograding sheltered coastline as a result of biogenic materials.
- Swan Bay - Alluvial fans, (Regional/Local Significance): Complex coastal landform history.
- Edwards Point - Spit complex, (Regional/Local Significance): Compound branching barrier/spit system.

2.5.9 KNOWLEDGE GAPS

There is a considerable amount of data available for Swan Bay most of which is the result of research projects undertaken by the Marine and Freshwater Resources Institute at the Queenscliff Marine Science Laboratories. Until very recently there was very little information regarding the saltmarsh habitat and the unvegetated soft sediment habitats. There are also relatively few studies on the invertebrate fauna of the seagrass habitat in comparison to the amount of information regarding the fish fauna.

2.5.10 RESEARCH

Author	Project	Notes
Crinall, S.	Assessing the use of saltmarsh habitat by fish and macro-invertebrates in relation diel cycles and food availability in a temperate marine embayment	Ongoing honours project (FRDC project)
(Morris and Keough In Press)	Variation in the response of intertidal infaunal invertebrates to nutrient additions: field manipulations at two sites within Port Phillip Bay, Australia.	
(Longmore *et al.*. 2002)	Causes of seagrass loss in Swan Bay and prospects for recovery	
(Blake and Ball 2001a)	Victorian marine habitat database: seagrass mapping of Port Phillip Bay	Monitoring data
(Longmore *et al.*. 2001)	Environmental baseline study for the MAFRI narrows site and Swan Bay environs	Monitoring program
(Ma *et al.* 2001)	Banding on the waders and terns between Australia and China.	
(Parry *et al.*. 2001)	Comparison of nearshore benthic communities near the MAFRI relocation site.	Monitoring program

(Jenkins *et al.*. 2000)	Determination of spawning areas and larval advection pathways for King George whiting in south-eastern Australia using otolith microstructure and hydrodynamic modelling	
(Jindra 2000)	Evaluation of 'in-situ' cages for comparing growth rates of juvenile King George whiting, Sillaginodes punctata in different habitats	Honours thesis
(Bird and Jenkins 1999)	Abundance, biomass and estimated production of invertebrate fauna associated with seagrass, Heterozostera tasmanica, in Swan Bay and an adjacent area of Port Phillip Bay, Victoria	
(Jenkins *et al.*. 1997)	Comparison of fish assemblages associated with seagrass and adjacent unvegetated habitats of Port Phillip Bay and Corner Inlet, Victoria, Australia, with emphasis on commercial species	
(Saunders 1997)	The influence of water depth and habitat complexity on fish communities associated with seagrass in Swan Bay, Victoria	
(Stevens and West 1997b)	Investigation of school and gummy shark nursery areas in south eastern Australia	
(Swadling and Bayly 1997)	Different zooplankton communities in confluent waters: Comparisons between three marine bays in Victoria, Australia.	
(Hamer and Jenkins 1996)	Larval supply and short-term recruitment of a temperate demersal fish, the King George whiting, Sillaginodes punctata Cuvier and Valenciennes, to an embayment in south-eastern Australia	
(Jenkins and May 1994)	Variation in settlement and larval duration of King George whiting, Sillaginodes punctata (Sillaginidae), in Swan Bay, Victoria, Australia	
(Henry 1993)	The effect of predation by the girdled goby Nesogobius sp. 1 on the abundances of its meiofaunal prey	Honours thesis
(Jenkins *et al.*. 1993a)	Patterns of utilisation of seagrass (Heterozostera) dominated habitats as nursery areas by commercially important fish	
(Jenkins *et al.*. 1993b)	Spatial variation in food-limited growth of juvenile Greenback flounder, Rhombosolea tapirina: evidence from otolith daily increments and otolith scaling	
(Shaw and Jenkins 1992)	Spatial variation in feeding, prey distribution and food limitation of juvenile flounder Rhombosolea tapirina Gunther	
(May and Jenkins 1992)	Patterns of settlement and growth of juvenile flounder Rhombosolea tapirina determined from otolith microstructure	
(Kerr and Strothers 1990)	Seasonal changes in standing crop of Zostera muelleri in south-eastern Australia	
(Thompson 1990)	Growth rates of juvenile flounder, Rhombosolea tapirina in relation to food availability and temperature: a comparison between Swan Bay and nearby sites in Port Phillip Bay	Honours thesis
(Jessop 1988)	The Ecology of Fish Inhabiting the Inter-Tidal Zone of Swan Bay, Victoria, Australia	PhD thesis
(Denning *et al.*. 1986)	Distribution of vascular hydrophytes and description of associated macrofaunal communities in Swan Bay, Victoria	

2.6 Port Phillip Heads Marine National Park – Popes Eye

Popes Eye is the only site in Victoria where fishing has been prohibited for an extended period. It is also one of the only nesting and roosting site for Australasian Gannets on an artificial substrate in Victoria as well as being a very popular dive and snorkel site. Fish are very abundant and include wrasse, morwongs, old wives, scaly fin and perch. The seaward side of the structure supports a colourful array of sessile invertebrates such as sponges, ascidians, bryozoans, anemones, soft corals and gorgonians.

2.6.1 PHYSICAL PARAMETERS

Popes Eyes is an artificial structure in the shape of a horse shoe (annulus) covering approximately 3 hectares and rising about 2.5 m above the water surface at low tide. Inside the annulus the water is shallow (1.5 – 3 m deep) and the annulus provides a sheltered environment with a sandy bottom, while the outside rock wall slopes down to a depth of 12 m and experiences strong tidal currents. Popes Eye is situated approximately 5 km from the entrance to Port Phillip Heads.

Table 2.6.1. Physical parameters of the Port Phillip Heads Marine National Park – Popes Eye.

Park Name	Port Phillip Heads - Popes Eye
Conservation status	Marine National Park
Biophysical Region	Victorian Embayments
Size of Park (ha)	4
Length of coastline (m)	290
Exposure rating	High/moderate
Wave Energy	Moderate
Influential currents	The Rip
Tidal variation - springs (m)	0.9
Tidal variation – neaps (m)	0.2
Water temp - summer (°C)	18.2
Water temp - winter (°C)	12.5
0 - 2 m (ha)	0.4
2 - 5 m (ha)	1
5 - 10 m (ha)	2
10 - 15 m (ha)	1
Discharges	N/A
Adjacent catchment	N/A

2.6.2 MARINE HABITAT CLASSES

Popes Eyes is an artificial structure constructed with bluestone boulders that encompasses a shallow sandy area. The main habitat classes of interest are the reef community that has developed on the bluestone boulder structure and the shallow sand area that exists within the annulus.

Table 2.6.2. Marine Habitat Classes for Port Phillip Heads Marine National Park – Popes Eye.

Marine Habitat Class	Attributes
Shoreline category	Artificial structure – bluestone artificial reef
Substratum relief	High profile reef
Subtidal reef biota	Kelp - Macrocystis dominated
	Kelp - Ecklonia dominated
Subtidal reef understorey biota	Sessile invertebrates
	Pyura Herdmania momus (Pyuridae)
Intertidal reef biota	Mussels
	Barnacles
	Turf algae
	Fleshy algae - mixed
Undefined Area	4.3

2.6.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.6.5.

Subtidal Reef

Flora

A recent survey at Popes Eye describes an *Ecklonia radiata* dominated community with occasional patches of the green alga *Cladophora rugosa*, and some sites dominated by *Macrocystis angustifolia* (Edmunds *et al*. 2000). The understorey generally consists of a sparse cover of thallose red algae with brown algal species in very low abundance. The deeper areas are characterised by a mixed algal community and include *Codium* sp., *Sargassum* sp. and *Caulerpa* sp. (O'Hara 2000).

Invertebrate fauna

Popes Eye is characterised by high abundances of the feather star *Cenolia trichoptera* and the seastars *Nectria multispina* and *Uniophora granifera*. Popes Eye has been described as depauperate in abundances of most mobile macroinvertebrate species relative to the other

Marine National Parks, including the mollusc species *Haliotis rubra*, *Turbo undulatus* and the echinoderms *Heliocidaris erythrogramma*, and *Nectria ocellata* (Edmunds *et al*. 2000). There is an abundant sessile invertebrate community on the seaward side of the annulus, which is dominated by filter feeders such as sponges, ascidians, bryozoans, zoanthids and anemones (Stone 1999).

Fish

The fish assemblage at Popes Eye is considered to be relatively diverse and is numerically dominated by the southern hulafish, *Trachinops caudimaculatus.* Other fish usually present in high abundances include the sea sweep, *Scorpis aequipinnis*, wrasse (*Notolabrus tetricus*, *N. fucicola*), the six spined leatherjacket *Meuschenia freycineti* and the scaly fin *Parma victoriae* (Edmunds *et al.*2000).

Unvegetated subtidal sediment

A literature search did not uncover any information describing the soft substrate flora and fauna in the Popes Eye Marine National Park. However, the stargazer (*Kathetostoma laeve*) and the goatfish (Mullidae) are thought to inhabit the subtidal soft sediment here (Park Notes).

2.6.4 BIOLOGICAL PROCESSES

Port Phillip Heads, which is also known as The Rip, experiences very strong tidal currents that deliver food in the form of planktonic organisms allowing a large variety of filter feeding sessile invertebrates to flourish.

2.6.5 SPECIES DISTRIBUTION INFORMATION

For distributional limits of algae, invertebrate and fish species in the Port Phillip Heads Marine National Park, refer to Table 2.4.4.

2.6.6 SHOREBIRDS

Popes Eye is of State significance for shorebirds. Popes Eye and nearby Wedge Light are nesting and roosting sites for Australasian Gannets. Table 2.6.3 lists threatened shorebird species recorded within and around the site.

2.6.7 MARINE MAMMALS

Whales and seals have been sighted in the waters around Popes Eye and it is known that Australian Fur Seals haul out onto the rocks at this site on occasion and it is highly likely that dolphins would also pass by in close proximity to the Marine National Park at times.

Table 2.6.3. Threatened shorebird records from Port Phillip Heads Marine National Park – Popes Eye and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		1986
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		1999
Cape Gannet	*Morus capensis*			CEn		1982
Crested Tern	*Sterna bergii*			LR		1999

Table 2.6.4. Threatened marine mammal records from Port Phillip Heads Marine National Park – Popes Eye and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Humpback Whale	*Megaptera novaeangliae*		Vul	End		2000
Australian Fur Seal	*Arctocephalus pusillus*			Vul		1998

Table 2.6.5. Selection of some animals and plants that may be found in the Port Phillip Heads Marine National Park - Popes Eye.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Sargassum* sp., *Macrocystis angustifolia, Ecklonia radiata*
	green algae	*Codium* sp., *Caulerpa* sp., *Cladophora rugosa*
Invertebrates	crinoid	*Cenolia trichoptera*
	mollusc	*Haliotis rubra* and *Turbo undulatus*
	urchin	*Heliocidaris erythrogramma*
	seastars	*Nectria ocellata* and *Uniophora granifera* and *Nectria multispina*
Fish	scaly fin	*Parma victoriae*
	sea sweep	*Scorpis aequipinnis*
	six spined leatherjacket	*Meuschenia freycineti*
	southern hulafish	*Trachinops caudimaculatus*
	wrasse	*Notolabrus tetricus* and *N. fucicola*

2.6.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

There are no known sites of geological or geomorphological significance in the Marine National Park

2.6.9 KNOWLEDGE GAPS

The primary knowledge gap for Popes Eye relates to the soft sediment environment within the annulus.

2.6.10 RESEARCH

Author	Project	Notes
(Lindsay)	Reef fish recruitment inside and outside of marine parks	Upcoming Honours project
(Francis)	Mechanisms of sex change in blue throat wrasse	Ongoing Honours thesis
(Metcalfe)	Effects of fishing mortality on demography of blue throat wrasse	Ongoing Honours project
(Hale 2002)	Interactions Between Vessels and Dolphins in Port Phillip Bay. Final Report, Sept 2002	
(Bunce 2001b)	Prey consumption of Australasian gannets Morus serrator breeding in Port Phillip Bay, south east Australia and potential overlap with commercial fisheries	
(Bunce 2001a)	Effects of supplementary feeding and artificial twinning on nestling growth and survival in Australasian gannets (Morus serrator).	
(Ewing 2001)	Preliminary investigation of the costs of incubation in the Australasian Gannet Morus serrator	Honours thesis
(Bunce 2000)	Population dynamics of Australasian gannets, Morus serrator breeding in Port Phillip Bay, Victoria: competition with fisheries and the potential use of seabirds in managing marine resources	PhD thesis
(Edmunds *et al.*. 2000)	Marine biogeography of Central Victoria and Flinders bioregions - a preliminary analysis of reef flora and fauna.	Ongoing monitoring
(Gibbs *et al.*. 2000)	Reproductive parameters, chick growth and adult 'age' in Australasian Gannets Morus serrator breeding in Port Phillip Bay, Victoria, in 1994-95.	
(Scarpaci *et al.*. 2000)	The bottlenose dolphin (Tursiops truncatus) in the southern end of Port Phillip Bay: behavioural characteristics in spring and summer	
(Norman and Menkhorst 1995)	Aspects of the Breeding and Feeding Ecology of the Australasian Gannet Morus serrator in Port Phillip Bay, Victoria, 1988-92.	
(Jones and Norman 1986)	Feeding selectivity in relation to territory size in herbivorous reef fish	
(Norman and Jones 1984)	Determinants of territory size in the pomacentrid reef fish Parma victoriae	

2.7 Port Phillip Heads Marine National Park – Mud Islands

Mud Islands are the only known locality in Port Phillip Bay where consolidated dune rock is exposed above high water mark and they form an unusual feature in Victoria. They are part of the Port Phillip Bay Ramsar site and combined with Swan Bay are the second ranked shorebird site in Victoria. The dense seagrass beds both within and around Mud Islands provide important habitat and nursery areas for fish species such as King George whiting (*Sillaginodes punctata*) and several species of sharks are known to commonly bask in the shallow waters surrounding Mud Islands.

2.7.1 PHYSICAL PARAMETERS

Mud Islands are an exposed section of the Great Sands, which rise 3.6 m above high spring tide level and are shaped like an emerged atoll (Bird 1993). The whole area of the Mud Islands part of the Port Phillip Marine National Park is part of the most extensive sandbank in Port Phillip Bay (the Great White Sands) and is continually changing in shape due to storms and sand movement (ECC 1998).

Table 2.7.1. Physical parameters of the Port Phillip Heads Marine National Park – Mud Islands.

Park Name	Port Phillip Heads - Mud Islands
Conservation status	Marine National Park
Biophysical Region	Victorian Embayments
Size of Park (ha)	572
Length of coastline (m)	9968
Exposure rating	Moderate/low
Wave Energy	Low
Influential currents	The Rip
Tidal variation - springs (m)	0.7
Tidal variation - neaps (m)	0.1
Water temp - summer (°C)	20
Water temp - winter (°C)	11.2
Intertidal (ha)	106
0 - 2 m (ha)	422
2 - 5 m (ha)	13
Discharges	N/A
Adjacent catchment	N/A

2.7.2 MARINE HABITAT CLASSES

Mud Islands consist of a group of sandy barriers with vegetated dunes that enclose a shallow lagoon with sandy mud floor and which is bordered by saltmarsh (Bird 1993; ECC 1998). These soft sediment habitats (sand dunes, saltmarsh, subtidal soft sediments) combined with the intertidal sand flats and the seagrass community that exists within the lagoon and in the surrounding areas are the most notable habitats in this part of the Marine National Park (Figure A1.7a).

Table 2.7.2. Marine Habitat Classes for Port Phillip Heads Marine National Park – Mud Islands.

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
Substratum texture	Fine sand
	Muddy sand
Lithology	Calcarenite
Subtidal soft sediment biota	Heterozostera
	Mixed seagrass/algae
Dominant intertidal sediment biota	Saltmarsh
	Seagrass
Macroalgae Area	306.6
Zostera/Heterozostera Dominant Seagrass	386.8
Zostera/Heterozostera Dominant Seagrass & Macroalgae Area (ha)	1266.5
Sediment Area (ha)	124.6
Salt Marsh Area (ha)	9.2
Land Area (ha)	0.14

2.7.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.7.5.

Saltmarsh

Flora

Vegetation on the low-lying islands consists of saltmarsh and dune shrubland surrounding a sheltered lagoon. A total of 112 plant species have been recorded from the saltmarsh and surrounding dune systems. A number of species found in this area (marsh saltbush, ovan sea wrack, yellow sea lavender, coast Hollyhock) are considered rare or threatened in Victoria, (Parks Victoria 2002).

Invertebrate fauna

No information on the invertebrate fauna of the saltmarsh and surrounding dunes of Mud Islands was uncovered by the literature search.

Fish

There is no existing data on the fish assemblages of the Mud Island saltmarsh environment and fish will only be transient visitors during periods of exceptionally high tides.

Seagrass

Flora

Medium to dense beds of *Zostera / Heterozostera* have been recorded within the lagoon at Mud Islands and in the Great Sands area around Mud Islands. Patches of sparse *Zostera / Heterozostera* mixed with filamentous algae have also been recorded in the area around Mud Islands (Blake and Ball 2001).

Invertebrate fauna

The seagrass beds at Mud Islands are considered to provide a habitat for numerous invertebrate species (Park Notes), however no information is available regarding the invertebrate fauna associated with the Mud Islands seagrass habitat.

Fish

These seagrass beds provide important foraging and nursery areas for fish species such as King George whiting (Jenkins unpublished data).

Unvegetated sediment

Invertebrate fauna

An abundance of invertebrates including small crustaceans and segmented worms can be found in the sediments around Mud Islands (Park Notes), although again no formal survey data was found that related to the invertebrate fauna of the soft sediment environment.

Fish

Flounder are known to thrive in the shallow sandy habitats, which also act as a basking and pupping area for a number of shark species including the Bronze Whaler (Park Notes).

Lagoon

Despite the potential conservation interest of the lagoon environment a literature search has not revealed any specific information regarding the invertebrate fauna or fish assemblages. The seagrasses *Zostera* and *Heterozostera* are known to be present in the lagoon and so we would expect invertebrate and fish fauna normally associated with these species of seagrasses also to be present. Large populations of seabirds use the lagoon and anecdotal evidence suggests that these birds have created a highly enriched, species-poor environment.

2.7.4 BIOLOGICAL PROCESSES

Biological processes occurring in the Marine National Park are unknown.

2.7.5 SPECIES DISTRIBUTION INFORMATION

For distributional limits of algae, invertebrate and fish species in the Port Phillip Heads Marine National Park, refer to Table 2.4.4.

2.7.6 SHOREBIRDS

Mud Islands is an internationally significant shorebird habitat listed under the Ramsar convention and, combined with Swan Bay, is the second ranked shorebird site in Victoria (Watkins 1987). Peak numbers of migratory waders occur in the summer months. Table 2.7.3 lists threatened shorebird species recorded within the site and its surrounds.

At low tide, the western shore intertidal sand flats represent important wader feeding areas with feeding occurring to a lesser extent within the lagoon. Mud Islands represents the largest and most diverse shorebird roosting site in southern Port Phillip (numbers roosting reaching 2 - 5,000 in summer and 100's in winter). This site is also a significant nesting area, with breeding species including approximately 450 pairs of pelicans (July - Feb), 1 - 2,000 pairs of Crested Terns (Oct - Jan) and 20 pairs of Caspian Terns (C. Minton pers. comm.).

Little Penguins enter Port Phillip Bay to feed all year round, but mainly from June - Sept. Small numbers may roost on nearby South Channel Fort and may also come ashore at Mud Islands.

2.7.7 MARINE MAMMALS

No records of threatened marine mammal sightings are listed in the AVW for Mud Islands, but Southern Right Whales have been sighted in the surrounding waters and it is likely that dolphins and seals would also be encountered in the waters surrounding this Marine National Park.

Table 2.7.3. Threatened shorebird records from Port Phillip Heads Marine National Park – Mud Islands and surrounds (AVW and listed references).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaty	Year TWV
Arctic Jaegar	*Stercorarius parasiticus*				J	ARI 1999
Asian Dowitcher	*Limnodromus semipalmatus*				CJ	ARI 1999
Australasian Gannet	*Morus serrator*			Vul		Emison *et al.* 1987
Australasian Shoveler	*Anas rhynchotis*			Vul		1997
Bar-tailed Godwit	*Limosa lapponica*				CJ	Emison *et al*. 1987
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		Emison *et al*. 1987
Black-tailed Godwit	*Limosa limosa*				CJ	ARI 1999
Brown Quail	*Coturnix ypsilophora*			Ins		1987
Cape Barren Goose	*Cereopsis novaehollandiae*			Vul		1980
Cape Gannet	*Morus capensis*			CEn		1981
Caspian Tern	*Sterna caspia*	L		Vul	CJ	Emison *et al*. 1987
Common Diving-Petrel	*Pelecanoides urinatrix*			LR		1988
Common Greenshank	*Tringa nebularia*				CJ	Emison *et al.* 1987
Common Tern	*Sterna hirundo*				CJ	Watkins 1987
Crested Tern	*Sterna bergii*			LR		1981
Curlew Sandpiper	*Calidris ferruginea*				CJ	Emison *et al.* 1987
Eastern Curlew	*Numenius madagascariensis*			LR	CJ	Emison *et al*. 1987
Fairy Prion	*Pachyptila turtur*		Vul	LR		ARI 1999
Fairy Tern	*Sterna nereis*	L		Vul		Emison *et al.* 1987
Great Knot	*Calidris tenuirostris*				CJ	ARI 1999
Greater Sand Plover	*Charadrius leschenaultii*				CJ	ARI 1999
Grey Plover	*Pluvialis squatarola*				CJ	ARI 1999
Grey-tailed Tattler	*Heteroscelus brevipes*				CJ	ARI 1999
Kelp Gull	*Larus dominicanus*			CEn		ARI 1999
Lesser Sand Plover	*Charadrius mongolus*				CJ	ARI 1999
Lewin's Rail	*Rallus pectoralis*			End		ARI 1999
Little Egret	*Egretta garzetta*	L		CEn		ARI 1999
Little Tern	*Sterna albifrons*	L	End	Vul	CJ	ARI 1999
Marsh Sandpiper	*Tringa stagnatilis*				CJ	ARI 1999

Musk Duck	*Biziura lobata*			Vul		Emison *et al.*. 1987
Nankeen Night Heron	*Nycticorax caledonicus*			Vul		1982
Pacific Golden Plover	*Pluvialis fulva*				CJ	ARI 1999
Pacific Gull	*Larus pacificus*			LR		Emison *et al.* 1987
Pied Cormorant	*Phalacrocorax varius*			LR		Emison *et al.*. 1987
Red Knot	*Calidris canutus*				CJ	ARI 1999
Red-necked Stint	*Calidris ruficollis*				CJ	Emison *et al.*. 1987
Royal Spoonbill	*Platalea regia*			Vul		Emison *et al.*. 1987
Ruddy Turnstone	*Arenaria interpres*				CJ	Emison *et al.*. 1987
Sharp-tailed Sandpiper	*Calidris acuminata*				CJ	Emison *et al.*. 1987
Short-tailed Shearwater	*Puffinus tenuirostris*				J	ARI 1999
Shy Albatross	*Diomedea cauta*		Vul			ARI 1999
Whimbrel	*Numenius phaeopus*				CJ	ARI 1999
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	L		End	C	Emison *et al.*. 1987
White-faced Storm-Petrel	*Pelagodroma marina*			Vul		ARI 1999

Table 2.7.4. Threatened marine mammal records from Port Phillip Heads Marine National Park – Mud Islands surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1989

Table 2.7.5. Selection of some animals and plants that may be found in the Port Phillip Heads Marine National Park - Mud Islands.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	seagrass	*Heterozostera tasmanica, Zostera muelleri*
Invertebrates	crustaceans	Crustacea
	polychaetes	Polychaeta
Fish	King George whiting	*Sillaginodes punctata*
	flounder	*Rhombosolea tapirina*
	bronze whaler	*Carcharhinus brachyurus*

2.7.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Port Phillip Heads Marine National Park - Mud Islands are listed below (MPV database and Buckley 1993):

- Port Phillip Bay Entrance and Great Sands, (State significance): Incised entrance with sandy flood tidal delta on rocky platforms.
- Mud Islands Ridges and Lagoons, (State significance): Mud Islands consist of shelly sand ridges capped by dunes which enclose a shallow lagoon and salt marshes. Uncommon type of island development in Victoria.

2.7.9 KNOWLEDGE GAPS

There is very little information on any of the habitats within the Mud Islands section of The Port Phillip Heads National Park, with the exception of the saltmarsh flora.

2.7.10 RESEARCH

Author	Project	Notes
(Francis)	Mechanisms of sex change in blue throat wrasse	Ongoing Honours project
(Metcalfe)	Effects of fishing mortality on demography of blue throat wrasse	Ongoing Honours project
(Friends of Mud Islands Inc 2002-03)	Terrestrial habitat maintenance and seagrass monitoring	Envirofund Project No. 37566
(Ma *et al*. 2001)	Banding on the waders and terns between Australia and China.	
(Yugovic 1988)	Vegetation dynamics of a bird-dominated ecosystem: Mud Islands, Port Phillip Bay, Australia	PhD Thesis

2.8 Port Phillip Heads Marine National Park – Portsea Hole

Portsea Hole is an extremely popular dive site, primarily due to the abundant and diverse reef-fish present, coupled with the fact that it is a less demanding site for divers than many of those closer to The Heads. The resident fish assemblage includes species such as wrasse, blue devils, leatherjackets, barber and butterfly perch, gurnards, goatfish, and jackass morwongs.

2.8.1 PHYSICAL PARAMETERS

The Portsea Hole is about 500 m from the Portsea Pier and is a remnant of the old Yarra River valley. The top of the hole is at about 14 m depth and to the north there is a vertical wall approximately 75 m long which drops to sand at 27 m, then into a sand bowl which bottoms at approximately 33 m depth.

Table 2.8.1. Physical parameters of the Port Phillip Heads Marine National Park – Portsea Hole.

Park Name	Port Phillip Heads - Portsea Hole
Conservation status	Marine National Park
Biophysical Region	Victorian Embayments
Size of Park (ha)	10
Length of coastline (m)	0
Exposure rating	Moderate
Wave Energy	Moderate
Influential currents	The Rip
Tidal variation - springs (m)	0.7
Tidal variation - neaps (m)	0.1
Water temp - summer (°C)	18.4
Water temp - winter (°C)	12.5
5 - 10 m (ha)	1
10 - 15 m (ha)	2
15 - 20 m (ha)	4
Undefined (ha)	3
Discharges	N/A
Adjacent catchment	N/A

2.8.2 MARINE HABITAT CLASSES

The reef habitat at Portsea Hole comprises of a wall that consists of small overhangs or ledges that are covered in a prolific growth of sessile invertebrates (Stone 1999). On the top of the hole there are several rock bommies and the wall drops down to a sandy bottom.

Table 2.8.2. Marine Habitat Classes for Port Phillip Heads Marine National Park – Portsea Hole.

Marine Habitat Class	Attributes
Substratum relief	High profile reef
Substratum texture	Solid reef
	Broken reef
	Fine sand
Lithology	Basalt
Subtidal reef biota	Sessile invertebrates
Undefined Area (ha)	10

2.8.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.8.3.

Flora

No information is available on the flora in Portsea Hole, but the wall itself is dominated by encrusting and sessile invertebrates rather than algae due to low light penetration at that depth, which restricts algal growth.

Invertebrate fauna

The ledges at Portsea Hole have been described as hosting a prolific growth of giant finger sponges, bryozoans, hydroids, zoanthids, ascidians, polychaetes, sea spiders, nudibranchs and gorgonians (fan corals) (LCC 1995; Lewis 1988).

Fish

The fish assemblage found at Portsea Hole is considered to be particularly diverse, making this a very popular spot for divers. Commonly seen fish species include the blue devil fish (*Paraplesiops meleagris*), leatherjackets (Monacanthidae), barber perch (*Caesioperca rasor*), butterfly perch (*Caesioperca lepidoptera*), gurnards (Triglidae), goat fish (Mullidae) and jackass morwong (*Nemadactylus macropterus*). The blue devil fish is particularly abundant and along with other sites within the Port Phillip Heads Marine National Park, Portsea Hole supports one of the biggest populations of this species in Victoria.

2.8.4 BIOLOGICAL PROCESSES

Biological processes occurring in the Marine National Park are unknown.

2.8.5 SPECIES DISTRIBUTION INFORMATION

For distributional limits of algae, invertebrate and fish species in the Port Phillip Heads Marine National Park, refer to Table 2.4.4.

Table 2.8.3. Selection of some animals and plants that may be found in the Port Phillip Bay Marine National Park – Portsea Hole.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	**Scientific name**
Fish	blue devil fish	*Paraplesiops meleagris*
	leatherjackets	Monacanthidae
	barber perch	*Caesioperca rasor*
	butterfly perch	*Caesioperca lepidoptera*
	gurnards	Triglidae
	goat fish	Mullidae
	Jackass morwong	*Nemadactylus macropterus*

2.8.6 SHOREBIRDS

No records of threatened shorebird species are listed in the AVW, but birds likely to be seen in the area will include feeding diving birds (cormorants, petrels, gulls etc) and Little Penguins may pass through the site while moving into the bay to feed.

2.8.7 MARINE MAMMALS

No records of threatened marine mammals are listed in the AVW for this site. However, dolphins are known to spend a large proportion of their time in the Point Nepean/Portsea to Rye area and as a result would very likely to be observed in the Portsea Hole Marine National Park.

2.8.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

There are no known sites of geological or geomorphological significance in the Marine National Park.

2.8.9 KNOWLEDGE GAPS

Despite the popularity of Portsea hole as a dive site, no quantitative data are available on the subtidal reefs in this section of the Port Phillip Heads Marine National Park. Information in this report derived from anecdotal reports and interviews.

2.8.10 RESEARCH

Author	Project	Notes
(Lindsay)	Reef fish recruitment inside and outside of marine parks	Upcoming Honours project
(Francis)	Mechanisms of sex change in blue throat wrasse	Ongoing Honours project
(Metcalfe)	Effects of fishing mortality on demography of blue throat wrasse	Ongoing Honours project
(McShane *et al.*. 1988)	Growth and morphometry in abalone Haliotis rubra Leach from Victoria Australia	Outside Marine National Park.
(Fletcher and Day 1983)	The distribution of epifauna on Ecklonia radiata and the effects of disturbance	Outside Marine National Park.

2.9 Port Phillip Heads Marine National Park – Point Nepean

The Point Nepean section of the Port Phillip Heads Marine National Park supports a wide variety of habitats backed by rugged cliffs and dunes, including exposed rocky platforms and beaches, subtidal reefs and *Amphibolis* seagrass habitat. The combination of different habitats within the Marine National Park boundaries, in turn, supports a rich diversity of flora and fauna. Australian Fur Seals and Southern Right Whales can also be spotted on the Bass Strait coast of Point Nepean.

2.9.1 PHYSICAL PARAMETERS

The Point Nepean section of the Port Phillip Heads Marine National Park extends seawards from the Point Nepean section of the Mornington Peninsula National Park. It encompasses the exposed southerly side of the peninsula on the Bass Strait coast, and extends around Port Phillip Heads into the more sheltered northerly side of the peninsula within the bay. There are no significant discharges to the Point Nepean Marine National Park.

Table 2.9.1. Physical parameters of the Port Phillip Heads Marine National Park – Point Nepean.

Park Name	**Port Phillip Heads - Pt Nepean**
Conservation status	Marine National Park
Biophysical Region	Victorian Embayments and Central Victoria
Size of Park (ha)	424
Length of coastline (m)	5941
Exposure rating	High/moderate
Wave Energy	Moderate
Influential currents	The Rip
Tidal variation – springs (m)	1.2
Tidal variation – neaps (m)	0.6
Water temp – summer (°C)	17.5
Water temp – winter (°C)	13.5
Intertidal (ha)	27
0 - 2 m (ha)	61
2 - 5 m (ha)	64
5 - 10 m (ha)	54
10 - 15 m (ha)	174
15 - 20 m (ha)	31
20 - 30 m (ha)	13
30 - 40 m (ha)	0.04

40 - 50 m (ha)	0.002
Discharges	None
Adjacent catchment	National Park

2.9.2 MARINE HABITAT CLASSES

The Point Nepean section of the Port Phillip Heads Marine National Park encompasses a wide diversity of different habitat types. The most notable habitats are the wide, flat calcarenite platform reefs, that include rock pools and surge channels and that are interspersed with sandy beaches on Bass Strait. These calcarenite reefs extend into the subtidal, but beyond the surf break at depths between 10-12 m, bommie-type reefs surrounded by sand cover the seafloor. Within Port Phillip Bay there are also intertidal and subtidal reefs interspersed with sandy beaches. The moderate wave exposure just inside The Heads provides the one of the few regions in Port Phillip Bay suitable for extensive growth of the seagrass *Amphibolis antarctica.* While not within the Marine National Park boundaries, there are extensive dune and rugged cliffs backing the shoreline of Point Nepean (Figure A1.9a).

Table 2.9.2. Marine Habitat Classes for Port Phillip Heads Marine National Park – Point Nepean.

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
	Platform
	Beach / Platform
	Cliff
	Artificial seawall
Substratum relief	Low profile reef
	High profile reef
Substratum texture	Broken reef
	Gutters
	Outcrops
	Fine sand
Lithology	Sandstone
	Calcarenite
Subtidal reef biota	Kelp - Phyllospora dominated
	Kelp - Ecklonia dominated
	Kelp - mixed Phyllospora / Ecklonia
Subtidal reef understorey biota	Cystophora

	Cystophora / Amphibolis
	Sessile invertebrates
Subtidal soft sediment biota	Amphibolis
Intertidal soft sediment biota	Seagrass
Intertidal reef biota	Hormosira
	Coralline algae
	Mussels
Amphibolis Dominant Seagrass Area (ha)	17.5
Heavy reef Area (ha)	67.6
Macroalgae on Reef Area (ha)	14.6
Total Reef Area (ha)	82.2
Sediment Area (ha)	42.5
Undefined Area (ha)	281.8

2.9.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.9.5.

Intertidal Reef

Flora

Hormosira banksii is the dominant alga at the mid tide level, forming mats that cover the majority of the rock surface. Coralline algae and the green alga *Cladophora rugulosa* and unidentified red turf algae have also been noted beneath the *Hormosira* mats (Povey and Keough 1991). Lower on the shore an upright branching species of coralline algae is the dominant alga, forming a turf with other red alga with *Cladophora rugulosa* again interspersed between the tufts of coralline alga (Povey and Keough 1991). Rockpools have been found to support a diverse range of algae from *Hormosira* and *Cystophora subfarcinata*, *Halopteris*, *Codium fragile* and *Caulerpa* to some *Ecklonia radiata* and *Phyllospora comosa* near to the bottom of the pools. The seagrass *Amphibolis* has also been recorded on the sandy substrate at the bottom of rockpools and *Ecklonia radiata*, *Macrocystis angustifolia* and foliose red algae are found on boulders at the bottom of some pools at Point Nepean (O'Hara 2000).

Invertebrate fauna

On the more exposed parts of Cheviot beach (Bass Strait coast) patches of mussel beds (*Xenostrobus pulex*, *Austromytilus rostratus*) occur on the rock surface. A number of other, mainly mobile animals, have also been recorded from this shore, including prosobranch gastropods (*Austrocochlea constricta*, *A. odontis*, *Bembicium nanum*, *Nerita atramentosa*, *Turbo undulata*, *Nodilittorina unifasciata*), limpets (*Cellana tramoserica*, *Patelloida alticostata*, *P. latistrigata* and the pulmonates *Siphonaria diemenensis* and *S. zelandica*), predatory or omniverous species (*Lepsiella vinosa*, *Thais orbita* and *Cominella lineolata*) (Povey and Keough 1991). Other animals recorded from this shore include the anemones, *Actinia tenebrosa* and *Oulactis mucosa*, the seastar *Pateriella calcar*, the polychaete *Galeolaria caespitosa* and the barnacle *Chthamalus antennatus* (Povey and Keough 1991).

Fish

Fish have been described as abundant in the rockpools on Cheviot Beach and include blennies, gobies, juvenile wrasse, leatherjackets and old wives (O'Hara2000).

Subtidal Reef

Flora

Records from the exposed southern subtidal reefs of Point Nepean show Phyllospora comosa to be the dominant alga, with Ecklonia radiata, Acrocarpia paniculata, Sargassum spp, Dictyopteris acrostichoides, Caulerpa longifolia, Plocamium angustum, P. dilatatum and Hymenena spp also present (O'Hara 2000). Within Nepean Bay, on the northerly side of Point Nepean Marine National Park, subtidal reefs are characterised by dense kelp beds consisting mainly of Phyllospora comosa, but also with some Ecklonia radiata and Cystophora platylobium. Encrusting corallines are also common as an understorey (Edmunds *et al.*. 2000, O'Hara pers. comm.). Low profile reef has been found to support Caulerpa moniliformis, C. retroflexa, Codium pomoides, C. fragile, Caulerpa brownii, C. flexilis, Halopteris, the occasional Phyllospora comosa or Ecklonia radiata plant and various species of red algae (O'Hara2000).

Invertebrate fauna

Data on the invertebrate assemblages from the Point Nepean section of the Marine National Park comes from the inside of the Marine National Park, that is, inside The Heads. Common invertebrates recorded from this area include the feather star *Cenolia trichoptera*, the seastars *Nectria multispina, Uniophora granifera* and *Pateriella brevispina*, the gastropods *Turbo undulatus*, *Thais orbita*, *Haliotis laevigata*, and the urchin *Heliocidaris erythrogramma* (Edmunds *et al.*. 2000).

Fish

The fish assemblages described from inside The Heads include relatively high abundances of the herring cale *Odax cyanomelas*, the horseshoe leatherjacket *Meuschenia hippocrepis*, the scaly fin *Parma victoriae* and the zebra fish *Girella zebra* (Edmunds *et al*. 2000). The western blue devilfish (*Paraplesiops meleagris*) is also commonly observed within the Port Phillip Heads Marine National Park. The population of blue devilfish at Port Phillip Heads is thought to be the largest in Victoria despite being near to the end of the eastern extent of its range (Park Notes). Weedy sea dragons (*Phyllopteryx taeniolatus*) have also been seen in this area (G. Jenkins pers comm.).

Amphibolis **seagrass community**

Flora

A recent survey (Blake and Ball 2001a) found that the areas within the Point Nepean Marine National Park that were dominated by *Amphibolis antarctica* were on the northerly side of the peninsula. There were also occasional patches of *Ecklonia radiata* and other brown algae such as *Cystophora*. *Caulerpa* is the main understorey with low abundances of other red algae (Edmunds *et al*., 2000). In separate observations, the seagrass was described as supporting little epiphytic algae and larger algae in the area included isolated plants of both *Cystophora* and *Macrocystis angustifolia* (plants up to 3 m high), *Ulva*, *Caulerpa brownii* and *C*. *Scapelliformis* (O'Hara 2000).

Invertebrate fauna

There is no data on the invertebrate fauna associated with the *Amphibolis* seagrass beds in this area.

Fish

There is no data on the fish communities associated with the *Amphibolis* seagrass beds in this area.

Unvegetated subtidal soft sediment

Invertebrate fauna

There is no invertebrate data from unvegetated soft sediment environments within the Marine National Park boundaries. However data from a single grab sample (0.1 m-2) taken at 40 m depth to the east of the Marine National Park is available and forms part of a larger survey covering the entire Victorian Bass Strait coast (Coleman *et al*. 2002). This sample contained

16 different species and 82 individuals. Data from the whole survey suggests that the shallower depths generally support fewer species. Many of the species found in the survey were recorded only once and so it is difficult to make generalisations as to whether or not the particular suite of species found at this nearby site would be the same within the Marine National Park boundaries. The nearest existing data from the northern side of Point Nepean (within Port Phillip Heads) is from the 1971 Port Phillip Bay study where again a 0.1 m^2 grab sampler was used at a 12 m depth to the east of the Marine National Park boundary. At this site they recorded 26 different species from 108 individuals.

Fish

There is little direct information regarding fish assemblages in the soft sediment environments of the Point Nepean section of the Marine National Park. The soft sediment environs are likely to provide important habitat and feeding areas for several important commercial and recreational species of fish such as King George whiting, flounder, flathead, mullet, salmon and snapper.

2.9.4 BIOLOGICAL PROCESSES

Biological processes occurring in the Marine National Park are unknown.

2.9.5 SPECIES DISTRIBUTION INFORMATION

For distributional limits of algae, invertebrate and fish species in the Port Phillip Heads Marine National Park, refer to Table 2.4.4.

2.9.6 SHOREBIRDS

The rocky shore, reef platforms and sandy beaches along the Point Nepean coast represent State significant feeding habitats for many shorebird species. Hooded Plovers have been observed nesting directly on beaches along the Marine National Park's open coast above high water mark or on adjacent sand dunes (M. Weston pers. comm.).

Table 2.9.3 lists threatened shorebird species recorded at Point Nepean.

2.9.7 MARINE MAMMALS

Records from the AVW show sightings of both Australian Fur Seals and Southern Right Whales along the open coast side of the Point Nepean site.

Bottlenose dolphins have a small population in Port Phillip (about 80) that appears to be resident in the southern part of the bay and primarily in the area on the inside of the mouth of the bay (Hale 2002). Dolphins probably spend most of their time close to the entrance in order to exploit feeding opportunities presented by migratory species such as squid, mullet and barracouta that move through the entrance. They are also likely to feed around seagrass beds in this area (Hale 2002). Dolphins are often observed feeding, travelling and socialising in the area close to the shore from Point Nepean to Portsea and further east towards Capel Sound where the tidal flow is weaker than deeper channels further offshore. The Port Phillip dolphins are thought to spend a large proportion of their time in this area due to the favourable topography (deep water with low currents) and foraging and feeding opportunities (Hale 2002).

Table 2.9.3. Threatened shorebird records from Port Phillip Heads Marine National Park – Point Nepean and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		1999
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		1998
Common Diving-Petrel	*Pelecanoides urinatrix*			LR		1985
Crested Tern	*Sterna bergii*			LR		1999
Fairy Prion	*Pachyptila turtur*		Vul	LR		1986
Fairy Tern	*Sterna nereis*	L		Vul		1986
Hooded Plover	*Thinornis rubricollis*	L		End		1989
Kelp Gull	*Larus dominicanus*			CEn		1998
Pacific Gull	*Larus pacificus*			LR		1999
Pied Cormorant	*Phalacrocorax varius*			LR		1999
Pomarine Jaeger	*Stercorarius pomarinus*			Ins	CJ	1989
Royal Spoonbill	*Platalea regia*			Vul		1999
Shy Albatross	*Diomedea cauta*		Vul			1986

Table 2.9.4. Threatened marine mammal records from Port Phillip Heads Marine National Park – Point Nepean and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australian Fur Seal	*Arctocephalus pusillus*			Vul		1998
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1992

Table 2.9.5. Selection of some animals and plants that may be found in the Port Phillip Heads Marine National Park – Point Nepean.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Hormosira banksii*, *Scytosiphon lomentaria*, *Notheia anomala*, *Ecklonia radiata*, *Sargassum vestitum, Phyllospora comosa*, *Cystophora retorta, Acrocarpia paniculata*, *Carpoglossum confluens, Cystophora platylobium*, *Cystophora moniliformis*, *Sargassum* spp.
	green algae	*Ulva rigida*, *Caulerpa flexilis*, *Caulerpa* spp. *Cladophora dalmatica*, *Cladophora prolifera*, *Codium fragilis*, *Cladophora* spp. and *Ulva* spp.
	red algae	*Corallina officinalis*, *Gelidium crinale*, *Ceramium flaccidum*, *Laurencia tumida*
Invertebrates	gastropods	*Austrocochlea* spp. *Turbo undulata, Thais orbita*, *Bembicium nanum*, *Cominella lineolata.*
	limpet gastropods	*Cellana tramoserica*, *Siphonaria diemenensis Siphonaria zelandica*, *Patelloida alticostata*
Fish	magpie perch	*Cheilodactylus nigripes*
	herring cale	*Odax cyanomelas*
	scaly fin	*Parma victoriae*
	sea carp	*Aplodactylus arctidens*
	sea sweep	*Scorpis aequipinnis*
	seagrass	*Amphibolis antarctica*
	six spined leatherjacket	*Meuschenia freycineti*
	wrasse	*Notolabrus tetricus*, *N. fucicola* and *Pictilabrus laticlavius*

2.9.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Port Phillip Heads Marine National Park - Point Nepean site are listed below (MPV database and Buckley 1993):

- Observatory Point Cuspate Foreland, (Regional/Local Significance): One of the few sites in Port Phillip Bay to show sustained sandy accretion.
- Point Nepean Platforms, (State significance): Entrance controlling many of the features of Port Phillip Bay.

2.9.9 KNOWLEDGE GAPS

There is no quantitative data on the floral communities of the intertidal reef at Point Nepean, the information contained in this report is taken from the site description of a research study undertaken on the Bass Strait coast (Povey and Keough 1991). No information regarding the intertidal floral and faunal assemblages within Port Phillip Bay was found. Other knowledge gaps include information about rockpool fish, the soft sediment environment, including the *Amphibolis* habitat. Data for subtidal reefs in this area is taken from inside the Heads; the invertebrate faunal assemblage on the more exposed Bass Strait is likely to differ to that observed within Nepean Bay.

2.9.10 RESEARCH

Author	Project	Notes
(Lindsay)	Reef fish recruitment inside and outside of marine parks	Upcoming Honours project
(Francis)	Mechanisms of sex change in blue throat wrasse	Ongoing Honours project
(Metcalfe)	Effects of fishing mortality on demography of blue throat wrasse	Ongoing Honours project
(Scarpaci)	The ecology and behaviour of the bottlenose dolphin *Tursiops truncatus* in Port Phillip Bay, Victoria, Australia	Ongoing PhD project
(Hale 2002)	Interactions Between Vessels and Dolphins in Port Phillip Bay. Final Report, Sept 2002	
(Edmunds *et al*. 2000)	Marine biogeography of Central Victoria and Flinders bioregions - a preliminary analysis of reef flora and fauna.	Ongoing monitoring program – includes sites at Point Nepean
(Hindell 2000)	Effects of sewage effluent on the population structure of *Brachidontes rostratus* (Mytilidae) on a temperate intertidal rocky shore	Control site at Point Nepean
(O'Hara 2000)	Faunal and floral assemblages associated with rocky reefs along the Victoria coast	
(Scarpaci *et al*. 2000)	The bottlenose dolphin (*Tursiops truncatus*) in the southern end of Port Phillip Bay: behavioural characteristics in spring and summer	
(Burton 1999)	Competitive interactions between and within the intertidal gastropod genera *Cellana* and *Siphonaria*	PhD thesis
(Chipchase 1999)	Low altitude aerial mapping of *Hormosira banksii* on intertidal rock platforms	Masters thesis
(Porter 1999)	Evaluation of the effectiveness of marine protected areas in temperate waters of Australasia	PhD thesis
(Bellgrove 1998)	Recruitment of intertidal macroalgae on a wave exposed rocky coast	PhD thesis
(Bellgrove *et al*. 1997)	The effects of secondarily treated sewage effluent on intertidal macroalgal recruitment processes	Control site at Point Nepean
(Keough *et al*. 1997)	Geographic variation in interactions between size classes of the limpet *Cellana tramoserica*	
(Povey and Keough 1991)	Effects of trampling on plant and animal populations on rocky shores	

2.10 Yaringa Marine National Park

Western Port is a large embayment to the east of Port Phillip Bay with extensive areas of intertidal mudflats and seagrass meadows and a dendritic network of tidal channels. Yaringa Marine National Park is a shallow embayment with large seagrass beds on extensive intertidal mudflats in the north of Western Port in Watson Inlet. The saltmarsh, mudflat and seagrass habitats of Yaringa are an important habitat for migratory birds, juvenile fish and invertebrates (Zann 1997). The mangrove-saltmarsh vegetation communities of Yaringa Marine National Park are internationally important as feeding habitat for wader birds.

2.10.1 PHYSICAL PARAMETERS

Yaringa Marine National Park is located about nine kilometres south-west of Tooradin in Watson Inlet at the northern end of Western Port and is bordered in the east by Quail Island and in the south by Yaringa Marina (Figure A1.10a). The area is characterised by extensive intertidal mudflats which are exposed during low tides, revealing a pattern of dendritic channels which drain into increasingly larger main channels towards the entrance of Western Port (Marsden and Mallett 1975).

The large western entrance to Western Port and the relatively shallow nature of the bay result in stronger tidal currents than those found in neighbouring Port Phillip Bay. While tidal currents are strong, the net current flow is largely confined to the main channel just south of the Yaringa Marine National Park (Hinwood 1979). The surrounding catchment is predominantly agricultural with some developing urban areas (*e.g.,* Pakenham, Berwick and Cranbourne) (EPA 1996). The major sources of freshwater input into the Yaringa Marine National Park are Langwarrin and Watson Creeks. For a summary of the physical parameters in Yaringa Marine National Park see Table 2.10.1.

Table 2.10.1. Physical parameters for Yaringa Marine National Park.

Park Name	Western Port – Yaringa
Conservation status	Marine National Park
Biophysical Region	Victorian embayments
Size of Park (ha)	980
Length of coastline (m)	20254
Exposure rating	Low
Wave Energy	Low
Influential currents	Tidal
Tidal variation - springs (m)	2.60
Tidal variation - neaps (m)	0.90

Water temp - summer (°C)	20.50
Water temp - winter (°C)	11.50
Intertidal (ha)	930
0 - 2 m (ha)	10
2 - 5 m (ha)	10
5 - 10 m (ha)	1
10 - 15 m (ha)	
Discharges	Intermittent creeks
Adjacent catchment	Agricultural

2.10.2 MARINE HABITAT CLASSES

The Yaringa Marine National Park is a sheltered, intertidal mudflat environment. The most notable habitats are the extensive seagrass beds, sheltered intertidal mudflats and the subtidal soft substrates in the central channel of Watson Inlet. The northern Marine National Park boundary and Quail Island are fringed by salt marsh and mangroves. A small area of particularly dense seagrass with some algae is present south of Quail Island.

Table 2.10.2. Marine Habitat Classes for Yaringa Marine National Park (Bird 1993; Blake and Ball 2001b).

Marine Habitat Class	Attributes
Shoreline category	Beach
	Artificial structure
Substratum texture	Fine sand
	Muddy sand
	Mud / silt
Subtidal soft sediment biota	Heterozostera
Intertidal soft sediment biota	Mangrove
	Saltmarsh
	Seagrass
	Mussels
	Barnacles
Area Zostera/Heterozostera Dominant Seagrass (ha)	276.7
Sediment Area (ha)	46.9
Mangroves Area (ha)	237.4
Salt Marsh Area (ha)	393.3

2.10.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.10.10.

Saltmarsh

Saltmarsh habitats exist throughout Western Port and are frequently found in the same regions as mangroves with saltmarsh growing on the landward edge of the mangroves (Hamilton 1994).

Flora

The saltmarsh plant community of Watson Inlet and Quail island is of national importance because it is floristically rich in comparison to other saltmarsh communities such as Corner Inlet and elsewhere in Australia (Adam 1990) and is relatively undisturbed by industry, grazing or weeds (Opie *et al*. 1984). The mangrove-saltmarsh vegetation zone at Watson Inlet is exceptionally wide and extends up to one kilometre (Bird 1974).

A recent quantitative survey of the Quail Island saltmarsh community revealed that *Sclerostegia arbucula* had the highest percentage cover followed by *Sarcocornia quinqueflora* and to a lesser extent *Suaeda australis* (Saintilan and Rogers 2001). Other species present included *Wilsonia backhousei*, *Selliera radicans*, *Samolus repens*, *Chenopodiaceae* sp., *Baumea* sp., *Juncus krausii*, and *Distichilis distichophylla* (Saintilan and Rogers 2001).

Comparison of historical and current aerial photographs by Saintilan and Rogers (2001) revealed that saltmarsh was displaced by mangroves in some tidal drainage creeks in the south-west corner of Quail Island between 1973 and 1999.

Invertebrate fauna

Information about the invertebrates found in saltmarsh habitats in Yaringa Marine National Parks was unavailable, but generalisations can be drawn about the likely species composition from studies of similar habitat elsewhere in Western Port. The fauna associated with saltmarsh in Western Port is characterised by a number of species of air-breathing gastropods including *Salinator solida*, *Ophiacardelus ornatus*, *Marinula meridionalis* and *Truncatella scalarina*. The littorinid *Bembicium melanostomum* is found in the lower part of the saltmarsh zone where it borders on the mangroves (Smith *et al*. 1975).

Fish

No information was available on fish occurring in saltmarsh in the Yaringa Marine National Park, but if they are present, it is only transiently when saltmarsh is covered by exceptionally high tides.

Mangrove

Flora

The white mangrove (*Avicennia marina* subsp. *australasica*) is the only species of mangrove occurring in Victoria where it reaches the southern extent of its distribution. The most extensive and well developed communities of mangroves in Victoria are found in Western Port where they are considered of State significance (Ross 2000). The mangrove plants grow as trees and shrubs with some almost 4 m tall on Quail Island in Yaringa Marine National Park (Saintilan and Rogers 2001). The mangrove zone occurs inshore of seagrass, sand and mudflats with all communities generally occurring parallel to the shore, except where drainage channels or creeks alter the surface (Chamberlain 1979).

All of the Western Port Marine National Parks include some stands of mangrove trees and Yaringa Marine National Park has the most extensive area of mangroves (Blake and Ball 2001b).

Historically, mangroves were removed from the Yaringa area causing the erosion of saltmarsh, however more recently mangroves have begun to recover (Bird 1993). Saintilan and Rogers (2001) found that within the tidal drainage creeks in the south-west corner of Quail Island mangrove vegetation has extended up into the creeks and displaced saltmarsh vegetation. They also found that between 1973 and 1999 mangrove vegetation has been expanding by prograding in a seaward direction in Yaringa Marine National Park (Saintilan and Rogers 2001).

The trunks and pneumatophores of mangrove trees provide the only hard substratum in this zone and numerous epiphytic filamentous algae including *Caloglossa*, *Catanella nipae* and *Bostrychnia* form mats on them (Smith *et al*. 1975).

Invertebrate fauna

No specific information about the invertebrates found in the mangroves of Yaringa Marine National Park was available, but generalisations can be drawn about the likely species composition from studies of similar habitat elsewhere in Western Port.

The mangrove trunks and pneumatophores are the only hard substratum in this zone and species including *Bembicium nanum*, *B. melanostomum*, and the barnacle *Chamaesipho columna* are commonly found. The mussel *Mytilus edulis planulatus* may be found attached to the roots (Smith *et al*. 1975).

Fish

No specific information was available directly relating to fish in Yaringa mangrove communities. However, a recent survey of nearby mangrove habitat in Western Port (Jenkins and Hindell FRDC 2001/036) recorded species including glass goby (*Gobiopterus semivestitus*), smooth toadfish (*Tetractenos glaber*), yellow-eye mullet (*Aldrichetta forsteri*), halfbridled goby (*Arenigobius frenatus*) and the bluespot goby (*Pseudogobius olorum*).

Seagrass

Flora

Typically, seagrass meadows are found in water depths between intertidal and 2 m, where sunlight intensity is greatest and therefore seagrass growth is highest (Lloyd 1997). The most abundant subtidal seagrass in Western Port is *Heterozostera tasmanica*. In shallow subtidal soft substrata the green alga *Caulerpa cactoides* and the brown alga *Sargassum* sp. and various species of red algae are commonly present (Ministry for Conservation 1975).

The most recent mapping of Western Port seagrass by Blake and Ball (2001b) found four species of seagrass in Western Port, although only three species (*Halophila ovalis*, *Zostera muelleri* and *Heterozostera tasmanica*) were present in the Western Port Marine National Parks. Blake and Ball (2001b) found the *Zostera*/*Heterozostera* community to be common in Yaringa Marine National Park, and little or no macroalgae present (Blake and Ball 2001b). Historically, Bulthuis (1981) found that *Zostera muelleri* dominated the Yaringa Marine National Park in Watson Inlet, with *Heterozostera tasmanica* mainly occurring outside the Inlet.

The two species *Z. muelleri* and *H. tasmanica*, were grouped into the single category of *Zostera*/*Heterozostera* in the study. However, it is possible to make inferences about their likely distribution based on their ecology. *Z. muelleri* is generally considered an intertidal species (Womersley 1984) and would therefore be expected to colonise the large intertidal mudflats in Western Port. Conversely, *H. tasmanica* is generally a subtidal species (Womersley 1984), and could therefore be expected to inhabit the subtidal borders of the channels. However, this is not always the case. Bulthuis (1981) observed that *Z. muelleri* inhabited the higher intertidal slopes and *H. tasmanica* the flat intertidal banks between channels. In many places the seaward edge of the mudflats is higher than the remainder of the flats (Marsden and Mallett 1975) creating a large shallow pool in which the desiccation prone *H. tasmanica* can survive. Stephens (1995) suggests that dense beds of *H. tasmanica* trap enough water on the ebbing tide to avoid desiccation during periods of exposure and hence inhabit intertidal flats.

Invertebrate fauna

Most studies that relate to the invertebrate fauna of seagrass habitats have been undertaken outside the Yaringa Marine National Park. Presented here are descriptions of invertebrate assemblages that might generally be expected in Western Port seagrass habitats. Seagrass habitats in Western Port support greater species richness than adjacent unvegetated habitats (Edgar *et al*. 1993), which may be a consequence of the structural heterogeneity of seagrass providing habitat for epifaunal species which cannot survive on bare substrata (Edgar 1990).

Considerable research effort has been directed at the invertebrate species of seagrass communities in Western Port (see EPA 1996, for a review), with some studies providing considerable detail on trophic interactions and production (*e.g.,* Edgar *et al*. 1994; Littlejohn *et al*. 1974; Watson *et al*. 1984). Most studies found a gradual change in the infaunal community structure from the near shore regions to the shallow channels and inlets and the deep channels (Coleman *et al*. 1978; Edgar *et al*. 1994; Littlejohn *et al*. 1974; Smith *et al*. 1975).

Prominent infaunal species include the bivalves *Anadara trapezia*, *Katelysia rhytiphora*, *Homalina deltoidalis*, *H*. *mariae* and *Laternula tasmania*. Common crustaceans are the ghost shrimp (Callianassidae), the shrimp *Alpheus* sp. and the tanaid *Paratanais* (Coleman *et al*. 1978; Edgar *et al*. 1994; Watson *et al*. 1984). Also common are the foraminiferans *Ammotium cassis* and *Trochommina sorosa*, the polychaete genera *Barantolla*, *Armandia*, *Nepthys*, *Lumbrineris*, *Platynereis* and *Pista* and the gastropods *Salinator fragilis*, *Nassarius burchardi* and *Polinices sordidus* (EPA 1996; Smith *et al*. 1975).

Common epifauna include a large number of grazing molluscs (families Trochidae and Rissoacea) *gammaridean* amphipods, the shrimp *Macrobrachium* sp., the crabs *Halicarcinus* sp. and *Litocheira bispinosa*, and occasional sponges, hydroids and ascidians (Edgar *et al*. 1994; Littlejohn *et al*. 1974; Smith *et al*. 1975).

A food web of the seagrass ecosystem in Western Port was developed by Watson *et al*., (1984).

Fish

Surveys of fish in seagrass habitats have not been undertaken from directly within the Yaringa Marine National Park. In Western Port in general, seagrass fish assemblages consist predominantly of pipefish, gobies, weedfish, leatherjackets (Monacanthidae), globefish (*Diodon nicthemerus*), soldierfish (*Gymnapistes marmoratus*), blue rock whiting (*Haletta semifasciata*) and adult rock flathead (*Platycephalus laevigatus*) (EPA 1996). See Table 2.10.3 for details.

Table 2.10.3. Common fish assemblages in Western Port seagrass (adapted from EPA 1996).

Family	Common name	Scientific Name
Moridae	Rock cod	*Pseudophycus bachus*
Atherinidae	Hardyheads	*Kestratherina brevirostris*
Syngnathidae	Pipefish	*Stigmatopora argus*
		Stigmatopora nigra
		Mitotichths semistriatis
		Vanacampus phillipi
		Urocampus carinirostris
Scorpaenidae	Soldierfish	*Gymnapistes marmoratus*
Platycephalidae	Rock flathead (adult)	*Platycephalus laevigatus*
Apogonidae	Woods siphon fish	*Siphaemia cephalotes*
Enoplosidae	Old wife	*Enoplosus armatus*
Odacidae	Blue rock whiting	*Haletta semifasciata*
Clinidae	Weedfish	*Cristiceps australis*
		Heteroclinus adelaidei
		Heteroclinus perpicillatus
Globiidae	Gobies	*Arenigobius frenatus*
		Gobiopterus semivestitus
Monacanthidae	Six spined leatherjacket	*Meuschenia freycineti*
	Bridled leatherjacket	*Acanthaluteres spilomelanurus*
	Toothbrush leatherjacket	*Acanthaluteres vittiger*
	Pygmy leatherjacket	*Brachaluteres jacksonianus*

Some notable changes have occurred in the fish fauna in recent years. Fifteen years ago the wide bodied pipefish (*Stigmatopora nigra*) was low in abundance and the spotted pipefish (*S. argus*) was unrecorded (Howard and Koehn 1985), however, both are now relatively common (Edgar and Shaw 1995a).

Intertidal mudflats

Flora

Most areas of the intertidal flats in the Western Port are dominated by seagrass and no specific information is available for unvegetated areas in Yaringa Marine National Park. However, generally intertidal mudflats elsewhere support a high biomass of micro-algae surface film and some fine-branched macroalgae usually dominated by red species (LCC 1994a).

Invertebrate fauna

No specific information about the invertebrates found in the sheltered intertidal mudflats of the Yaringa Marine National Park was available, but generalisations can be drawn about the likely species composition from studies of similar habitat elsewhere in Western Port. Typical invertebrate species on sheltered intertidal mudflats in Western Port include a number of bivalve molluscs including the triangular tellin (*Tellina deltoidalis*), elongated lantern shell (*Laternula creccina*), and mud ark (*Anadara trapezia*). Several crustaceans occur in large numbers on, or in, mudflats including the crabs (*Mictyris platycheles*, *Macrophthalmus latifrons*, *Heloecius cordiformis*) and the ghost shrimp (*Callianassa* sp.) (LCC 1994a).

Fish

No specific information regarding the fish species found in unvegetated intertidal flats in Yaringa Marine National Park. The fish fauna of the unvegetated intertidal flats elsewhere in Western Port has recently been sampled and the common species included smooth toadfish (*Tetractenos glaber*), yellow-eye mullet (*Aldrichetta forsteri*), bluespot goby (*Pseudogobius olorum*), long fin goby (*Favonigobius lateralis*) and the glass goby (*Gobiopterus semivestitus*) (Jenkins and Hindell FRDC 2001/036).

For a summary of the most common fish species in unvegetated intertidal mudflats refer to Table 2.10.4.

Table 2.10.4. Common fish assemblages in Western Port unvegetated intertidal mudflat (adapted from EPA 1996).

Family	Common name	Scientific Name
Elasmobranchs	Sharks and Rays	Various (mostly undocumented)
Clupeidae	Sand sprat	*Hyperlophus vittatus*
Platycephalidae	Rock flathead (juvenile)	*Platycephalus laevigatus*
	Sand flathead	*Platycephalus bassiensis*
Siliginidae	King George whiting	*Sillaginodes punctata*

Globiidae	Gobies	*Favonigobius lateralis*
		Favonigobius tamarensis
		Arenigobius frenatus
		Pseudogobius olorum
Pleuronectidae	Greenback flounder	*Rhombosolea tapirina*
	Long snouted flounder	*Ammotretis rostratus*
Tatradontidae	Smooth toadfish	*Tetractenos glaber*

Unvegetated subtidal soft substrata

No information relating specifically to the Yaringa Marine National Park was found for this habitat class and so we present general information from Western Port. These habitats occur in the deep main (10-30 m) channels of Western Port where winnowing by currents cause a coarser sand substrate than on the sheltered intertidal mudflats (Edgar *et al*. 1994; Littlejohn *et al*. 1974; Smith *et al*. 1975).

Invertebrate fauna

The seapen *Virgularia mirabilis* which anchors to the substrate by a fleshy stalk is present in high abundance in deepwater channels in Western Port with densities reaching approximately 200/m^2 (Edgar *et al*. 1994). Similarly, the epifaunal brachiopod *Magellania flavescens* occurs locally at high densities of up to 250/m^2 mainly around San Remo (Smith *et al*. 1975). Other epifaunal species attached to rubble and shells include the gastropod *Sigapatella calyptraeformis*, the sea stars *Nectria ocellata*, *Patiriella brevispina* and *Tosia magnifica*, the urchin *Goniocidaris tubaria* and the solitary ascidian *Pyura stolonifera* (Smith *et al*. 1975).

The most abundant infaunal taxa of the deep channels are polychaetes and crustaceans, the bivalve molluscs, *Neotrigonia margaritacea*, *Pronuncula* sp. *Notocallista diemensis*, *Bellucina crassillirata*, *Venericardia bimaculata*, the rock-boring bivalve *Pholas australiasiae*, and the carnivorous gastropods *Nassarius burchardi*, *Pterynotus triformis* and *Amorena undulata* (Smith *et al*. 1975). The molluscs *Neotrigonia margaritacea* and *Anadara trapezia*, and the brachiopod *Magellania flavescens* are of particular value because they are restricted in distribution elsewhere but are abundant within Western Port (Smith *et al*. 1975).

Fish

No specific data about the fish fauna of channels in Yaringa Marine National Park was available, but common species typically include stingarees (Urolophidae), gurnard perch (*Neosebastes scorpaenoides*), sand flathead (*Platycephalus bassiensis*) and gobies (*e.g.,* *Favonigobius lateralis*) (Edgar and Shaw 1995b). Juvenile King George whiting (*Sillaginodes punctata*) can sometimes be found in unvegetated areas adjacent to seagrass (Edgar and Shaw 1995b). Table 2.10.5. provides a summary of common fish assemblages in Western Port drainage channels.

Table 2.10.5. Common fish assemblages in Western Port drainage channels (adapted from EPA 1996).

Family	Common name	Scientific Name
Urolophidae	Banded stingaree	*Urolophus cruciatus*
Scorpaenidae	Gurnard perch	*Neosebastes scorpaenoides*
Platycephalidae	Sand flathead	*Platycephalus bassiensis*
Globiidae	Goby	*Favonigobius lateralis*
Tatradontidae	Smooth toadfish	*Tetractenos glaber*

Pelagic environment

Flora

No specific information about the pelagic flora environment in Yaringa Marine National Park was found. One of the few studies of the pelagic environment in Western Port was carried out by (Kimmerer and McKinnon 1985)(1985) who found numerous species of phytoplankton.

Invertebrate fauna

No specific information about the pelagic invertebrate fauna in Yaringa Marine National Park was found. Kimmerer and McKinnon (1985) found the copepod *Acartia tranteri* dominated the pelagic invertebrate fauna elsewhere in Western Port. Information about the larger invertebrates in the pelagic environment is unknown.

Fish

No specific information about the fish in the pelagic environment in Yaringa Marine National Park was found. In general, Western Port supports a group of highly mobile pelagic species including Australian Salmon (*Arripis* spp.), yellow-eye mullet, pilchards and anchovies, barracouta (*Thyrsites atun*) and various sharks and rays (Edgar and Shaw 1995b; Robertson 1982). See Table 2.10.6 for details.

Table 2.10.6. Common mobile pelagic fishes in Western Port (adapted from EPA 1996).

Family	Common name	Scientific Name
Carcharhinidae	School shark	*Galeorhinus galeus*
	Gummy shark	*Mustelus antarcticus*
Callorhynchidae	Elephant fish	*Callorhynchus milii*
Rajiforms	Rays	*Various (mostly undocumented)*
Clupeidae	Sand sprat	*Hyperlophus vittatus*
	Pilchard	*Sardinops neopilchardus*
Engraulidae	Australian anchovy	*Engraulis australis*
Hemiramphidae	Southern sea garfish	*Hyporhamphus melanochir*
Pomatomidae	Tailor	*Pomatomus saltatrix*
Carangidae	Silver trevally	*Pseudocaranx dentex*
	Jack mackerel	*Trachurus declivis*
Arripidae	Australian salmon	*Arripis truttacea*
Mugilidae	Yellow-eyed mullet	*Aldrichetta forsteri*
Gempylidae	Barracouta	*Thyrsites atun*

2.10.4 BIOLOGICAL PROCESSES

No information regarding biological processes occurring in the Yaringa Marine National Park was found.

2.10.5 SPECIES DISTRIBUTION INFORMATION

No marine species are known to have their distributional limits near or within the Yaringa Marine National Park.

2.10.6 SHOREBIRDS

The intertidal mudflats of Western Port are listed under the Ramsar convention, with the intertidal mudflats of the Yaringa Marine National Park also being identified as State significance as a secondary foraging area for the 32 species of migratory waders recorded in Western Port Bay. The surrounding salt marsh and mangrove are of regional significance for shorebirds, providing roosting areas for waders, cormorants, herons and egrets.

Table 2.10.7 lists threatened shorebird species sighted in and around the Yaringa Marine National Park. Of particular interest is the presence of the Orange-bellied Parrot which may feed in the adjacent salt marsh. Around 40 further, non-threatened species are recorded in this Marine National Park and its surrounds.

Studies focusing on the distribution and abundance of Little Penguins in Western Port have recorded specimens at the top of the northern arm so it is possible that these birds would occasionally enter the Yaringa Marine National Park (Dann *et al.* 2001).

2.10.7 MARINE MAMMALS

A record of a Humpback Whale is listed in the AVW at the deeper channel to the south of the Yaringa Marine National Park. Australian Fur Seals have been recorded in the upper northern arm of Western Port but not over the intertidal flats (Dann *et al.* 1996) so it would seem unlikely that they would be present in the Marine National Park.

Research into the distribution of Bottlenose Dolphins in Western Port (Dann *et al.* 1996) did not record and sightings in the northern parts of the bay or over intertidal areas so it is unlikely that these animals would be seen in the Marine National Park.

Table 2.10.7. Threatened shorebird records from Yaringa Marine National Park and surrounds (AVW and listed references).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Bittern	*Botaurus poiciloptilus*			End		ARI 1999
Australasian Gannet	*Morus serrator*			Vul		Emison *et al.*. 1987
Baillon's Crake	*Porzana pusilla*	L		Vul		1980
Caspian Tern	*Sterna caspia*	L		Vul	CJ	1986
Crested Tern	*Sterna bergii*			LR		Emison *et al.*. 1987
Great Egret	*Ardea alba*			End	CJ	1988
Hardhead	*Aythya australis*			Vul		1980
Latham's Snipe	*Gallinago hardwickii*				CJ	ARI 1999
Lewin's Rail	*Rallus pectoralis*			End		ARI 1999
Musk Duck	*Biziura lobata*			Vul		Emison *et al.*. 1987
Nankeen Night Heron	*Nycticorax caledonicus*			Vul		ARI 1999
Pacific Gull	*Larus pacificus*			LR		1988
Pied Cormorant	*Phalacrocorax varius*			LR		1988
Royal Spoonbill	*Platalea regia*			Vul		1992
Turquoise Parrot	*Neophema pulchella*	L		LR		1982
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	L		End	C	1995

Table 2.10.8. Threatened marine mammal records from Yaringa Marine National Park surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Humpback Whale	*Megaptera novaeangliae*		Vul	End		1996

Table 2.10.10. Selection of some animals and plants that may be found in the Yaringa Marine National Park.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown alga	*Sargassum* sp.
	green alga	*Caulerpa cactoides*
	saltmarsh species	*Sclerostegia arbucula, Sarcocornia quinqueflora*, *Suaeda australis*
	seagrass	*Heterozostera tasmanica, Halophila ovalis*, *Zostera muelleri*
	white mangrove	*Avicennia marina*
Invertebrates	gastropods	*Salinator solida, Ophiacardelus ornatus, Marinula meridionalis, Truncatella scalarina*, *Nassarius burchardi*, *Polinices sordidus Bembicium nanum*, *B. melanostomum*
	barnacle	*Chamaesipho columna*
	crab	*Mictyris platycheles*
	seastars	*Nectria ocellata*, *Patiriella brevispina* and *Tosia magnifica*,
	shrimp	*Alpheus* sp.
	tanaid	*Paratanais* sp.
	solitary ascidian	*Pyura stolonifera*
	urchin	*Goniocidaris tubaria*
	brachiopod	*Magellania flavescens*
	ghost shrimp	Callianassidae
	glass goby	*Gobiopterus semivestitus*
	mussel	*Mytilus edulis planulatus*
	bivalves	*Anadara trapezia*, *Katelysia rhytiphora*, *Homalina deltoidalis*, *H. mariae* and *Laternula tasmania*.
	littorinid	*Bembicium melanostomum*
	polychaetes	*Barantolla*, *Armandia*, *Nepthys*, *Lumbrineris*, *Platynereis* and *Pista*
Fish	blue rock whiting	*Haletta semifasciata*
	bluespot goby	*Pseudogobius olorum*
	globefish	*Diodon nicthemerus*

	goby	*Favonigobius lateralis*
	gurnard perch	*Neosebastes scorpaenoides*
	halfbridled goby	*Arenigobius frenatus*
	King George whiting	*Sillaginodes punctata*
	long fin goby	*Favonigobius lateralis*
	flatheads	*Platycephalus laevigatus, Platycephalus bassiensis*
	smooth toadfish	*Tetractenos glaber*
	soldierfish	*Gymnapistes marmoratus*
	stingarees	*Urolophus cruciatus*
	yellow-eye mullet	*Aldrichetta forsteri*

2.10.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Yaringa Marine National Park are listed below (MPV database and Buckley 1993):

- Bungower Point - Multiple Spit, (Regional/Local Significance): Relict multiple recurved sand spit.
- Watson Inlet and Quail Island, (State significance): Relatively undisturbed mangrove and salt marsh area.

2.10.9 KNOWLEDGE GAPS

Although Western Port is relatively well studied, few studies have focused on the biota actually located in the Yaringa Marine National Park. Most of the information in this report is derived from studies of nearby areas, which are assumed to be similar to the protected areas.

2.10.10 RESEARCH

No research was found relating specifically to the Yaringa Marine National Park, but a list of research pertaining to Western Port in general can be found in Table 2.10.9.

Table 2.10.9. Summary of research projects conducted in Western Port Marine National Parks.

Author	Project	Notes
(Campbell and Miller 2002)	Shoot and abundance characteristics of the seagrass *Heterozostera tasmanica* in Western Port estuary (south eastern Australia).	
(Blake and Ball 2001b)	Victorian marine habitat database: seagrass mapping of Western Port.	
(Dann *et al*. 2001)	The Distribution and Abundance of Little Penguins at Sea in Western Port, Victoria	

(Saintilan and Rogers 2001)	Mangrove and saltmarsh monitoring in Westernport Bay	
(Jenkins and Hindell FRDC 2001/036)	Assessment of the importance of different nearshore habitats to commercial and recreational fish in Victoria	FRDC 2001/036
(Dann 2000)	Foraging behaviour and diets of red-necked stints and curlew sandpipers in south-eastern Australia.	
(Jenkins *et al*. 2000)	Determination of spawning areas and larval advection pathways for King George whiting in south-eastern Australia using otolith microstructure and hydrodynamic modelling	
(Dann 1999)	Feeding periods and supratidal feeding of Red-necked Stints and Curlew Sandpipers in Western Port, Victoria.	
(Satumanatpan and Keough 1999)	Effect of barnacles on the survival and growth of temperate mangrove seedlings.	
(Wright and Boxshall 1999)	The influence of small-scale flow and chemical cues on the settlement of two congeneric barnacle species.	
(Boon *et al*. 1997)	Diet of the intertidal callianassid shrimps *Biffarius arenosus* and *Trypea australiensis* (Decapoda: Thalassinidea) in western Port (southern Australia), determined with multiple stable-isotope analyses.	
(Nateekanjanalar p 1997)	Ecological studies of barnacles in temperate mangrove forests	PhD thesis
(Stevens and West 1997a)	Investigation of school and gummy shark nursery areas in south eastern Australia	FRDC
(Swadling and Bayly 1997)	Different zooplankton communities in confluent waters: Comparisons between three marine bays in Victoria, Australia.	
(Dann *et al*. 1996)	The Distribution and Abundance of Australian Fur Seals *Arctocephalus pusillus* and Bottlenose Dolphins *Tursiops truncatus* in Western Port, Victoria.	
(Stephens 1995)	The distribution of seagrass in Western Port, Victoria.	
(Edgar and Shaw 1995a)	The production and trophic ecology of shallow-water fish assemblages in Southern Australia I. Species richness, size-structure and production of fishes in Western Port, Victoria.	
(Edgar and Shaw 1995b)	The production and trophic ecology of shallow-water fish assemblages in Southern Australia II. Diets of fishes and trophic relationships between fishes and benthos at Western Port, Victoria.	
(Edgar and Shaw 1995c)	The production and trophic ecology of shallow-water fish assemblages in Southern Australia III. General relationships between sediments, seagrasses, invertebrates and fishes.	
(Edgar *et al*. 1994)	Comparisons of species richness, size-structure and production of benthos in vegetated and unvegetated habitats in Western Port, Victoria.	
(MSE 1994)	Marine ecological monitoring, Western Port, Victoria. 1993 Survey.	
(Dann 1991)	Feeding behaviour and diet of double banded plovers Charadrius bicinctus in Western Port, Victoria.	
(Kuo *et al*. 1990)	The leaf internal morphology and ultrastructure of *Zostera muelleri* Irmisch ex Aschers. Zosteraceae. A comparative study of the intertidal and subtidal forms.	

(Kimmerer and McKinnon 1989)	Zooplankton in a marine bay III. Evidence for influence of vertebrate predation on distributions of two common copepods	
(Boon and Cain 1988)	Nitrogen cycling in saltmarsh and mangrove sediments at Western Port Victoria, Australia.	
(Kimmerer and A.D. 1987)	Growth, mortality and secondary production of the copepod *Acartia tranteri* in Westernport Bay, Australia.	
(Petch 1986)	Selective deposit feeding by *Lumbrinereis latreilli* (Polychaeta Lumbrinereidae) with a new method for assessing selectivity by deposit feeding organisms.	
(Vollebergh and Congdon 1986)	Germination and growth of *Ruppia polycarpa* and *Lepilaena cylindrocarpa* in ephemeral saltmarsh pools in Western Port Bay.	
(Davey and Woelkerling 1985)	Studies on Australian mangrove algae 3. Victorian community structure and recolonisation in Western Port Bay.	
(Howard and Koehn 1985)	Population dynamics and feeding ecology of pipefish (Syngnathidae) associated with eelgrass beds of Western Port, Victoria.	
(Kimmerer and McKinnon 1985)	A comparative study of the zooplankton in two adjacent embayments, Port Phillip and Westernport Bays, Australia.	
(Howard 1984)	The trophic ecology of caridean shrimps in an eelgrass community.	
(Howard and Lowe 1984)	Predation by birds as a factor influencing the demography of an intertidal shrimp.	
(Robertson 1984)	Trophic interactions between the fish fauna and macrobenthos of an eelgrass community in Western Port, Victoria.	
(Van der Valk and Attiwill 1984)	Decomposition of leaf and roof litter of Abicennia marina at Western Port Bay Victoria Australia.	
(Watson *et al*. 1984)	Invertebrate macrobenthos of the seagrass communities in Western Port, Victoria.	
(Bulthuis *et al*. 1984)	Suspended sediments and nutrients in water ebbing from seagrass-covered and denuded tidal mudflats in a Southern Australian embayment.	
(Bulthius 1983a)	Effects of in-situ light reduction on density and growth of the seagrass Heterozostera tasmanica in Western Port Victoria Australia.	
(Bulthius 1983b)	Effects of temperature on the photosynthesis irradiance curve of the Australian seagrass *Heterozostera tasmanica*.	
(Bulthuis and Woelkerling 1983)	Biomass accumulation and shading effects of epiphytes on leaves of the seagrass *Heterozostera tasmanica* in Victoria, Australia.	
(Bulthius and Woelkerling 1983)	Seasonal variation in standing crop density and leaf growth rate of the seagrass Heterozostera tasmanica in Western Port and Port Phillip Bay Australia	
(Coleman 1982)	Population density and biomass of the bivalves *Tellina mariae* and *Katelysia rhytiphora* from a seagrass bed in Western Port Victoria Australia.	
(Fabris *et al*. 1982)	Uptake of Cadmium by the seagrass *Heterozostera tasmanica* from Corio Bay and Western Port, Victoria.	
(Lowe 1982)	Feeding behaviour and diet of royal spoonbills *Patealea regia* in	

	Westernport Bay Victoria Australia.	
(Robertson 1982)	Population dynamics and feeding ecology of juvenile Australian Salmon (*Arripis trutta*) in Western Port, Victoria.	
(Barnard and Drummond 1981)	3 Corophoids crustacea amphipoda from Western Port Victoria Australia.	
(Bulthuis 1981)	The standing crop of submerged macrophytes in Westernport Bay. Project No. 124 to the *Westernport Bay Environmental Study* (1973-1974).	
(Bulthuis and Woelkerling 1981)	Effects of *in situ* nitrogen and phosphorus enrichment of the sediments on the seagrass *Heterozostera tasmanica* (Martens ex Aschers.) den Hartog in Western Port, Victoria, Australia.	
(Clough and Attiwill 1980)	Primary productivity of *Zostera muelleri* in Westernport Bay Victoria Australia.	
(Hinwood 1979)	Hydrodynamic and transport models of Western Port, Victoria.	
(Coleman *et al*. 1978)	A quantitative survey of the main benthos of Western Port, Victoria.	
(Smith *et al*. 1975)	The invertebrate fauna of Westernport Bay.	

2.11 French Island Marine National Park

Western Port is a large embayment to the east of Port Phillip Bay with extensive areas of intertidal mudflats and seagrass meadows and a dendritic network of tidal channels. French Island Marine National Park is located on the northern side of French Island National Park. The Marine National Park includes mangrove and saltmarsh habitats of State significance and is covered with extensive seagrass beds including some which have remained healthy while seagrass beds elsewhere in Western Port suffered significant loss. Extensive intertidal mudflats which support a diverse range of invertebrate and fish species and the well developed system of tidal channels of varying depths and profiles contribute to a high diversity of marine habitats (ECC 2000).

2.11.1 PHYSICAL PARAMETERS

French Island is located centrally in the north of Western Port and is approximately ten kilometres south of Tooradin. The French Island Marine National Park runs from Barrallier Island parallel to the northern coast of the French Island and extends out to the southern edge of the North Arm and Horseshoe Channel (Figure A1.11a). Major channels in the Marine National Park include Post Office Channel, Chicory Lane Channel and Inside Channel. There are no major freshwater inputs into the Marine National Park and the net circulation of water through the Marine National Park is West to East (Hinwood 1979). For a summary of the physical parameters in the French Island Marine National Park see Table 2.11.1.

Table 2.11.1. Physical parameters for French Island Marine National Park.

Park Name	**Western Port - French Island**
Conservation status	Marine National Park
Biophysical Region	Victorian embayments
Size of Park (ha)	2800
Length of coastline (m)	14517
Exposure rating	low
Wave Energy	Low
Influential currents	Tidal
Tidal variation - springs (m)	2.60
Tidal variation - neaps (m)	0.90
Water temp - summer (°C)	20.80
Water temp - winter (°C)	11.30
Intertidal (ha)	2450
0 - 2 m (ha)	180

2 - 5 m (ha)	90
5 - 10 m (ha)	90
10 - 15 m (ha)	4
Discharges	Intermittent creeks and drains
Adjacent catchment	Agricultural

2.11.2 MARINE HABITAT CLASSES

French Island Marine National Park contains representatives of habitats including seagrass, mangroves, sandy beaches, subtidal soft sediment and tidal channels. Major areas of saltmarsh and mangrove fringe are present adjacent to the Marine National Park on the northern shore of French Island.

Table 2.11.2. Marine Habitat Classes for French Island Marine National Park (Bird 1993; Blake and Ball 2001b).

Marine Habitat Class	Attributes
Shoreline category	Beach
Substratum texture	Medium sand
	Fine sand
	Muddy sand
	Mud / silt
Subtidal soft sediment biota	Halophila
	Heterozostera
	Mixed seagrass/algae
	Mixed Zostera/Halophila
Intertidal soft sediment biota	Mangrove
	Saltmarsh
	Seagrass
	Mussels
	Barnacles
Halophila Dominant Seagrass & Macroalgae Area (ha)	7.4
Macroalgae Area (ha)	529.1
Zostera/Heterozostera/Halophila Dominant	4.0
Zostera/Heterozostera Dominant Seagrass (ha)	5.3
Zostera/Heterozostera Dominant Seagrass &	1005.8
Sediment Area (ha)	1193.6
Mangroves Area (ha)	64.1
Salt Marsh Area (ha)	0.3

2.11.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.11.8.

Saltmarsh

Saltmarsh habitats exist throughout Western Port and are frequently found in the same regions as mangroves with saltmarsh growing on the landward edge of the mangroves (Hamilton 1994).

Flora

The recent quantitative survey by Saintilan and Rogers (2001) of the French Island Marine National Park saltmarsh community found a different community to that on Quail Island adjacent to Yaringa Marine National Park. *Sclerostegia arbucula* was the dominant species in both Marine National Parks, but *Wilsonia backhousei* and *Samolus repens* were less abundant on Quail Island and *Suaeda australis* was more abundant. *Sarcocornia quinqueflora* was an important species with *Selliera radicans*, *Samolus repens*, *Distichilis distichophylla*, *Triglochin striata*, *Atriplex paludosa*, *Disphyma crassifolium*, and *Rhagodia candolleana* also present (Saintilan and Rogers 2001). Some species found on Quail Island (*Chenopodiaceae* sp., *Baumea* sp., *Juncus krausii*) were not present on French Island (Saintilan and Rogers 2001). Analysis of historical photography found that the area covered by saltmarsh vegetation on French Island decreased slightly between 1973 and 1999 (Saintilan and Rogers 2001).

Invertebrate fauna

Information about the invertebrates found in saltmarsh habitats in French Island Marine National Park was unavailable, but generalisations can be drawn about the likely species composition from studies of similar habitat elsewhere in Western Port. The fauna associated with saltmarsh in Western Port is characterised by a number of species of air-breathing gastropods including *Salinator solida*, *Ophiacardelus ornatus*, *Marinula meridionalis* and *Truncatella scalarina*. The littorinid *Bembicium melanostomum* is found in the lower part of the saltmarsh zone where it borders on the mangroves (Smith *et al.*. 1975).

Fish

No information was available on fish occurring in saltmarsh in French Island Marine National Park, but if they are present, it is only transiently when saltmarsh is covered by exceptionally high tides.

Mangrove

Flora

The white mangrove (*Avicennia marina* subsp. *australasica*) is the only species of mangrove occurring in Victoria where it reaches the southern extent of its distribution. The most extensive and well developed communities of mangroves in Victoria are found in Western Port where they are considered of State significance (Ross 2000). All of the Western Port Marine National Parks including French Island include some stands of mangrove trees (Blake and Ball 2001b). The mangrove plants grow as trees and shrubs with some almost 4 m tall on French Island (Saintilan and Rogers 2001). The mangrove zone occurs inshore of seagrass, sand and mudflats with all communities generally occurring parallel to the shore, except where drainage channels or creeks alter the surface (Chamberlain 1979).

Saintilan and Rogers (2001) found that within the tidal drainage creeks in the French Island Marine National Park, mangrove vegetation has extended up into the creeks and displaced saltmarsh vegetation. They also found that between 1973 and 1999 mangrove vegetation has been expanding by prograding in a shoreward direction at French Island (Saintilan and Rogers 2001).

The trunks and pneumatophores of mangrove trees provide the only hard substratum in this zone and numerous epiphytic filamentous algae including *Caloglossa*, *Catanella nipae* and *Bostrychnia* form mats on them (Smith *et al*. 1975).

Invertebrate fauna

No specific information about the invertebrates found in the mangroves of French Island Marine National Park was available, but generalisations can be drawn about the likely species composition from studies of similar habitat elsewhere in Western Port.

The mangrove trunks and pneumatophores are the only hard substratum in this zone and species including *Bembicium nanum*, *B. melanostomum*, and the barnacle *Chamaesipho columna* are commonly found. The mussel *Mytilus edulis planulatus* may be found attached to the roots (Smith *et al*. 1975).

Fish

No specific information regarding the fish associated with mangrove habitat in French Island Marine National Park was available. A recent survey of mangrove habitat elsewhere in Western Port (Jenkins and Hindell FRDC 2001/036) recorded species including glass goby (*Gobiopterus semivestitus*), smooth toadfish (*Tetractenos glaber*), yellow-eye mullet

(*Aldrichetta forsteri*), halfbridled goby (*Arenigobius frenatus*) and the bluespot goby (*Pseudogobius olorum*).

Seagrass

Flora

Typically, seagrass meadows are found in water depths between intertidal and 2 m, where sunlight intensity is greatest and therefore seagrass growth is highest (Lloyd 1997). The most abundant subtidal seagrass in Western Port is *Heterozostera tasmanica*. In shallow subtidal soft substrata the green alga *Caulerpa cactoides* and the brown alga *Sargassum* sp. and various species of red algae are commonly present (Ministry for Conservation 1975).

The most recent mapping of Western Port seagrass by Blake and Ball (2001b) found four species of seagrass in Western Port, although only three species (*Halophila ovalis*, *Zostera muelleri* and *Heterozostera tasmanica*) were present in Western Port Marine National Parks. In French Island Marine National Park Blake and Ball (2001b) found dense *Zostera*/*Heterozostera* beds with macroalgae to the east of Barrallier Island, with medium *Zostera*/*Heterozostera* cover and macroalgae closer to the shore. Interspersed with the seagrass were patches of macroalgae with no seagrass present and also some areas of unvegetated intertidal mudflats. To the east of Post Office Channel near the centre of the Marine National Park, patches of sparse *Halophila* with algae were also recorded (Blake and Ball 2001b)

The two species *Z. muelleri* and *H. tasmanica*, were grouped into the single category of *Zostera*/*Heterozostera* in the study. However, it is possible to make inferences about their likely distribution based on their ecology. *Z. muelleri* is generally considered an intertidal species (Womersley 1984) and would therefore be expected to colonise the large intertidal mudflats in Western Port. Conversely, *H. tasmanica* is generally a subtidal species (Womersley 1984), and could therefore be expected to inhabit the subtidal borders of the channels. However, this is not always the case. Bulthuis (1981) observed that *Z. muelleri* inhabited the higher intertidal slopes and *H. tasmanica* the flat intertidal banks between channels. In many places the seaward edge of the mudflats is higher than the remainder of the flats (Marsden and Mallett 1975) creating a large shallow pool in which the desiccation prone *H. tasmanica* can survive. Stephens (1995) suggests that dense beds of *H. tasmanica* trap enough water on the ebbing tide to avoid desiccation during periods of exposure and hence inhabit intertidal flats.

Invertebrate fauna

Most studies that relate to the invertebrate fauna of seagrass habitats have been undertaken outside the French Island Marine National Park. Presented here are descriptions of invertebrate assemblages that might generally be expected in Western Port seagrass habitats. Seagrass habitats in Western Port support greater species richness than adjacent unvegetated habitats (Edgar *et al*. 1993), which may be a consequence of the structural heterogeneity of seagrass providing habitat for epifaunal species which cannot survive on bare substrata (Edgar 1990).

Considerable research effort has been directed at the invertebrate species of seagrass communities in Western Port (see EPA 1996, for a review), with some studies providing considerable detail on trophic interactions and production (*e.g.,* Edgar *et al*. 1994; Littlejohn *et al*. 1974; Watson *et al*. 1984). Most studies found a gradual change in the infaunal community structure from the near shore regions to the shallow channels and inlets and the deep channels (Coleman *et al*. 1978; Edgar *et al*. 1994; Littlejohn *et al*. 1974; Smith *et al*. 1975).

Prominent infaunal species include the bivalves *Anadara trapezia*, *Katelysia rhytiphora*, *Homalina deltoidalis*, *H*. *mariae* and *Laternula tasmania*. Common crustaceans are the ghost shrimp (Callianassidae), the shrimp *Alpheus* sp. and the tanaid *Paratanais* (Coleman *et al*. 1978; Edgar *et al*. 1994; Watson *et al*. 1984). Also common are the foraminiferans *Ammotium cassis* and *Trochommina sorosa*, the polychaete genera *Barantolla*, *Armandia*, *Nepthys*, *Lumbrineris*, *Platynereis* and *Pista* and the gastropods *Salinator fragilis*, *Nassarius burchardi* and *Polinices sordidus* (EPA 1996; Smith *et al*. 1975).

Common epifauna include a large number of grazing molluscs (families Trochidae and Rissoacea) *gammaridean* amphipods, the shrimp *Macrobrachium* sp., the crabs *Halicarcinus* sp. and *Litocheira bispinosa*, and occasional sponges, hydroids and ascidians (Edgar *et al*. 1994; Littlejohn *et al*. 1974; Smith *et al*. 1975).

A food web of the seagrass ecosystem in Western Port was developed by Watson *et al*., (1984).

Fish

No information regarding fishes associated with seagrass habitats was available for French Island Marine National Park. In Western Port in general, seagrass fish assemblages consist predominantly of pipefish, gobies, weedfish, leatherjackets (Monacanthidae), globefish (*Diodon nicthemerus*), soldierfish (*Gymnapistes marmoratus*), blue rock whiting (*Haletta* *semifasciata*) and adult rock flathead (*Platycephalus laevigatus*) (EPA 1996). See Table 2.11.3 for a summary of fish found in seagrass habitat in Western Port.

Table 2.11.3. Common fish assemblages in Western Port seagrass (adapted from EPA 1996).

Family	Common name	Scientific Name
Moridae	Rock cod	*Pseudophycus bachus*
Atherinidae	Hardyheads	*Kestratherina brevirostris*
Syngnathidae	Pipefish	*Stigmatopora argus*
		Stigmatopora nigra
		Mitotichths semistriatis
		Vanacampus phillipi
		Urocampus carinirostris
Scorpaenidae	Soldierfish	*Gymnapistes marmoratus*
Platycephalidae	Rock flathead (adult)	*Platycephalus laevigatus*
Apogonidae	Woods siphon fish	*Siphaemia cephalotes*
Enoplosidae	Old wife	*Enoplosus armatus*
Odacidae	Blue rock whiting	*Haletta semifasciata*
Clinidae	Weedfish	*Cristiceps australis*
		Heteroclinus adelaidei
		Heteroclinus perpicillatus
Globiidae	Gobies	*Arenigobius frenatus*
		Gobiopterus semivestitus
Monacanthidae	Six spined leatherjacket	*Meuschenia freycineti*
	Bridled leatherjacket	*Acanthaluteres spilomelanurus*
	Toothbrush leatherjacket	*Acanthaluteres vittiger*
	Pygmy leatherjacket	*Brachaluteres jacksonianus*

Some notable changes have occurred in the fish fauna in recent years. Fifteen years ago the wide bodied pipefish (*Stigmatopora nigra*) was low in abundance and the spotted pipefish (*S. argus*) was unrecorded (Howard and Koehn 1985), however, both are now relatively common (Edgar and Shaw 1995a).

Intertidal mudflats

Flora

Most areas of the intertidal flats in the Western Port are dominated by seagrass and no specific information is available for unvegetated areas in French Island Marine National Park. However, generally intertidal mudflats elsewhere support a high biomass of micro-algae surface film and some fine macroalgae usually dominated by red species (LCC 1994a).

Invertebrate fauna

No specific information about the invertebrates found in the sheltered intertidal mudflats of the French Island Marine National Park was available, but generalisations can be drawn about the likely species composition from studies of similar habitat elsewhere in Western Port. Typical invertebrate species on sheltered intertidal mudflats in Western Port include a number of bivalve molluscs including the triangular tellin (*Tellina deltoidalis*), elongated lantern shell (*Laternula creccina*), and mud ark (*Anadara trapezia*). Several crustaceans occur in large numbers on, or in, mudflats including the crabs (*Mictyris platycheles*, *Macrophthalmus latifrons*, *Heloecius cordiformis*) and the ghost shrimp (*Callianassa* sp.) (LCC 1994a).

Fish

No information was available regarding the fish assemblages associated with unvegetated intertidal flats in the French Island Marine National Park. The fish fauna of the unvegetated intertidal flats elsewhere in Western Port has recently been sampled and the common species included smooth toadfish (*Tetractenos glaber*), yellow-eye mullet (*Aldrichetta forsteri*), bluespot goby (*Pseudogobius olorum*), long fin goby (*Favonigobius lateralis*) and the glass goby (*Gobiopterus semivestitus*) (Jenkins and Hindell FRDC 2001/036).

For a summary of the most common fish species in unvegetated intertidal mudflats refer to Table 2.11.4.

Table 2.11.4. Common fish assemblages in Western Port unvegetated intertidal mudflat (adapted from EPA 1996).

Family	Common name	Scientific Name
Elasmobranchs	Sharks and Rays	Various (mostly undocumented)
Clupeidae	Sand sprat	*Hyperlophus vittatus*
Platycephalidae	Rock flathead (juvenile)	*Platycephalus laevigatus*
	Sand flathead	*Platycephalus bassiensis*
Siliginidae	King George whiting	*Sillaginodes punctata*
Globiidae	Gobies	*Favonigobius lateralis*
		Favonigobius tamarensis
		Arenigobius frenatus
		Pseudogobius olorum
Pleuronectidae	Greenback flounder	*Rhombosolea tapirina*
	Long snouted flounder	*Ammotretis rostratus*
Tatradontidae	Smooth toadfish	*Tetractenos glaber*

Unvegetated subtidal soft substrata

Again, there is very little information relating specifically to the French Island Marine National Park and so we present general information from Western Port. These habitats occur in the deep main (10-30 m) channels of Western Port where winnowing by currents cause a coarser sand substrate than on the sheltered intertidal mudflats (Edgar *et al*. 1994; Littlejohn *et al*. 1974; Smith *et al*. 1975).

Invertebrate fauna

No information specifically relating to the French Island Marine National Park was available. Elsewhere in Western Port, the seapen *Virgularia mirabilis* which anchors to the substrate by a fleshy stalk is present in high abundance in deepwater channels in Western Port with densities reaching approximately 200/m^2 (Edgar *et al*. 1994). Similarly, the epifaunal brachiopod *Magellania flavescens* occurs locally at high densities of up to 250/m^2 mainly around San Remo (Smith *et al*. 1975). Other epifaunal species attached to rubble and shells include the gastropod *Sigapatella calyptraeformis*, the sea stars *Nectria ocellata*, *Patiriella brevispina* and *Tosia magnifica*, the urchin *Goniocidaris tubaria* and the solitary ascidian *Pyura stolonifera* (Smith *et al*. 1975).

The most abundant infaunal taxa of the deep channels are polychaetes and crustaceans, the bivalve molluscs, *Neotrigonia margaritacea*, *Pronuncula* sp. *Notocallista diemensis*, *Bellucina crassillirata*, *Venericardia bimaculata*, the rock-boring bivalve *Pholas australiasiae*, and the carnivorous gastropods *Nassarius burchardi*, *Pterynotus triformis* and *Amorena undulata* (Smith *et al*. 1975). The molluscs *Neotrigonia margaritacea* and *Anadara trapezia*, and the brachiopod *Magellania flavescens* are of particular value because they are restricted in distribution elsewhere but are abundant within Western Port (Smith *et al*. 1975).

Fish

No information regarding the fish fauna of channels in the French Island Marine National Park was available. In general in Western Port, the fish fauna of channels typically include stingarees (Urolophidae), gurnard perch (*Neosebastes scorpaenoides*), sand flathead (*Platycephalus bassiensis*) and gobies (*e.g., Favonigobius lateralis*) (Edgar and Shaw 1995b). Juvenile King George whiting (*Sillaginodes punctata*) can sometimes be found in unvegetated areas adjacent to seagrass (Edgar and Shaw 1995b). Table 2.11.5. provides a summary of common fish assemblages in Western Port drainage channels.

Table 2.11.5. Common fish assemblages in Western Port drainage channels (adapted from EPA 1996).

Family	Common name	Scientific Name
Urolophidae	Banded stingaree	*Urolophus cruciatus*
Scorpaenidae	Gurnard perch	*Neosebastes scorpaenoides*
Platycephalidae	Sand flathead	*Platycephalus bassiensis*
Globiidae	Goby	*Favonigobius lateralis*
Tatradontidae	Smooth toadfish	*Tetractenos glaber*

Pelagic environment

Flora

No specific information about the pelagic flora environment in French Island Marine National Park was found. One of the few studies of the pelagic environment in Western Port was carried out by (Kimmerer and McKinnon 1985) who found many species of phytoplankton.

Invertebrate fauna

No specific information about the pelagic invertebrate fauna in French Island Marine National Park was found. Kimmerer and McKinnon (1985) found the copepod *Acartia tranteri* dominated the pelagic invertebrate fauna elsewhere in Western Port. Information about the larger invertebrates in the pelagic environment is unknown.

Fish

No specific information about the fish in the pelagic environment in French Island Marine National Park was found. In general, Western Port supports a group of highly mobile pelagic species including Australian Salmon (*Arripis* spp.), yellow-eye mullet, pilchards and anchovies, barracouta (*Thyrsites atun*) and various sharks and rays (Edgar and Shaw 1995b; Robertson 1982). See Table 2.11.6 for details of common mobile pelagic fish in Western Port in general.

Table 2.11.6. Common mobile pelagic fishes in Western Port (adapted from EPA 1996).

Family	Common name	Scientific Name
Carcharhinidae	School shark	*Galeorhinus galeus*
	Gummy shark	*Mustelus antarcticus*
Callorhynchidae	Elephant fish	*Callorhynchus milii*
Rajiforms	Rays	*Various (mostly undocumented)*
Clupeidae	Sand sprat	*Hyperlophus vittatus*
	Pilchard	*Sardinops neopilchardus*

Engraulidae	Australian anchovy	*Engraulis australis*
Hemiramphidae	Southern sea garfish	*Hyporhamphus melanochir*
Pomatomidae	Tailor	*Pomatomus saltatrix*
Carangidae	Silver trevally	*Pseudocaranx dentex*
	Jack mackerel	*Trachurus declivis*
Arripidae	Australian salmon	*Arripis truttacea*
Mugilidae	Yellow-eyed mullet	*Aldrichetta forsteri*
Gempylidae	Barracouta	*Thyrsites atun*

2.11.4 BIOLOGICAL PROCESSES

No information about biological processes occurring in the French Island Marine National Park was found.

2.11.5 SPECIES DISTRIBUTION INFORMATION

No marine species are known to have their distributional limits near or within the Marine National Park.

2.11.6 SHOREBIRDS

The intertidal mudflats of Western Port are listed under the Ramsar sites convention. The French Island Marine National Park boundary contains an area of national significance to the west (primary feeding area for migratory waders) and an area of State significance to the east (secondary feeding area).

Table 2.11.7 lists records of threatened shorebird species sighted in and around the French Island Marine National Park. Approximately 60 further, non-threatened species have been recorded in this Marine National Park and its surrounds.

Barrallier Island, in the west of the Marine National Park, represents a major high tide roosting site. A high proportion of unusual sightings has been recorded at this site. It is the only site in Western Port where the Little Tern is regularly observed. In addition, 1 or 2 pairs of Little Penguins nest on the island in most years. Other major roosting sites are present nearby, on French Island.

2.11.7 MARINE MAMMALS

No records of threatened marine mammal sightings in the French Island Marine National Park are listed in the AVW. Research on the distribution of Australian Fur Seals and Bottlenose Dolphins in Western Port indicate it would be unlikely to find such species in the

Marine National Park (Dann *et al*. 1996). The presence of whales in the Marine National Park is also unlikely.

Table 2.11.7. Threatened shorebird records from French Island Marine National Park and surrounds (AVW and listed references).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		1987
Australasian Shoveler	*Anas rhynchotis*			Vul		1984
Bar-tailed Godwit	*Limosa lapponica*				CJ	Emison *et al.*. 1987
Black Bittern	*Ixobrychus flavicollis*			CEn		ARI 1999
Blue-billed Duck	*Oxyura australis*	L		Vul		1994
Caspian Tern	*Sterna caspia*	L		Vul	CJ	1992
Common Greenshank	*Tringa nebularia*				CJ	Emison *et al.*. 1987
Common Sandpiper	*Actitis hypoleucos*				CJ	ARI 1999
Crested Tern	*Sterna bergii*			LR		1987
Curlew Sandpiper	*Calidris ferruginea*				CJ	Emison *et al.*. 1987
Eastern Curlew	*Numenius madagascariensis*			LR	CJ	1985
Fairy Tern	*Sterna nereis*	L		Vul		1989
Great Egret	*Ardea alba*	L		End	CJ	1980
Great Knot	*Calidris tenuirostris*				CJ	ARI 1999
Grey Plover	*Pluvialis squatarola*				CJ	ARI 1999
Grey-tailed Tattler	*Heteroscelus brevipes*				CJ	ARI 1999
Hardhead	*Aythya australis*			Vul		1991
Hooded Robin	*Melanodryas cucullata*					1981
Lewin's Rail	*Rallus pectoralis*			End		ARI 1999
Little Egret	*Egretta garzetta*	L		CEn		ARI 1999
Little Tern	*Sterna albifrons*	L	End	Vul	CJ	1992
Musk Duck	*Biziura lobata*			Vul		Emison *et al.*. 1987
Nankeen Night Heron	*Nycticorax caledonicus*			Vul		ARI 1999
Pacific Golden Plover	*Pluvialis fulva*				CJ	ARI 1999
Pacific Gull	*Larus pacificus*			LR		2000
Pied Cormorant	*Phalacrocorax varius*			LR		2000
Red Knot	*Calidris canutus*				CJ	ARI 1999
Red-necked Stint	*Calidris ruficollis*				CJ	Emison *et al.*. 1987

Royal Spoonbill	*Platalea regia*			Vul		Emison *et al.*. 1987
Ruddy Turnstone	*Arenaria interpres*				CJ	Emison *et al.*. 1987
Sharp-tailed Sandpiper	*Calidris acuminata*				CJ	Emison *et al.*. 1987
Short-tailed Shearwater	*Puffinus tenuirostris*				J	ARI 1999
Terek Sandpiper	*Xenus cinereus*				CJ	ARI 1999
Whimbrel	*Numenius phaeopus*				CJ	ARI 1999
Whiskered Tern	*Chlidonias hybridus*			LR		1987
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	L		End	C	Emison *et al.*. 1987

Table 2.11.8. Selection of some animals and plants that may be found in the French Island Marine National Park.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	**Scientific name**
Flora	brown alga	*Sargassum* sp.
	green alga	*Caulerpa cactoides*
	saltmarsh species	*Sclerostegia arbucula, Sarcocornia quinqueflora*, *Suaeda australis*
	seagrass	*Heterozostera tasmanica, Halophila ovalis*, *Zostera muelleri*
	white mangrove	*Avicennia marina*
Invertebrates	gastropods	*Salinator solida, Ophiacardelus ornatus, Marinula meridionalis, Truncatella scalarina*, *Nassarius burchardi*, *Polinices sordidus Bembicium nanum*, *B. melanostomum*
	barnacle	*Chamaesipho columna*
	crab	*Mictyris platycheles*
	seastars	*Nectria ocellata*, *Patiriella brevispina* and *Tosia magnifica*,
	shrimp	*Alpheus* sp.
	tanaid	*Paratanais* sp.
	solitary ascidian	*Pyura stolonifera*
	urchin	*Goniocidaris tubaria*
	brachiopod	*Magellania flavescens*
	ghost shrimp	Callianassidae
	glass goby	*Gobiopterus semivestitus*
	mussel	*Mytilus edulis planulatus*
	bivalves	*Anadara trapezia*, *Katelysia rhytiphora*, *Homalina deltoidalis*, *H. mariae* and *Laternula tasmania*.

	littorinid	*Bembicium melanostomum*
	polychaetes	*Barantolla*, *Armandia*, *Nepthys*, *Lumbrineris*, *Platynereis* and *Pista*
Fish	blue rock whiting	*Haletta semifasciata*
	bluespot goby	*Pseudogobius olorum*
	globefish	*Diodon nicthemerus*
	goby	*Favonigobius lateralis*
	gurnard perch	*Neosebastes scorpaenoides*
	halfbridled goby	*Arenigobius frenatus*
	King George whiting	*Sillaginodes punctata*
	long fin goby	*Favonigobius lateralis*
	flatheads	*Platycephalus laevigatus, Platycephalus bassiensis*
	smooth toadfish	*Tetractenos glaber*
	soldierfish	*Gymnapistes marmoratus*
	stingarees	*Urolophus cruciatus*
	yellow-eye mullet	*Aldrichetta forsteri*

2.11.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to French Island Marine National Park are listed below (MPV database and Buckley 1993):

- North Coast of French Island, (State significance): One of the main mangrove and salt marsh areas of Victoria.
- Barrallier Island, (Regional/Local Significance): Small gravelly island.
- Palmer Point - Sand Ridges, (Regional/Local Significance): Features displaying a relict geomorphic process.

2.11.9 KNOWLEDGE GAPS

Although Western Port is relatively well studied, few studies have focused on the biota actually located in the French Island Marine National Parks. Most of the information in this report is derived from studies of nearby areas, which are assumed to be similar to the protected areas.

2.11.10 RESEARCH

No research was found relating specifically to the French Island Marine National Park, but a list of research related to Western Port in general can be found in Table 2.11.9.

Table 2.11.9. Summary of research projects conducted in Western Port Marine National Parks.

Author	Project	Notes
(Campbell and Miller 2002)	Shoot and abundance characteristics of the seagrass *Heterozostera tasmanica* in Western Port estuary (south eastern Australia).	
(Blake and Ball 2001b)	Victorian marine habitat database: seagrass mapping of Western Port.	
(Dann *et al*. 2001)	The Distribution and Abundance of Little Penguins at Sea in Western Port, Victoria	
(Saintilan and Rogers 2001)	Mangrove and saltmarsh monitoring in Westernport Bay	
(Jenkins and Hindell FRDC 2001/036)	Assessment of the importance of different nearshore habitats to commercial and recreational fish in Victoria	FRDC 2001/036
(Dann 2000)	Foraging behaviour and diets of red-necked stints and curlew sandpipers in south-eastern Australia.	
(Jenkins *et al*. 2000)	Determination of spawning areas and larval advection pathways for King George whiting in south-eastern Australia using otolith microstructure and hydrodynamic modelling	
(Dann 1999)	Feeding periods and supratidal feeding of Red-necked Stints and Curlew Sandpipers in Western Port, Victoria.	
(Satumanatpan and Keough 1999)	Effect of barnacles on the survival and growth of temperate mangrove seedlings.	
(Wright and Boxshall 1999)	The influence of small-scale flow and chemical cues on the settlement of two congeneric barnacle species.	
(Boon *et al*. 1997)	Diet of the intertidal callianassid shrimps *Biffarius arenosus* and *Trypea australiensis* (Decapoda: Thalassinidea) in western Port (southern Australia), determined with multiple stable-isotope analyses.	
(Nateekanjanalar p 1997)	Ecological studies of barnacles in temperate mangrove forests	PhD thesis
(Stevens and West 1997a)	Investigation of school and gummy shark nursery areas in south eastern Australia	FRDC
(Swadling and Bayly 1997)	Different zooplankton communities in confluent waters: Comparisons between three marine bays in Victoria, Australia.	
(Dann *et al*. 1996)	The Distribution and Abundance of Australian Fur Seals *Arctocephalus pusillus* and Bottlenose Dolphins *Tursiops truncatus* in Western Port, Victoria.	
(Stephens 1995)	The distribution of seagrass in Western Port, Victoria.	
(Edgar and Shaw 1995a)	The production and trophic ecology of shallow-water fish assemblages in Southern Australia I. Species richness, size-structure and production of fishes in Western Port, Victoria.	
(Edgar and Shaw 1995b)	The production and trophic ecology of shallow-water fish assemblages in Southern Australia II. Diets of fishes and trophic relationships between fishes and benthos at Western Port, Victoria.	
(Edgar and Shaw 1995c)	The production and trophic ecology of shallow-water fish assemblages in Southern Australia III. General relationships	

	between sediments, seagrasses, invertebrates and fishes.	
(Edgar *et al*. 1994)	Comparisons of species richness, size-structure and production of benthos in vegetated and unvegetated habitats in Western Port, Victoria.	
(MSE 1994)	Marine ecological monitoring, Western Port, Victoria. 1993 Survey.	
(Dann 1991)	Feeding behaviour and diet of double banded plovers Charadrius bicinctus in Western Port, Victoria.	
(Kuo *et al*. 1990)	The leaf internal morphology and ultrastructure of *Zostera muelleri* Irmisch ex Aschers. Zosteraceae. A comparative study of the intertidal and subtidal forms.	
(Kimmerer and McKinnon 1989)	Zooplankton in a marine bay III. Evidence for influence of vertebrate predation on distributions of two common copepods	
(Boon and Cain 1988)	Nitrogen cycling in saltmarsh and mangrove sediments at Western Port Victoria, Australia.	
(Kimmerer and A.D. 1987)	Growth, mortality and secondary production of the copepod *Acartia tranteri* in Westernport Bay, Australia.	
(Petch 1986)	Selective deposit feeding by *Lumbrinereis latreilli* (Polychaeta Lumbrinereidae) with a new method for assessing selectivity by deposit feeding organisms.	
(Vollebergh and Congdon 1986)	Germination and growth of *Ruppia polycarpa* and *Lepilaena cylindrocarpa* in ephemeral saltmarsh pools in Western Port Bay.	
(Davey and Woelkerling 1985)	Studies on Australian mangrove algae 3. Victorian community structure and recolonisation in Western Port Bay.	
(Howard and Koehn 1985)	Population dynamics and feeding ecology of pipefish (Syngnathidae) associated with eelgrass beds of Western Port, Victoria.	
(Kimmerer and McKinnon 1985)	A comparative study of the zooplankton in two adjacent embayments, Port Phillip and Westernport Bays, Australia.	
(Howard 1984)	The trophic ecology of caridean shrimps in an eelgrass community.	
(Howard and Lowe 1984)	Predation by birds as a factor influencing the demography of an intertidal shrimp.	
(Robertson 1984)	Trophic interactions between the fish fauna and macrobenthos of an eelgrass community in Western Port, Victoria.	
(Van der Valk and Attiwill 1984)	Decomposition of leaf and roof litter of Abicennia marina at Western Port Bay Victoria Australia.	
(Watson *et al*. 1984)	Invertebrate macrobenthos of the seagrass communities in Western Port, Victoria.	
(Bulthuis *et al*. 1984)	Suspended sediments and nutrients in water ebbing from seagrass-covered and denuded tidal mudflats in a Southern Australian embayment.	
(Bulthius 1983a)	Effects of in-situ light reduction on density and growth of the seagrass Heterozostera tasmanica in Western Port Victoria Australia.	
(Bulthius 1983b)	Effects of temperature on the photosynthesis irradiance curve of the Australian seagrass *Heterozostera tasmanica*.	
(Bulthuis and Woelkerling	Biomass accumulation and shading effects of epiphytes on leaves of the seagrass *Heterozostera tasmanica* in Victoria, Australia.	

1983)		
(Bulthius and Woelkerling 1983)	Seasonal variation in standing crop density and leaf growth rate of the seagrass Heterozostera tasmanica in Western Port and Port Phillip Bay Australia	
(Coleman 1982)	Population density and biomass of the bivalves *Tellina mariae* and *Katelysia rhytiphora* from a seagrass bed in Western Port Victoria Australia.	
(Fabris *et al*. 1982)	Uptake of Cadmium by the seagrass *Heterozostera tasmanica* from Corio Bay and Western Port, Victoria.	
(Lowe 1982)	Feeding behaviour and diet of royal spoonbills *Patealea regia* in Westernport Bay Victoria Australia.	
(Robertson 1982)	Population dynamics and feeding ecology of juvenile Australian Salmon (*Arripis trutta*) in Western Port, Victoria.	
(Barnard and Drummond 1981)	3 Corophoids crustacea amphipoda from Western Port Victoria Australia.	
(Bulthuis 1981)	The standing crop of submerged macrophytes in Westernport Bay. Project No. 124 to the *Westernport Bay Environmental Study* (1973-1974).	
(Bulthuis and Woelkerling 1981)	Effects of *in situ* nitrogen and phosphorus enrichment of the sediments on the seagrass *Heterozostera tasmanica* (Martens ex Aschers.) den Hartog in Western Port, Victoria, Australia.	
(Clough and Attiwill 1980)	Primary productivity of *Zostera muelleri* in Westernport Bay Victoria Australia.	
(Hinwood 1979)	Hydrodynamic and transport models of Western Port, Victoria.	
(Coleman *et al*. 1978)	A quantitative survey of the main benthos of Western Port, Victoria.	
(Smith *et al*. 1975)	The invertebrate fauna of Westernport Bay.	

2.12 Churchill Marine National Park

Western Port is a large embayment to the east of Port Phillip Bay with extensive areas of intertidal mudflats and seagrass meadows and a dendritic network of tidal channels. Churchill Marine National Park is in the south of Western Port on the north-eastern shore of Phillip Island. Churchill Island Marine National supports a variety of habitats including seagrass beds, mangroves, mudflats and sandy beaches. The mudflats and seagrass communities of Marine National Park support a diverse range of invertebrate and fish species including a dense population of the highly unusual “living-fossil” animals known as brachiopods (*Magellania flavescens*) which are very rare worldwide.

2.12.1 PHYSICAL PARAMETERS

Churchill Marine National Park is located south of Rhyll on the north-eastern shore of Phillip Island. The seaward boundary of the Marine National Park extends from Long Point south of Rhyll to the north point of Churchill Island where it continues along the island’s western shore to the bridge (Figure A1.12a). There is limited freshwater input into the Churchill Marine National Park. Churchill Island is primarily agricultural and adjacent land use on the Phillip Island and the mainland is primarily urban with some agricultural uses. For a summary of the physical parameters in Churchill Marine National Park see Table 2.12.1.

Table 2.12.1. Physical parameters for Churchill Marine National Park.

Park Name	Western Port - Churchill Island
Conservation status	Marine National Park
Biophysical Region	Victorian embayments
Size of Park (ha)	670
Length of coastline (m)	11124
Exposure rating	Low
Wave Energy	Low
Influential currents	Tidal
Tidal variation - springs (m)	2.00
Tidal variation - neaps (m)	0.80
Water temp - summer (°C)	20.40
Water temp - winter (°C)	11.70
Intertidal (ha)	550
0 - 2 m (ha)	120
2 - 5 m (ha)	
5 - 10 m (ha)	
10 - 15 m (ha)	
Discharges	Intermittent creeks
Adjacent catchment	Agricultural

2.12.2 MARINE HABITAT CLASSES

Churchill Marine National Park contains representatives of habitat types including seagrass beds, mangroves, sheltered intertidal mudflats, sandy beaches, subtidal soft sediments and rocky intertidal habitats.

Table 2.12.2 Marine Habitat Classes for Churchill Marine National Park (Bird 1993; Blake and Ball 2001b).

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
Substratum texture	Fine sand
	Muddy sand
	Mud / silt
Subtidal soft sediment biota	Zostera
	Mixed seagrass/algae
Intertidal soft sediment biota	Mangrove
	Saltmarsh
	Seagrass
	Mussels
	Barnacles
Macroalgae Area (ha)	0.3
Zostera/Heterozostera Dominant Seagrass & Macroalgae Area (ha)	446.9
Sediment Area (ha)	202.9
Mangroves Area (ha)	15.1
Salt Marsh Area (ha)	1.7

2.12.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.12.7.

Saltmarsh

Saltmarsh habitats exist throughout Western Port and are frequently found in the same regions as mangroves with saltmarsh growing on the landward edge of the mangroves (Hamilton 1994). Saltmarsh habitat is present in Churchill Marine National Park, but no surveys are available from directly within the Marine National Park.

Flora

There is no direct information about the saltmarsh vegetation of Churchill Marine National Park, however a recent quantitative survey from nearby Rhyll may provide some indication of the species likely to be present. Saintilan and Rogers (2001) found that Rhyll saltmarsh community was dominated by *Sarcocornia quinqueflora*, *Sclerostegia arbucula* and occasionally *Wilsonia backhousei*. Also present were *Selliera radicans*, *Samolus repens*, *Triglochin striata*, *Chenopodiaceae* sp., *Baumea* sp., *Juncus krausii*, and *Distichilis distichophylla* (Saintilan and Rogers 2001).

Invertebrate fauna

Information about the invertebrates found in saltmarsh habitats in Churchill Marine National Parks was unavailable, but generalisations can be drawn about the likely species composition from studies of similar habitat elsewhere in Western Port. The fauna associated with saltmarsh in Western Port is characterised by a number of species of air-breathing gastropods including *Salinator solida*, *Ophiacardelus ornatus*, *Marinula meridionalis* and *Truncatella scalarina*. The littorinid *Bembicium melanostomum* is found in the lower part of the saltmarsh zone where it borders on the mangroves (Smith *et al*. 1975).

Fish

No information was available on fish occurring in saltmarsh in Churchill Marine National Park, but if they are present, it is only transiently when saltmarsh is covered by exceptionally high tides.

Mangrove

Flora

The white mangrove (*Avicennia marina* subsp. *australasica*) is the only species of mangrove occurring in Victoria where it reaches the southern extent of its distribution. The most extensive and well developed communities of mangroves in Victoria are found in Western Port where they are considered of State significance (Ross 2000). All of the Western Port Marine National Parks include some stands of mangrove trees. Significant communities of mangroves exist on North Point and Swan Corner in Churchill Marine National Park (Blake and Ball 2001b). The mangrove zone occurs inshore of seagrass, sand and mudflats with all communities generally occurring parallel to the shore, except where drainage channels or creeks alter the surface (Chamberlain 1979).

The trunks and pneumatophores of mangrove trees provide the only hard substratum in this zone and numerous epiphytic filamentous algae including *Caloglossa*, *Catanella nipae* and *Bostrychnia* form mats on them (Smith *et al*. 1975).

Invertebrate fauna

No specific information about the invertebrates found in the mangroves of Churchill Marine National Park was available, but generalisations can be drawn about the likely species composition from studies of similar habitat elsewhere in Western Port.

The mangrove trunks and pneumatophores are the only hard substratum in this zone and species including *Bembicium nanum*, *B. melanostomum*, and the barnacle *Chamaesipho columna* are commonly found. The mussel *Mytilus edulis planulatus* may be found attached to the roots (Smith *et al*. 1975).

Fish

No specific information regarding the fish associated with mangrove habitat in Churchill Marine National Park was available. A recent survey of mangrove habitat nearby in Western Port (Jenkins and Hindell FRDC 2001/036) recorded species including glass goby (*Gobiopterus semivestitus*), smooth toadfish (*Tetractenos glaber*), yellow-eye mullet (*Aldrichetta forsteri*), halfbridled goby (*Arenigobius frenatus*) and the bluespot goby (*Pseudogobius olorum*).

Seagrass

Flora

Typically, seagrass meadows are found in water depths between intertidal and 2 m, where sunlight intensity is greatest and therefore seagrass growth is highest (Lloyd 1997). The most abundant subtidal seagrass in Western Port is *Heterozostera tasmanica*. In shallow subtidal soft substrata the green alga *Caulerpa cactoides* and the brown alga *Sargassum* sp. and various species of red algae are commonly present (Ministry for Conservation 1975).

The most recent mapping of Western Port seagrass by Blake and Ball (2001b) found four species of seagrass in Western Port, although only three species (*Halophila ovalis*, *Zostera muelleri* and *Heterozostera tasmanica*) were present in the Western Port Marine National Parks. Blake and Ball (2001b) found that the Churchill Marine National Park is dominated by dense *Zostera*/*Heterozostera* with algae and areas of unvegetated mudflats found only in the upper intertidal.

The two species *Z. muelleri* and *H. tasmanica*, were grouped into the single category of *Zostera*/*Heterozostera* in the study. However, it is possible to make inferences about their likely distribution based on their ecology. *Z. muelleri* is generally considered an intertidal species (Womersley 1984) and would therefore be expected to colonise the large intertidal mudflats in Western Port. Conversely, *H. tasmanica* is generally a subtidal species (Womersley 1984), and could therefore be expected to inhabit the subtidal borders of the channels. However, this is not always the case. Bulthuis (1981) observed that *Z. muelleri* inhabited the higher intertidal slopes and *H. tasmanica* the flat intertidal banks between channels. In many places the seaward edge of the mudflats is higher than the remainder of the flats (Marsden and Mallett 1975) creating a large shallow pool in which the desiccation prone *H. tasmanica* can survive. Stephens (1995) suggests that dense beds of *H. tasmanica* trap enough water on the ebbing tide to avoid desiccation during periods of exposure and hence inhabit intertidal flats.

Invertebrate fauna

Most studies that relate to the invertebrate fauna of seagrass habitats have been undertaken outside the Churchill Marine National Park. Presented here are descriptions of invertebrate assemblages that might generally be expected in Western Port seagrass habitats. Seagrass habitats in Western Port support greater species richness than adjacent unvegetated habitats (Edgar *et al*. 1993), which may be a consequence of the structural heterogeneity of seagrass providing habitat for epifaunal species which cannot survive on bare substrata (Edgar 1990).

Considerable research effort has been directed at the invertebrate species of seagrass communities in Western Port (see EPA 1996, for a review), with some studies providing considerable detail on trophic interactions and production (*e.g.,* Edgar *et al*. 1994; Littlejohn *et al*. 1974; Watson *et al*. 1984). Most studies found a gradual change in the infaunal community structure from the near shore regions to the shallow channels and inlets and the deep channels (Coleman *et al*. 1978; Edgar *et al*. 1994; Littlejohn *et al*. 1974; Smith *et al*. 1975).

Prominent infaunal species include the bivalves *Anadara trapezia*, *Katelysia rhytiphora*, *Homalina deltoidalis*, *H*. *mariae* and *Laternula tasmania*. Common crustaceans are the ghost shrimp (Callianassidae), the shrimp *Alpheus* sp. and the tanaid *Paratanais* (Coleman *et al*. 1978; Edgar *et al*. 1994; Watson *et al*. 1984). Also common are the foraminiferans *Ammotium cassis* and *Trochommina sorosa*, the polychaete genera *Barantolla*, *Armandia*, *Nepthys*, *Lumbrineris*, *Platynereis* and *Pista* and the gastropods *Salinator fragilis*, *Nassarius burchardi* and *Polinices sordidus* (EPA 1996; Smith *et al*. 1975).

Common epifauna include a large number of grazing molluscs (families Trochidae and Rissoacea) *gammaridean* amphipods, the shrimp *Macrobrachium* sp., the crabs *Halicarcinus* sp. and *Litocheira bispinosa*, and occasional sponges, hydroids and ascidians (Edgar *et al*. 1994; Littlejohn *et al*. 1974; Smith *et al*. 1975).

A food web of the seagrass ecosystem in Western Port was developed by Watson *et al*. (1984).

Fish

No information regarding fishes associated with seagrass habitats was available for Churchill Marine National Park. In Western Port in general, seagrass fish assemblages consist predominantly of pipefish, gobies, weedfish, leatherjackets (Monacanthidae), globefish (*Diodon nicthemerus*), soldierfish (*Gymnapistes marmoratus*), blue rock whiting (*Haletta semifasciata*) and adult rock flathead (*Platycephalus laevigatus*) (EPA 1996). See Table 2.12.3 for a summary of fish found in seagrass habitat in Western Port in general.

Table 2.12.3. Common fish assemblages in Western Port seagrass (adapted from EPA 1996).

Family	Common name	Scientific Name
Moridae	Rock cod	*Pseudophycus bachus*
Atherinidae	Hardyheads	*Kestratherina brevirostris*
Syngnathidae	Pipefish	*Stigmatopora argus*
		Stigmatopora nigra
		Mitotichths semistriatis
		Vanacampus phillipi
		Urocampus carinirostris
Scorpaenidae	Soldierfish	*Gymnapistes marmoratus*
Platycephalidae	Rock flathead (adult)	*Platycephalus laevigatus*
Apogonidae	Woods siphon fish	*Siphaemia cephalotes*
Enoplosidae	Old wife	*Enoplosus armatus*
Odacidae	Blue rock whiting	*Haletta semifasciata*
Clinidae	Weedfish	*Cristiceps australis*
		Heteroclinus adelaidei
		Heteroclinus perpicillatus
Globiidae	Gobies	*Arenigobius frenatus*
		Gobiopterus semivestitus
Monacanthidae	Six spined leatherjacket	*Meuschenia freycineti*
	Bridled leatherjacket	*Acanthaluteres spilomelanurus*
	Toothbrush leatherjacket	*Acanthaluteres vittiger*
	Pygmy leatherjacket	*Brachaluteres jacksonianus*

Some notable changes have occurred in the fish fauna in recent years. Fifteen years ago the wide bodied pipefish (*Stigmatopora nigra*) was low in abundance and the spotted pipefish (*S. argus*) was unrecorded (Howard and Koehn 1985), however, both are now relatively common (Edgar and Shaw 1995a).

Intertidal mudflats

Flora

Most areas of the intertidal flats in the Western Port are dominated by seagrass and no specific information is available for unvegetated areas in Churchill Marine National Park. However, generally intertidal mudflats elsewhere support a high biomass of micro-algae surface film and some fine macroalgae usually dominated by red species (LCC 1994a).

Invertebrate fauna

No specific information about the invertebrates found in the sheltered intertidal mudflats of Churchill Marine National Park was available, but generalisations can be drawn about the likely species composition from studies of similar habitat elsewhere in Western Port. Typical invertebrate species on sheltered intertidal mudflats in Western Port include a number of bivalve molluscs including the triangular tellin (*Tellina deltoidalis*), elongated lantern shell (*Laternula creccina*), and mud ark (*Anadara trapezia*). Several crustaceans occur in large numbers on, or in, mudflats including the crabs (*Mictyris platycheles*, *Macrophthalmus latifrons*, *Heloecius cordiformis*) and the ghost shrimp (*Callianassa* sp.) (LCC 1994a).

Fish

No information was available regarding the fish assemblages associated with unvegetated intertidal flats in the Churchill Marine National Park. The fish fauna of the unvegetated intertidal flats within Western Port has recently been sampled and the common species included smooth toadfish (*Tetractenos glaber*), yellow-eye mullet (*Aldrichetta forsteri*), bluespot goby (*Pseudogobius olorum*), long fin goby (*Favonigobius lateralis*) and the glass goby (*Gobiopterus semivestitus*) (Jenkins and Hindell FRDC 2001/036). For a summary of the most common fish species in unvegetated intertidal mudflats refer to Table 2.10.4.

Unvegetated subtidal soft substrata

No information relating specifically to the Churchill Marine National Park was found and so we present general information from Western Port. These habitats occur in the deep main (10-30 m) channels of Western Port where winnowing by currents cause a coarser sand substrate than on the sheltered intertidal mudflats (Edgar *et al*. 1994; Littlejohn *et al*. 1974; Smith *et al*. 1975).

Invertebrate fauna

No information specifically relating to the Churchill Marine National Park was available. Elsewhere in Western Port, the seapen *Virgularia* mirabilis which anchors to the substrate by a fleshy stalk is present in high abundance in deepwater channels in Western Port with densities reaching approximately 200/m^2 (Edgar *et al*. 1994). Similarly, the epifaunal brachiopod *Magellania flavescens* occurs locally at high densities of up to 250/m^2 mainly around San Remo (Smith *et al*. 1975). Other epifaunal species attached to rubble and shells include the gastropod *Sigapatella calyptraeformis*, the sea stars *Nectria ocellata*, *Patiriella brevispina* and *Tosia magnifica*, the urchin *Goniocidaris tubaria* and the solitary ascidian *Pyura stolonifera* (Smith *et al*. 1975).

The most abundant infaunal taxa of the deep channels are polychaetes and crustaceans, the bivalve molluscs, *Neotrigonia margaritacea*, *Pronuncula* sp. *Notocallista diemensis*, *Bellucina crassillirata*, *Venericardia bimaculata*, the rock-boring bivalve *Pholas australiasiae*, and the carnivorous gastropods *Nassarius burchardi*, *Pterynotus triformis* and *Amorena undulata* (Smith *et al*. 1975). The molluscs *Neotrigonia margaritacea* and *Anadara trapezia*, and the brachiopod *Magellania flavescens* are of particular value because they are restricted in distribution elsewhere but are abundant within Western Port (Smith *et al*. 1975).

Fish

The fish fauna of channels are typically stingarees (Urolophidae), gurnard perch (*Neosebastes scorpaenoides*), sand flathead (*Platycephalus bassensis*) and gobies (*e.g., Favonigobius lateralis*) (Edgar and Shaw 1995b). Juvenile King George whiting (*Sillaginodes punctata*) can sometimes be found in unvegetated areas adjacent to seagrass (Edgar and Shaw 1995b). Table 2.12.4. provides a summary of common fish assemblages in Western Port drainage channels.

Table 2.12.4. Common fish assemblages in Western Port drainage channels (adapted from EPA 1996).

Family	Common name	Scientific Name
Urolophidae	Banded stingaree	*Urolophus cruciatus*
Scorpaenidae	Gurnard perch	*Neosebastes scorpaenoides*
Platycephalidae	Sand flathead	*Platycephalus bassiensis*
Globiidae	Goby	*Favonigobius lateralis*
Tatradontidae	Smooth toadfish	*Tetractenos glaber*

Pelagic environment

Flora

No specific information about the pelagic flora environment in Churchill Marine National Park was found. One of the few studies of the pelagic environment in Western Port was carried out by (Kimmerer and McKinnon 1985)(1985) who found many species of phytoplankton.

Invertebrate fauna

No specific information about the pelagic invertebrate fauna in Churchill Marine National Park was found. Kimmerer and McKinnon (1985) found the copepod *Acartia tranteri* dominated the pelagic invertebrate fauna elsewhere in Western Port. Information about the larger invertebrates in the pelagic environment is unknown.

Fish

No specific information about the fish in the pelagic environment in Churchill Marine National Park was found. In general, Western Port supports a group of highly mobile pelagic species including Australian Salmon (*Arripis* spp.), yellow-eye mullet, pilchards and anchovies, barracouta (*Thyrsites atun*) and various sharks and rays (Edgar and Shaw 1995b; Robertson 1982). See Table 2.12.5 for details of common mobile pelagic fish in Western Port in general.

Table 2.12.5. Common mobile pelagic fishes in Western Port (adapted from EPA 1996).

Family	Common name	Scientific Name
Carcharhinidae	School shark	*Galeorhinus galeus*
	Gummy shark	*Mustelus antarcticus*
Callorhynchidae	Elephant fish	*Callorhynchus milii*
Rajiforms	Rays	*Various (mostly undocumented)*
Clupeidae	Sand sprat	*Hyperlophus vittatus*
	Pilchard	*Sardinops neopilchardus*
Engraulidae	Australian anchovy	*Engraulis australis*
Hemiramphidae	Southern sea garfish	*Hyporhamphus melanochir*
Pomatomidae	Tailor	*Pomatomus saltatrix*
Carangidae	Silver trevally	*Pseudocaranx dentex*
	Jack mackerel	*Trachurus declivis*
Arripidae	Australian salmon	*Arripis truttacea*
Mugilidae	Yellow-eyed mullet	*Aldrichetta forsteri*
Gempylidae	Barracouta	*Thyrsites atun*

2.12.4 BIOLOGICAL PROCESSES

No information regarding the biological processes occurring in the Churchill Marine National Park was found.

2.12.5 SPECIES DISTRIBUTION INFORMATION

No marine species are known to have their distributional limits near or within the Churchill Marine National Park.

2.12.6 SHOREBIRDS

The intertidal mudflats of Western Port are listed under the Ramsar convention. The Churchill Island Marine National Park site also contains an area of national significance (primary feeding area for migratory waders) and an area of State significance (secondary feeding area).

Table 2.12.6 lists recorded sightings of threatened shorebird species from in and around the Churchill Island Marine National Park. Approximately 80 further, non-threatened species are recorded in this Marine National Park and its surrounds.

2.12.7 MARINE MAMMALS

No records of threatened marine mammal sightings in the Churchill Island Marine National Park are listed in the AVW. Research on the distribution of Australian Fur Seals and Bottlenose Dolphins in Western Port indicate it may be possible to see these species in the Marine National Park area (Dann *et al.* 1996). In particular, dolphins are most commonly found in the western and eastern arms of the bay usually in the vicinity of the two entrances. However, as neither dolphins nor seals were recorded in intertidal areas it is possible that these species would only enter the deeper channels in the Marine National Park.

Table 2.12.6. Threatened shorebird records from Churchill Island Marine National Park and surrounds (AVW and listed references).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Bittern	*Botaurus poiciloptilus*			End		1999
Australasian Gannet	*Morus serrator*			Vul		1993
Australasian Shoveler	*Anas rhynchotis*			Vul		1981
Bar-tailed Godwit	*Limosa lapponica*				CJ	Emison *et al.*. 1987
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		Emison *et al.*. 1987
Blue-billed Duck	*Oxyura australis*	L		Vul		ARI 1999
Cape Barren Goose	*Cereopsis novaehollandiae*			Vul		1997

Caspian Tern	*Sterna caspia*	L		Vul	CJ	1997
Cattle Egret	*Ardea ibis*				CJ	ARI 1999
Common Greenshank	*Tringa nebularia*				CJ	Emison *et al.*. 1987
Common Sandpiper	*Actitis hypoleucos*				CJ	ARI 1999
Crested Tern	*Sterna bergii*			LR		2001
Curlew Sandpiper	*Calidris ferruginea*				CJ	Emison *et al.*. 1987
Eastern Curlew	*Numenius madagascariensis*			LR	CJ	1992
Fairy Tern	*Sterna nereis*	L		Vul		Emison *et al.*. 1987
Freckled Duck	*Stictonetta naevosa*	L		End		1995
Glossy Ibis	*Plegadis falcinellus*			Vul	C	
Great Egret	*Ardea alba*	L		End	CJ	1997
Great Knot	*Calidris tenuirostris*				CJ	ARI 1999
Greater Sand Plover	*Charadrius leschenaultii*				CJ	ARI 1999
Grey Plover	*Pluvialis squatarola*				CJ	ARI 1999
Grey-tailed Tattler	*Heteroscelus brevipes*				CJ	ARI 1999
Hardhead	*Aythya australis*			Vul		ARI 1999
Hooded Plover	*Thinornis rubricollis*	L	Vul	End		Emison *et al.*. 1987
Intermediate Egret	*Ardea intermedia*	L		CEn		2000
Latham's Snipe	*Gallinago hardwickii*				CJ	ARI 1999
Lesser Sand Plover	*Charadrius mongolus*				CJ	ARI 1999
Little Egret	*Egretta garzetta*	L		CEn		ARI 1999
Magpie Goose	*Anseranas semipalmata*			End		ARI 1999
Marsh Sandpiper	*Tringa stagnatilis*				CJ	ARI 1999
Musk Duck	*Biziura lobata*			Vul		1992
Pacific Golden Plover	*Pluvialis fulva*				CJ	ARI 1999
Pacific Gull	*Larus pacificus*			LR		Emison *et al.*. 1987
Pied Cormorant	*Phalacrocorax varius*			LR		2001
Red Knot	*Calidris canutus*				CJ	ARI 1999
Red-necked Stint	*Calidris ruficollis*				CJ	Emison *et al.*. 1987
Royal Spoonbill	*Platalea regia*			Vul		1990
Ruddy Turnstone	*Arenaria interpres*				CJ	Emison *et al.*. 1987
Sharp-tailed Sandpiper	*Calidris acuminata*				CJ	Emison *et al.*. 1987

Short-tailed Shearwater	*Puffinus tenuirostris*				J	ARI 1999
Terek Sandpiper	*Xenus cinereus*				CJ	ARI 1999
Whimbrel	*Numenius phaeopus*				CJ	ARI 1999
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	L		End	C	1999

Table 2.12.7. Selection of some animals and plants that may be found in the Churchill Marine National Park.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown alga	*Sargassum* sp.
	green alga	*Caulerpa cactoides*
	saltmarsh species	*Sclerostegia arbucula, Sarcocornia quinqueflora*, *Suaeda australis*
	seagrass	*Heterozostera tasmanica, Halophila ovalis*, *Zostera muelleri*
	white mangrove	*Avicennia marina*
Invertebrates	gastropods	*Salinator solida, Ophiacardelus ornatus, Marinula meridionalis, Truncatella scalarina*, *Nassarius burchardi*, *Polinices sordidus Bembicium nanum*, *B. melanostomum*
	barnacle	*Chamaesipho columna*
	crab	*Mictyris platycheles*
	seastars	*Nectria ocellata*, *Patiriella brevispina* and *Tosia magnifica*,
	shrimp	*Alpheus* sp.
	tanaid	*Paratanais* sp.
	solitary ascidian	*Pyura stolonifera*
	urchin	*Goniocidaris tubaria*
	brachiopod	*Magellania flavescens*
	ghost shrimp	Callianassidae
	glass goby	*Gobiopterus semivestitus*
	mussel	*Mytilus edulis planulatus*
	bivalves	*Anadara trapezia*, *Katelysia rhytiphora*, *Homalina deltoidalis*, *H. mariae* and *Laternula tasmania*.
	littorinid	*Bembicium melanostomum*
	polychaetes	*Barantolla*, *Armandia*, *Nepthys*, *Lumbrineris*, *Platynereis* and *Pista*
Fish	blue rock whiting	*Haletta semifasciata*
	bluespot goby	*Pseudogobius olorum*
	globefish	*Diodon nicthemerus*
	goby	*Favonigobius lateralis*

	gurnard perch	*Neosebastes scorpaenoides*
	halfbridled goby	*Arenigobius frenatus*
	King George whiting	*Sillaginodes punctata*
	long fin goby	*Favonigobius lateralis*
	flatheads	*Platycephalus laevigatus, Platycephalus bassiensis*
	smooth toadfish	*Tetractenos glaber*
	soldierfish	*Gymnapistes marmoratus*
	stingarees	*Urolophus cruciatus*
	yellow-eye mullet	*Aldrichetta forsteri*

2.12.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Churchill Island Marine National Park are listed below (MPV database and Buckley 1993):

- Churchill Island, (Regional/Local Significance): Features indicative of higher sea levels.
- Swan Corner - Cliffs and Bluffs, (Regional/Local Significance): Active and relict marine cliffs.
- Chambers Point to Long Point - Raised Beach, (State significance): Important assemblages of emerged coastal forms.

2.12.9 KNOWLEDGE GAPS

Although Western Port is relatively well studied, few studies have focused on the biota actually located in the Churchill Marine National Park. Most of the information in this report is derived from studies of nearby areas, which are assumed to be similar to the protected areas.

2.12.10 RESEARCH

No research was found relating specifically to the Churchill Marine National Park, but a list of research related to Western Port in general can be found in Table 2.12.8.

Table 2.12.8. Summary of research projects conducted in Western Port Marine National Parks.

Author	Project	Notes
(Campbell and Miller 2002)	Shoot and abundance characteristics of the seagrass *Heterozostera tasmanica* in Western Port estuary (south eastern Australia).	
(Blake and Ball 2001b)	Victorian marine habitat database: seagrass mapping of Western Port.	
(Dann *et al.*. 2001)	The Distribution and Abundance of Little Penguins at Sea in Western Port, Victoria	

(Saintilan and Rogers 2001)	Mangrove and saltmarsh monitoring in Westernport Bay	
(Jenkins and Hindell FRDC 2001/036)	Assessment of the importance of different nearshore habitats to commercial and recreational fish in Victoria	FRDC 2001/036
(Dann 2000)	Foraging behaviour and diets of red-necked stints and curlew sandpipers in south-eastern Australia.	
(Jenkins *et al*. 2000)	Determination of spawning areas and larval advection pathways for King George whiting in south-eastern Australia using otolith microstructure and hydrodynamic modelling	
(Dann 1999)	Feeding periods and supratidal feeding of Red-necked Stints and Curlew Sandpipers in Western Port, Victoria.	
(Satumanatpan and Keough 1999)	Effect of barnacles on the survival and growth of temperate mangrove seedlings.	
(Wright and Boxshall 1999)	The influence of small-scale flow and chemical cues on the settlement of two congeneric barnacle species.	
(Boon *et al*. 1997)	Diet of the intertidal callianassid shrimps *Biffarius arenosus* and *Trypea australiensis* (Decapoda: Thalassinidea) in western Port (southern Australia), determined with multiple stable-isotope analyses.	
(Nateekanjanalarp 1997)	Ecological studies of barnacles in temperate mangrove forests	PhD thesis
(Stevens and West 1997a)	Investigation of school and gummy shark nursery areas in south eastern Australia	FRDC
(Swadling and Bayly 1997)	Different zooplankton communities in confluent waters: Comparisons between three marine bays in Victoria, Australia.	
(Dann *et al*. 1996)	The Distribution and Abundance of Australian Fur Seals *Arctocephalus pusillus* and Bottlenose Dolphins *Tursiops truncatus* in Western Port, Victoria.	
(Stephens 1995)	The distribution of seagrass in Western Port, Victoria.	
(Edgar and Shaw 1995a)	The production and trophic ecology of shallow-water fish assemblages in Southern Australia I. Species richness, size-structure and production of fishes in Western Port, Victoria.	
(Edgar and Shaw 1995b)	The production and trophic ecology of shallow-water fish assemblages in Southern Australia II. Diets of fishes and trophic relationships between fishes and benthos at Western Port, Victoria.	
(Edgar and Shaw 1995c)	The production and trophic ecology of shallow-water fish assemblages in Southern Australia III. General relationships between sediments, seagrasses, invertebrates and fishes.	
(Edgar *et al*. 1994)	Comparisons of species richness, size-structure and production of benthos in vegetated and unvegetated habitats in Western Port, Victoria.	
(MSE 1994)	Marine ecological monitoring, Western Port, Victoria. 1993 Survey.	
(Dann 1991)	Feeding behaviour and diet of double banded plovers Charadrius bicinctus in Western Port, Victoria.	
(Kuo *et al*. 1990)	The leaf internal morphology and ultrastructure of *Zostera muelleri* Irmisch ex Aschers. Zosteraceae. A comparative study of the intertidal and subtidal forms.	

(Kimmerer and McKinnon 1989)	Zooplankton in a marine bay III. Evidence for influence of vertebrate predation on distributions of two common copepods	
(Boon and Cain 1988)	Nitrogen cycling in saltmarsh and mangrove sediments at Western Port Victoria, Australia.	
(Kimmerer and A.D. 1987)	Growth, mortality and secondary production of the copepod *Acartia tranteri* in Westernport Bay, Australia.	
(Petch 1986)	Selective deposit feeding by *Lumbrinereis latreilli* (Polychaeta Lumbrinereidae) with a new method for assessing selectivity by deposit feeding organisms.	
(Vollebergh and Congdon 1986)	Germination and growth of *Ruppia polycarpa* and *Lepilaena cylindrocarpa* in ephemeral saltmarsh pools in Western Port Bay.	
(Davey and Woelkerling 1985)	Studies on Australian mangrove algae 3. Victorian community structure and recolonisation in Western Port Bay.	
(Howard and Koehn 1985)	Population dynamics and feeding ecology of pipefish (Syngnathidae) associated with eelgrass beds of Western Port, Victoria.	
(Kimmerer and McKinnon 1985)	A comparative study of the zooplankton in two adjacent embayments, Port Phillip and Westernport Bays, Australia.	
(Howard 1984)	The trophic ecology of caridean shrimps in an eelgrass community.	
(Howard and Lowe 1984)	Predation by birds as a factor influencing the demography of an intertidal shrimp.	
(Robertson 1984)	Trophic interactions between the fish fauna and macrobenthos of an eelgrass community in Western Port, Victoria.	
(Van der Valk and Attiwill 1984)	Decomposition of leaf and roof litter of Abicennia marina at Western Port Bay Victoria Australia.	
(Watson *et al*. 1984)	Invertebrate macrobenthos of the seagrass communities in Western Port, Victoria.	
(Bulthuis *et al*. 1984)	Suspended sediments and nutrients in water ebbing from seagrass-covered and denuded tidal mudflats in a Southern Australian embayment.	
(Bulthius 1983a)	Effects of in-situ light reduction on density and growth of the seagrass Heterozostera tasmanica in Western Port Victoria Australia.	
(Bulthius 1983b)	Effects of temperature on the photosynthesis irradiance curve of the Australian seagrass *Heterozostera tasmanica*.	
(Bulthuis and Woelkerling 1983)	Biomass accumulation and shading effects of epiphytes on leaves of the seagrass *Heterozostera tasmanica* in Victoria, Australia.	
(Bulthius and Woelkerling 1983)	Seasonal variation in standing crop density and leaf growth rate of the seagrass Heterozostera tasmanica in Western Port and Port Phillip Bay Australia	
(Coleman 1982)	Population density and biomass of the bivalves *Tellina mariae* and *Katelysia rhytiphora* from a seagrass bed in Western Port Victoria Australia.	
(Fabris *et al*. 1982)	Uptake of Cadmium by the seagrass *Heterozostera tasmanica* from Corio Bay and Western Port, Victoria.	

(Lowe 1982)	Feeding behaviour and diet of royal spoonbills *Patealea regia* in Westernport Bay Victoria Australia.	
(Robertson 1982)	Population dynamics and feeding ecology of juvenile Australian Salmon (*Arripis trutta*) in Western Port, Victoria.	
(Barnard and Drummond 1981)	3 Corophoids crustacea amphipoda from Western Port Victoria Australia.	
(Bulthuis 1981)	The standing crop of submerged macrophytes in Westernport Bay. Project No. 124 to the *Westernport Bay Environmental Study* (1973-1974).	
(Bulthuis and Woelkerling 1981)	Effects of *in situ* nitrogen and phosphorus enrichment of the sediments on the seagrass *Heterozostera tasmanica* (Martens ex Aschers.) den Hartog in Western Port, Victoria, Australia.	
(Clough and Attiwill 1980)	Primary productivity of *Zostera muelleri* in Westernport Bay Victoria Australia.	
(Hinwood 1979)	Hydrodynamic and transport models of Western Port, Victoria.	
(Coleman *et al*. 1978)	A quantitative survey of the main benthos of Western Port, Victoria.	
(Smith *et al*. 1975)	The invertebrate fauna of Westernport Bay.	

2.13 Bunurong Marine National Park

The Bunurong Marine National Park features extensive intertidal and subtidal reef platforms with a geology and form that is uncommon elsewhere in Victoria. The Bunurong Marine National Park is representative of the Flinders Bioregion. The Cretaceous sandstone/mudstone of the Bunurong Marine National Park provides considerable habitat diversity with numerous microhabitats, which has encouraged high invertebrate and algal diversity (LCC 1994a). The Marine National Park contains a significant proportion of Victoria's rocky shores invertebrate diversity with many representatives from groups including brittle stars, sea cucumbers, barnacles, sea anemones and chitons (LCC 1994a).

2.13.1 PHYSICAL PARAMETERS

The Bunurong Marine National Park is located about six kilometres south-west of Inverloch in South Gippsland, and covers about five kilometres of coastline. Cretaceous sandstone, shale and Quaternary deposits dominated by calcareous sands are the two major lithic materials occurring in the Bunurong (Bird 1993). Extensive gradually sloping intertidal platforms and subtidal reefs protect the coast from the very high energy waves occurring in other Flinders bioregion locations such as Cape Schanck and Cape Liptrap (Bird 1993). The subtidal platform extends several kilometres from the shore in relatively shallow water mostly between 6-9 m with a maximum depth of about 15 m. The coast is partially protected from storm waves by King Island in Bass Strait and experiences only medium wave exposure.

Table 2.13.1. Physical parameters for the Bunurong Marine National Park.

Park Name	**Bunurong**
Conservation status	Marine National Park
Biophysical Region	Central Victoria
Size of Park (ha)	2100
Length of coastline (m)	5720
Exposure rating	High
Wave Energy	High
Influential currents	None
Tidal variation - springs (m)	2.1
Tidal variation - neaps (m)	1.3
Water temp - summer (°C)	17.5
Water temp - winter (°C)	13
0 - 10 m (ha)	190
10 - 20 m (ha)	130
20 - 30 m (ha)	480

30 - 40 m (ha)	350
40 - 50 m (ha)	590
50 - 60 m (ha)	330
Discharges	Intermittent creeks
Adjacent catchment	Agricultural

2.13.2 MARINE HABITAT CLASSES

Gradually sloping intertidal and subtidal reefs, sand sediment with shell and cobble and seagrass communities are the major habitat classes found in the Bunurong Marine National Park (Figure A1.13a). The mixture of high and low profile reef supports numerous microhabitats, with smaller areas of patchy reef interspersed with sand and shelly sediments (LCC 1994). The complex topography of the intertidal rock platforms in the Bunurong Marine National Park encourages the development of high floral and faunal diversity. A total of 201 algal species, 87 fish species and 258 sub-tidal invertebrate species have been identified from the Bunurong region (Campbell 1989; Edmunds *et al*. 2000; Wilson *et al*. 1983).

Table. 2.13.2. Marine Habitat Classes for Bunurong Marine National Park (Campbell 1989; Department of Conservation and Natural Resources 1992; Ferns and Hough 2002; Wilson *et al*. 1983).

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
	Platform
	Beach / Platform
	Cliff
Substratum relief	Low profile reef
	High profile reef
Substratum texture	Solid reef
	Broken reef
	Gutters
	Outcrops
	Coarse sand
	Medium sand
	Shell rubble / grit
Lithology	Sandstone
Subtidal reef biota	Kelp - Ecklonia dominated
Subtidal reef understorey biota	Mixed algae - brown dominated
	Mixed algae - other

	Cystophora
	Acrocarpia
	Seirococcus
	Sessile invertebrates
	Red algae dominated
	Caulerpa
Subtidal soft sediment biota	Amphibolis
	Seagrass
Intertidal reef biota	Durvillaea
	Hormosira
	Coralline algae
	Pyura
	Mussels
	Barnacles
Heavy reef Area (ha)	183
Low Profile Reef Area (ha)	1008
Total Reef Area (ha)	1191
Sediment Area (ha)	849
Undefined Area (ha)	26

2.13.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.13.6.

Sandy beaches

Flora

The lack of appropriate substrate for attachment restricts the flora to drift macroalgae and macroalgal epiphytes.

Invertebrate fauna

Infaunal zonation for most species is unpredictable and temporally variable, but some generalisations can be made. Dipteran insects are confined to the upper beach zone and polychaetes are confined to the lower beach zone in the Bunurong Marine National Park and crustacean species span the entire beach (Haynes and Quinn 1995). The most common infauna species is the dipteran *Chaetocoelopa sydneyensis* that accounted for 75% of individuals collected in one survey by Haynes and Quinn (1995). Other common species include the coleopteron *Sphargeris physodes*, the isopods *Pseudolana cocinna* and *Actaecia thomsoni*, the amphipods *Talorchestia* cf *novaehollandiae* and *Exoediceroides maculosus*, and the polychaetes *Magelona* sp. and *Scolelepis lamellicincta* (Haynes and Quinn 1995).

Fish

Fishes on sandy beaches are usually mobile and often transient. They generally include mugilids, atherinids and at least one species of arripid, the Australian Salmon *Arripis trutta* (Wilson *et al.* 1983).

Intertidal reef platform

Flora

The upper intertidal areas of the rock platforms, support the green algae *Enteromorpha intestinalis*, the red algae *Porphyra* sp. and blue-green algae such as *Rivularia firma* (Campbell 1989). The desiccation tolerant *Gelidium pusillum* forms dense mats of flattened tangled growth on the seaward edge of exposed rocks and boulders. Neptune's necklace (*Hormosira banksii*), and the green alga *Ulva lactuca* dominate the extensive mid-intertidal communities where they grow in small rock pools and cracks, which also support *Cystophora* spp. and articulated and encrusting coralline red algae. Various other genera of brown algae including *Ectocarpus* spp., *Caulocystis* spp. and *Padina* spp. and the green algae *Chaetomorpha darwinii* are also present (Wilson *et al.* 1983). The lower intertidal platforms are dominated by brown algae and branching and encrusting coralline red algae. Green algae species of the genera *Codium* and *Caulerpa* have also been recorded as have the seagrasses *Zostera muelleri* and *Amphibolis antarctica* (Wilson *et al.* 1983).

Invertebrate fauna

Large boulders and cliffs in the spray zone of the Bunurong Marine National Park support few invertebrate species with only the littorinid mollusc *Nodilittorina unifasciata*, and trochid *Bembicium nanum* being common. Below the high water mark in the upper intertidal, the nestling mussel *Brachidontes rostratus* and several barnacle species (*Chthamalus antennatus*, *Chamaesipho columna* and *Catomerus polymerus*) are commonly found (Wilson *et al.* 1983; Campbell 1989). The mid-intertidal area invertebrates include the variegated limpets (*Cellana tramoserica*, *Patelloida alticostata*) and top shells (*Austrocochlea constricta* and *A. odontis*). Also present are anemones (*Actinia tenebrosa*, *Cniopus verater*, *Oulactis muscosa* and *Anthothoe albocincta*), bristle worms of the genera *Eunice* and *Galeolaria* sp., the sipunculid worm *Phascolosoma annulatum*, the gastropods (*Turbo undulata*, *Thais orbita* and *Cominella lineolata*), pulmonate limpets (*Siphonaria diemenensis* and *S. tasmanica*), the little horse mussel *Xenostrobus pulex*, barnacles (*Tetraclitella purpurascens* and *Tesseropora rosea*), the common sea centipede *Euidotea bakeri*, shrimps (*Alpheus parasocialis* and *Palaemon serenus*), the red rock crab *Plagusia chabrus*, the masking crab *Naxia tumida*, the hairy stone crab *Lomis hirta*, sea stars of the genera *Patiriella* and *Allostichaster*, and many other species (Wilson *et al.* 1983; Campbell 1989).

The lower intertidal contains a wide range of habitats such as under stable boulders, rock pools on shaded vertical surfaces and in channels open to the sea even at low water. Notable species found in these habitats are blacklip abalone *Haliotis ruber*, elephant snails *Scutus antipodes*, and crabs (*Notomithrax ursus*, *Lomis hirta*). In rock pools the seastars *Patiriella* spp., *Coscinasterias calamaria*, gastropods and smaller crustaceans abound (Wilson *et al.* 1983). Other taxa includes the sea anemone *Isanemonia australis*, marine flatworms of the genus *Thysanozoa*, bristle worms of the genera *Lepidonotus* and *Eupolymnia*, chitons of the genera *Ischnochiton*, *Ischnoradsia* and *Poneroplax*, cone shell *Conus anemone*, sea slug *Onchidella patelloides*, blue ring octopus *Hapalochlaena maculosa*, giant rock barnacle *Austromegabalanus nigrescens*, shrimp *Alope australis*, crab *Notomithrax ursus*, urchins (*Holopneustes porossimus* and *Heliocidaris erythrogramma*), sea squirt (*Pyura stolonifera*) and sea tulip (*P. pachydermatina*) (Wilson *et al.* 1983). There is a considerable diversity of isopods. The chiton fauna mentioned above represents a fraction of the total chiton diversity as there are at least 24 different species recorded from the area (Handreck and O'Hara 1994).

Fish

The most common fish species inhabiting large intertidal rock pools are the toadfish *Tetractenos glaber* and the small and cryptic *Parablennius tasmanianus* and *Bovichthys variegatus* (Wilson *et al.* 1983).

Subtidal reef

Flora

This community features a high diversity of red and green algae (Wilson *et al.* 1983). Several surveys have concluded that the macrophyte community of Bunurong Marine National Park can be described as "*Cystophora-Sargassum*" dominated (Wilson *et al.* 1983; O'Hara 2000). This assemblage is characterised by species including *Cystophora platylobium*, *C. moniliformis*, *C. retorta*, *C. subfarcinata*, and *Sargassum fallax*. A variety of other fucoid brown species are also present in high abundance including *Acrocarpia paniculata*, *Seirococcus axillaris*, *Perithalia cordata* and *Carpoglossum confluens*.

Other larger brown species such as *Ecklonia radiata* and *Phyllospora comosa* are generally absent in shallow water, while *Macrocystis angustifolia* is uncommon. The predominant green algae are *Caulerpa brownii* and *Caulerpa flexilis*, however these species are relatively low in abundance. Typical understorey cover is dominated by the fleshy red species *Plocamium angustum*, *Plocamium dilatum*, *Areschougia* spp. and *Phacelocarpus peperocarpos*, the small brown species *Chlonidophora microphylla* and *Halopteris* sp. and the corallines *Metagoniolithon* sp. and *Haliptilon roseum* (Wilson *et al.* 1983; O'Hara 2000).

Invertebrate fauna

Epifauna from algae and turf samples from this community have revealed an important collection of isopod crustaceans including two families (Pseudidotheidae, Plakarthriidae), which had not been previously recorded from Australia. The Sphaeromatidae was an especially diverse isopod family, with 20 species recorded from this community (Wilson *et al.* 1983).

Edmunds *et al.*(2000) found that larger mobile invertebrates are numerically dominated by the blacklip abalone (*Haliotis ruber*), the gastropod *Turbo undulatus*, the common sea urchin *Heliocidaris erythrogramma* and a variety of sea stars, particularly *Patiriella brevispina*, *Tosia australis*, *Nectria ocellata* and *Nepanthia troughtoni*. Other commonly encountered species include the green lip abalone *H. laevigata*, the dogwhelk *Thais orbita*, and the feather star *Cenolia trichoptera*. The densities of southern rock lobster *Jasus edwardsii* were very low, with only one sighted during a recent survey in (Edmunds 2000). However, the substratum at most of the survey sites had few cracks and crevices suitable for sheltering lobsters.

On some areas of Twin Reefs in the east of the Park, encrusting invertebrate communities were recorded. These communities were dominated by several species of sponges and bryozoans, none of which were identified. Only two anemones, *Anthothoe albocincta* and *Epiactis* sp. occurred widely (Wilson *et al.* 1983).

Fish

The subtidal rock platform provides a variety of protective niches and abundance of food in the form of plankton, algae and small invertebrates which results in considerable fish diversity (Department of Conservation and Natural Resources 1992). Most of the fish associated with reef in the Bunurong are found in all marine habitat types, although the abundance varies between different habitats. The reef fauna is typified by high abundances of the blue throat wrasse *Notolabrus tetricus*, and intermediate to low abundances of wrasse (*Pictilabrus laticlavius, N. fucicola*), sweep (*Scorpis aequipinnis*), scaly fin (*Parma victoriae*), magpie perch (*Cheilodactylus nigripes*) and herring cale (*Odax cyanomelas*) (Edmunds *et al.*

2000). Monacanthids (leatherjackets) such as *Acanthaluteres vittiger* are not common, but are sometimes present among the algae. Blue devil fish (*Paraplesiops meleagris*) are also present, but only in sponge-bryozoan dominated rocky reefs. Within the Marine National Park, Edmunds *et al.* (2000) found schools of long-finned pike (*Dinolestes lewini*) at Shack Bay and Keough and King (1991) found *N. tetricus*, *P. laticlavius* and *S. aequipinnis* the dominant species at Shack Bay and Eagles Nest.

The odacid *Siphonognathus beddomei* occurs in aggregations on reef-flats and slopes, with the serranoid *Caesioperca rasor* being apparent in slightly deeper areas, particularly around rocky outcroppings. The clinid (weedfish) *Heteroclinus heptaeolus* and the sea dragon *Phyllopteryx taeniolatus* can also be seen sheltering among the algae (Wilson *et al.* 1983).

Also present in lower abundances are the common bullseye *Pempheris multiradiatus*, the old wife *Enoplosus armatus*, Gunn's (velvet) leatherjacket *Eubalichthys gunnii*, the Tasmanian blenny *Pictiblennius tasmanianus*, and the blue rock whiting *Haletta semifasciata* (Wilson *et al*. 1983).

Porter (1997) reports at least 87 species of fish from the Bunurong with around 60-70 of these being relatively sedentary, with small territories and associated with reefs (Department of Conservation and Natural Resources 1992).

Subtidal soft sediment

Flora

A variety of brown algae dominated the soft-sand substrate of the Marine National Park. The brown algae *Cystophora moniliformis* is common whilst *Seirococcus axillaris*, *Acrocarpia paniculata* and *Cystophora retorta* are also abundant (O'Hara 2002).

Invertebrate fauna

No records of infauna in sand sediments are available for the Bunurong Marine National Park. However, a single 0.1 m^2 grab sample of medium subtidal sand sediments at 40 m depth from approximately ten kilometres west of the Marine National Park (offshore of Cape Patterson) contained high diversity with 66 species from 40 families consisting mainly of polychaetes, crustaceans and molluscs (Coleman and Gason 2002).

Fish

Numerous pelagic fishes such as gummy shark *Mustelus antarcticus*, school shark, *Galeorhinus australis*, common saw shark, *Pristiophorus cirratus*, southern saw shark, *P. nudipinnis*, angel shark *Squatina australis* and elephant shark *Callorhynchus milii* are likely to occur in the Bunurong Marine National Park (Wilson *et al*. 1983). Several species of mullet, pike, flathead and snapper *Chrysophrys auratus*, tailor *Pomatomus saltator*, King George whiting *Sillaginodes punctatus* and barracouta *Thyrsites atun* are also common in the area (Classon and Wilson 2002).

Amphibolis antarctica seagrass

Flora

Patches of the seagrass *Amphibolis antarctica* and some *Heterozostera tasmanica* are found in sheltered coves on sand substrate, interspersed by algal communities growing on rocky reefs. Notable patches of *Amphibolis antarctica* have been recorded to the east of Twin Reefs and Shack Bay in the Bunurong Marine National Park. *Amphibolis antarctica* are known to support a diverse flora of algal epiphytes (Ducker *et al*. 1977).

Invertebrate fauna

Species-rich communities of hydroid and bryozoan epizoans inhabit the seagrass of Bunurong Marine National Park. Numerous species of invertebrates are known to specialise in living in the long-lived rhizomes of *Amphibolis antarctica*. Wilson *et al.*(1983) found the infaunal and epiphytic assemblages were dominated by the crabs *Halicarcinus ovatus* and *Pilumnus acer*, the shrimp *Hippolyte australiensis*, various ostracods, the holothurians *Trochodota allani*, *Cucuvitrum rowei* and *Pentacta ignava*, the ophiuroid *Amphipholis squamata* and the mollusc *Musculus paulucciae* (O'Hara 2000).

Fish

Seagrass and associated sand substrate supports a variety of fish species including goatfish *Upeneichthys vlamingii*, silver belly *Parequula melbournensis*, pipefishes (*Stigmatopora nigra*, *S. argus*, *Siphonognathus attenuatus*), blue throat wrasse *Notolabrus tetricus*, goby *Nesogobius* spp., weedfishes (*Heteroclinus* spp., *Cristiceps* spp.), and leatherjacket *Acanthaluteres vittiger* (Wilson *et al.* 1983).

2.13.4 BIOLOGICAL PROCESSES

Biological processes occurring in the Marine National Park are unknown.

2.13.5 SPECIES DISTRIBUTION INFORMATION

Species algae, invertebrates and fish that are thought to have their distributional limits at or near the Bunurong Marine National Park are listed in Table 2.13.3. The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

Table 2.13.3. Biota with distributional limits located at or near the Bunurong Marine National Park. (PW – presumed to be at or near western limit in the Marine National Park, PE – presumed to be at or near eastern limit in the Marine National Park, RE – eastern limit recorded in Marine National Park).

Phylum	Family	Species	Common name	Category
Chlorophyta	Udoteaceae	*Rhipiliopsis peltata*	Green algae	PE
Chlorophyta	Derbesiaceae	*Pedobesia clavaeformis*	Green algae	RE
Crustacea	Leucosiidae	*Phlyixia dentifrons*	Crab	RE
Crustacea	Majidae	*Naxia spinosa*	Crab	PE
Crustacea	Majidae	*Tumulosternum wardi*	Crab	PW
Crustacea	Pilumnidae	*Pilumnus monilifer*	Crab	RE
Echinodermata	Oreasteridae	*Nectria saoria*	Seastar	RE
Echinodermata	Chiridotidae	*Taeniogyrus roebucki*	Sea Cucumber	RE
Echinodermata	Cucumariidae	*Neocnus bimarsupiis*	Sea Cucumber	RE
Echinodermata	Cucumariidae	*Pentocnus bursatus*	Sea Cucumber	RE
Echinodermata	Cucumariidae	*Squamocnus aureoruber*	Sea Cucumber	RE
Echinodermata	Ophiacanthidae	*Ophiacantha shepherdi*	Brittle star	PE
Mollusca	Chitonidae	*Chiton (Rhyssoplax) oruktus*	Chiton	PE
Mollusca	Ischnochitonidae	*Ischnochiton (Haploplax) thomasi*	Chiton	RE
Phaeophyta	Sargassaceae	*Sargassum heteromorphum*	Brown algae	RE
Rhodophyta	Ceramiaceae	*Hirsutithallia mucronata*	Red algae	PE
Rhodophyta	Ceramiaceae	*Wollastoniella mucranata*	Red algae	PE
Rhodophyta	Corallinaceae	*Jania pusilla*	Red algae	RE
Rhodophyta	Areschougiaceae	*Erythroclonium angustatum*	Red algae	RE
Rhodophyta	Areschougiaceae	*Erythroclonium muelleri*	Red algae	RE
Rhodophyta	Dicranemataceae	*Tylotus obtusatus*	Red algae	PE

2.13.6 SHOREBIRDS

The list of threatened shorebird species recorded in and around the Bunurong Marine National Park is shown in Table 2.13.4. There are two recognised areas of significance for Hooded Plovers along the Marine National Park shore (M. Weston pers. comm.). Twin Reefs is a non-breeding site with only occasional sightings and there is a nesting site for this species at The Oaks.

Other species of shorebird to be recorded at the site include the Sooty Oystercatcher, Double-banded Plover, Short-tailed Shearwater, Crested Tern, Arctic Jaegar, Ruddy

Turnstone and Pomarine Jaeger (Dept. of Cons. and Environment 1992). Little Penguins have also been recorded in the Park.

2.13.7 MARINE MAMMALS

Australian Fur Seals and Southern Right Whales have been recorded in and around the boundaries of the Bunurong Marine National Park (AVW). Other species recorded have included the Bottlenose Dolphin, Subantarctic Fur Seal and Leopard Seal (Dept. of Cons. and Environment 1992).

Table 2.13.4. Threatened shorebird records from Bunurong Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		2001
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		1980
Blue Petrel	*Halobaena caerulea*		Vul			1985
Common Diving-Petrel	*Pelecanoides urinatrix*			LR		1985
Crested Tern	*Sterna bergii*			LR		1998
Great Egret	*Ardea alba*	L		End	CJ	2001
Hooded Plover	*Thinornis rubricollis*	L		End		1998
Intermediate Egret	*Ardea intermedia*	L		CEn		2001
Northern Giant-Petrel	*Macronectes halli*		Vul	End		1980
Pacific Gull	*Larus pacificus*			LR		1998
Pied Cormorant	*Phalacrocorax varius*			LR		2000
Pomarine Jaeger	*Stercorarius pomarinus*			Ins	CJ	1980
Shy Albatross	*Diomedea cauta*		Vul			1980
Southern Giant-Petrel	*Macronectes giganteus*		End	End		1980
Wandering Albatross	*Diomedea exulans*		Vul	CEn	J	1980
White-faced Storm-Petrel	*Pelagodroma marina*			Vul		1980

Table 2.13.5. Threatened marine mammal records from Bunurong Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australian Fur Seal	*Arctocephalus pusillus*			Vul		1980
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1992
Subantarctic Fur Seal	*Arctocephalus tropicalis*		Vul			1991

Table 2.13.6. Selection of some animals and plants that may be found in the Bunurong Marine National Park.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	**Scientific name**
Flora	intertidal algae	*Gelidium pusillum*, *Hormosira banksii*, *Ulva lactuca*
	brown algae	*Cystophora platylobium*, *C. moniliformis*, *C. retorta*, *C. subfarcinata*,, *Sargassum fallax, Acrocarpia paniculata*, *Seirococcus axillaris*, *Perithalia cordata*, *Carpoglossum confluens*.
	seagrasses	*Zostera muelleri*, *Amphibolis antarctica*
Invertebrates	anemones	*Actinia tenebrosa*, *Cniopus verater*, *Oulactis muscosa*, *Anthothoe albocincta*
	ascidians	*Pyura stolonifera*, *P. pachydermatina.*
	gastropods	*Turbo undulata*, *Thais orbita, Cominella lineolata, Bembicium nanum, Austrocochlea constricta*, *A. odontis*
	barnacles	*Chthamalus antennatus*, *Chamaesipho columna, Catomerus polymerus, Tetraclitella purpurascens, Tesseropora rosea*, *Austromegabalanus nigrescens*
	urchins	*Holopneustes porossimus, Heliocidaris erythrogramma.*
	little horse mussel	*Xenostrobus pulex.*
	littorinid mollusc	*Nodilittorina unifasciata*
	nestling mussel	*Brachidontes rostratus*
	pulmonate limpets	*Siphonaria diemenensis*, *S. tasmanica.*
	sea stars	*Patiriella* spp., *Allostichaster* spp. *Coscinasterias calamaria.*
	shrimps	*Alpheus parasocialis, Palaemon serenus, Alope australis*
	sipunculid worm	*Phascolosoma annulatum*
	limpet gastropods	*Cellana tramoserica*, *Patelloida alticostata*.
	blacklip abalone	*Haliotis ruber.*
	blue ring octopus	*Hapalochlaena maculosa.*
	bristle worms	*Eunice*, *Galeolaria* sp.
	common sea centipede	*Euidotea bakeri.*
	crabs	*Plagusia chabrus*, *Naxia tumida*, *Lomis hirta*, *Notomithrax ursus.*
	elephant snails	*Scutus antipodes.*
Fish	flathead	several species
	King George whiting	*Sillaginodes punctatus*
	barracouta	*Thyrsites atun*
	sharks	*Mustelus antarcticus, Pristiophorus cirratus, P. nudipinnis, Galeorhinus australis Squatina australis, Callorhynchus milii*

	snapper	*Chrysophrys auratus*
	tailor	*Pomatomus saltator*
	wrasse	*Notolabrus tetricus*, *Pictilabrus laticlavius*, *Scorpis aequipinnis*

2.13.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Bunurong Marine National Park are listed below (MPV database and Buckley 1993):

- Eagles Nest, (National Significance): Rich fossil dinosaur locality. Prominent stack. One of the earliest & richest Mesozoic vertebrate fossil localities in Victoria, lungfish, dinosaurs & turtle.

2.13.9 KNOWLEDGE GAPS

Most of the Bunurong Marine National Park is well studied with several quantitative surveys covering the Marine Habitat Classes found in the protected areas. Fish associated with sandy beaches in the Marine National Park are poorly studied.

2.13.9 RESEARCH

Author	Project	Notes
(Ferns and Hough 2002)	High Resolution Marine Habitat Mapping of the Bunurong Coast (Victoria) - including the Bunurong Marine and Coastal Park	
(Edmunds *et al*. 2000)	Marine biogeography of Central Victoria and Flinders bioregions - a preliminary analysis of reef flora and fauna.	
(O'Hara 2000)	Faunal and floral assemblages associated with rocky reefs along the Victoria coast	
(Haynes and Quinn 1995)	Temporal and spatial variation in community structure of a sandy intertidal beach, Cape Paterson, Victoria, Australia	
(King 1992)	Human activity and its effect on marine intertidal plant and animal populations: monitoring and management.	MSc. thesis
(Keough and King 1991)	Recommendations for monitoring of marine plant and animal populations in Wilsons Promontory Marine National Park and Bunurong Marine Park	
(Campbell 1989)	Management of the biological communities within the proposed Bunurong Marine Park	MSc thesis. Focus is on Twin Reefs.
(Wilson *et al*. 1983)	Marine habitats at Wilsons Promontory and the Bunurong Coast, Victoria: Report on a survey.	

2.14 Wilsons Promontory Marine National Park

The Wilsons Promontory Marine National Park Marine National Park features an unusual combination of habitats and biological communities with distinct biogeographic patterns. Wilsons Promontory is part of the Flinders Bioregion. The extensive granite formations and sand marine habitats support abundant and diverse marine animal life with hundreds of fish species and invertebrates including many sponges, ascidians, sea whips and bryozoans (LCC 1994a). Marine flora is also diverse with many species of algae and seagrass beds found in sheltered areas of Waterloo and Oberon Bay. The Marine National Park surrounds Kanowna, Anser and Wattle Islands, which are important breeding or nesting sites for Australian fur-seals, little penguins and several seabirds, and all are a part of the Western Port National Park.

2.14.1 PHYSICAL PARAMETERS

Wilsons Promontory protrudes into Bass Strait and forms the southernmost point of the south eastern Australian mainland. Devonian granite mountains reach high above the promontory and extend below the water line into the Marine National Park to emerge as outcrops or offshore islands (Wallis 1980). The Marine National Park lies adjacent to the Wilsons Promontory National Park. The sandy beaches and dunes of Oberon and Waterloo Bay are comprised of quaternary sediments with sand in Oberon Bay predominantly calcareous and sand in Waterloo Bay predominantly siliceous in origin (Wallis 1980).

Table 2.14.1 Physical parameters for the Wilsons Promontory Marine National Park.

Park Name	**Wilsons Promontory**
Conservation status	Marine National Park
Biophysical Region	Flinders
Size of Park (ha)	15,550
Length of coastline (m)	44480
Exposure rating	High
Wave Energy	High
Influential currents	None
Tidal variation - springs (m)	1.8
Tidal variation - neaps (m)	1.4
Water temp - summer (°C)	17.5
Water temp - winter (°C)	13
0 - 10 m (ha)	960
10 - 20 m (ha)	640
20 - 30 m (ha)	980

30 - 40 m (ha)	1620
40 - 50 m (ha)	4490
50 - 60 m (ha)	2570
70 - 80 m (ha)	2650
Discharges	Growler, Frasers, Roaring Meg, Picnic, Ferr, First Bridge, Freshwater and numerous intermittent Creeks
Adjacent catchment	Wilsons Promontory National Park

2.14 2 MARINE HABITAT CLASSES

The major marine habitat classes for Wilsons Promontory are intertidal and subtidal reefs, both vegetated and unvegetated subtidal soft sediment and sandy beaches (Wilson *et al*. 1983) (Figure A1.14a). Huge granite boulders dominate much of the coastline whilst the subtidal topography is diverse, ranging from vertical walls, large granite slabs, boulder slopes, and extensive sand plains that surround the promontory at depths of 30-50 m (Turner and Norman 1998). The subtidal sand plains extend to at least 20 m depth and are composed of both coarse and fine calcarenite sediments (Wallis 1980).

Table 2.14.2 Marine Habitat Classes for Wilsons Promontory Marine National Park.

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
	Platform
	Beach / Platform
	Cliff
Substratum relief	Low profile reef
	High profile reef
Substratum texture	Broken reef
	Coarse sand
	Medium sand
	Fine sand
Lithology	Basalt
	Granite
	Calcarenite
Subtidal reef biota	Kelp - Phyllospora dominated
	Kelp - Macrocystis dominated
	Kelp - Durvillaea dominated
	Kelp - Ecklonia dominated
Subtidal understorey biota	Mixed algae - brown dominated

	Cystophora
	Acrocarpia
	Seirococcus
	Sessile invertebrates
	Red algae dominated
	Fleshy algae -mixed greens
	Fleshy algae -mixed browns
Subtidal soft sediment biota	Halophila
	Amphibolis
	Heterozostera
	Mixed seagrass/algae
	Caulerpa
	Seagrass
Intertidal reef biota	Durvillaea
	Hormosira
	Turf algae
	Coralline algae
	Pyura
	Mussels
	Barnacles
Heavy reef Area (ha)	650
Low Profile Reef Area (ha)	140
Total Reef Area (ha)	790
Sediment Area (ha)	12130
Land Area (ha)	130
Undefined Area (ha)	2530

2.14.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.14.6.

Sandy beaches

Flora

No macrophytes recorded.

Invertebrate fauna

No records of marine invertebrate fauna exist for sandy beaches within the Marine National Park. However, Norman Bay just north of the Park boundary may provide an indication of the likely fauna of similar areas within the Marine National Park. Norman Bay features 200 m of fine intertidal sand and has impoverished infauna with fewer than 10 macroinvertebrate species recorded (Wilson *et al*. 1983). The soldier crab *Mictyris longicarpus* is the dominant invertebrate reaching very high densities at mid-tide level. The gastropods *Polinices conicus* and *P. sordidus* are also common. The coarser sand at Squeaky Beach is unlike beaches within the Marine National Park and supports only tenebrionid beetles (*Sphargeris physodes*), amphipods and isopods (Wilson *et al*. 1983). Amphipods are sporadically abundant in association with macroalgal drift that becomes stranded on the beach.

Fish

No specific data of fish on sandy beaches are available. Fish species likely to be associated with sandy beaches are the mobile transient species including mugilids, atherinids and usually arripids including the Australian Salmon *Arripis trutta* (Wilson *et al*. 1983).

Intertidal rocky shore

Flora

Littorinid-lichen zone: Two lichens *Lichina confinis* and the orange *Gasparinnia murorum* (which is rare elsewhere in Victoria) dominated the region above the high water mark which is exposed to wind blown spray and water droplets (Bennett and Pope 1960).

Barnacle-mussel zone: *Rivularia firma* were common in this mid-intertidal zone while *Splachnidium rugosum* occurred only in summer when it formed a conspicuous band (Bennett and Pope 1953)

***Cystophora* zone**: Encrusting calcareous red algae and *Cystophora* sp. were common in this region near the low water mark (Bennett and Pope 1953).

Large brown algae zone: The large brown algae *Durvillaea potatorum* was particularly well developed at Wilsons Promontory in comparison to other regions of Victoria (Wilson *et al*. 1983). Also dominant in the surge zone exposed only by low spring tides were the browns *Ecklonia radiata* and *Phyllospora comosa* along with coralline red algae (Bennett and Pope 1953).

Invertebrate fauna

The intertidal rocky shore at Wilsons Promontory Marine National Park was not as diverse as some other locations in Victoria, probably due to the weathering patterns of the granite which result in less varied and well protected microhabitats for invertebrates (LCC 1994a). The steep aspect of the large granite boulders at Wilsons Promontory Marine National Park mean that the intertidal zone is often only as wide as the tidal range which limits the substrate available (Wilson *et al*. 1983). Four major intertidal zones are recognised on the rocky shore at Wilsons Promontory (Bennett and Pope 1953).

Littorinid-lichen zone: Situated high above high water mark, this area is exposed to wind blown spray and water droplets, but never covered by the tide. The dominant species were two littorinid gastropods; the widespread *Nodilittorina unifasciata* and *N. praetermissa* which were found only on Bass Strait coasts and is dominant in Tasmania (Bennett and Pope 1960).

Barnacle-mussel zone: Dominant invertebrates in this mid-intertidal zone included the mussel *Brachidontes rostratus* and the barnacles *Chthamalus antennatus*, *Chamaesipho columna* and *Catomerus polymerus*. Towards the lower limit of the zone, the large barnacle *Austromegabalanus nigrescens* was common. Other common species included the anemone *Actinia tenebrosa*, the limpets (*Cellana solida*, *C. tramoserica*, *Notoacmea alta*, *N. mayi*, *N. petteridi*, *Patelloida victoriana*, *P. latistrigata*) and the gastropods *Thais orbita* and *Lepsiella vinosa* (Bennett and Pope 1953).

***Cystophora* zone**: Typical invertebrates in this zone near low-water mark included chitons of the genus *Plaxiphora* spp. and the ascidian *Pyura stolonifera*. An assemblage including limpets, the gastropods *Thais orbita* and *Subninella undulata* and the large barnacle *Austromegabalanus nigrescens* was recognised where the ascidian *P. stolonifera* is common (Bennett and Pope 1953).

Large brown algae zone: This zone is exposed only by low spring tides and is in the surge zone frequently washed by waves. Characteristic invertebrate fauna included the limpet *Patella peroni* and the chiton *Plaxiphora* sp. (Bennett and Pope 1953).

Fish

The steep rocky intertidal zone at Wilsons Promontory Marine National Park supports only small and cryptic fishes such as *Parablennius tasmaniensis* and *Bovichthys variegatus* (Wilson *et al*. 1983).

Subtidal reef

Flora

Almost all high energy wave exposed rock faces at Wilson Promontory support a *Phyllospora-Ecklonia* dominated macroalgae community. Rocky surfaces between 6-9 m near sand flats support a green alga *Caulerpa* dominated community at some locations (LCC 1994a). The high water clarity in many locations allows the *Phyllospora-Ecklonia* algae dominated community to extend to a depth of up to 20 m, but where light is excluded in narrow chasms or under boulders, encrusting animal communities replace algal communities (Wilson *et al*. 1983).

Diversity and species composition varies with location within the Wilson Promontory Marine National Park. Central Waterloo Bay on the east coast in the Wilsons Promontory Marine National Park and other areas to the north-east of the Marine National Park were identified as having high macrophyte species diversity and richness (Edmunds *et al*. 2000). The macrophyte population in the southern part of Wilsons Promontory Marine National Park is of low diversity, predominantly because a dense canopy is comprised of only one to three species (*Phyllospora comosa*, *Ecklonia radiata* and *Seirococcus axillaris*) with a sparse understorey (Edmunds *et al*. 2000).

The understorey of the *Phyllospora-Ecklonia* communities is sparse and characterised by low abundances of *Phacelocarpus peperocarpos*, *Ballia callitricha*, *Plocamium angustum*, *Melanthalia obtusata* and *Haliptilon roseum*. Much of the reef beneath the canopy is covered by pink encrusting coralline algae (*e.g.,*, *Corallina officinalis*, *Haliptilon*, *Metagoniolithon*) and *Durvillaea* is often also present in the shallow sub-littoral zone (Edmunds *et al*. 2000). Other species present include tufting or epiphytic algae including the browns *Dictyota dichotoma*, *Zonaria*, *Halopteris* and *Pachydictyon*, the reds *Rhodymenia australis*, *Dasyclonium incisum*, and the green alga *Codium australicum* (O'Hara 2000)

In Waterloo Bay on the east coast of Wilsons Promontory, the brown alga *Phyllospora comosa* is usually dominated the tops of boulders whilst *Ecklonia radiata*, *Acrocarpia paniculata* and *Caulerpa* sp. were common on the vertical sides of boulders (O'Hara 2000). Other common brown algae included *Cystophora* spp*.*, *Sargassum* and *Zonaria* whilst common green algae included *Caulerpa* (C. *brownii*, C. *flexilis*, C. *cactoides*, C. *obscura*) and *Codium australicum* (O'Hara 2000). The dominant *Phyllospora-Ecklonia* canopy was often broken by patches of smaller browns such as *Sargassum sonderi*, *Sargassum fallax*, *Acrocarpia paniculata* and *Perithalia cordata* (O'Hara 2000). Red algae included *Jeannerettia*, *Polysiphonia*, *Laurencia* and various foliose corallines (O'Hara 2000). In deeper water *E. radiata* tended to become the dominant brown, along with *Acrocarpia paniculata*, and *Seirococcus axillaris* with common reds including *Rhodymenia australis*, *Rhodophyllis multipatita*, *Sonderopelta coriacea* and *Plocamium angustum* (O'Hara 2000) Other understorey species typically included *Phacelocarpus peperocarpos*, *Melanthalia obtusata*, *Pterocladia lucida*, *Callophyllis rangiferinus* and *Zonaria turneriana* (Edmunds *et al*. 2000).

Invertebrate fauna

Scuba surveys of Wilsons Promontory Marine National Park found a higher than average (for central Victoria) abundance of the sea urchin *Heliocidaris erythrogramma*, abalone *Haliotis rubra*, feather star *Cenolia trichoptera* and most sea stars, including *Patiriella brevispina*, *Petricia vernicina, Nectria ocellata*, *Nectria macrobrachia* and *Plectaster decanus* (Edmunds *et al*. 2000).

Faunal distribution varied regionally and *Nectria macrobrachia* was a typical component of the “south to east community” (Anser Island to Cape Wellington), while *Patiriella brevispina* and *Petricia vernicina* was typical of the “north west community” (Oberon Bay and Sea Eagle Bay) (Edmunds *et al*. 2000). Characteristic fauna of both regions included the blacklip abalone *Haliotis rubra*, the feather star *Cenolia trichoptera*, the seastar *Nectria ocellata* and the urchin *Heliocidaris erythrogramma* (Edmunds *et al*. 2000).

In addition to the motile invertebrates already mentioned, other groups including gastropods, polychaetes, crustaceans, echinoids, ophiuroids and several conspicuous seastars (including *Tosia australis* and *Allostichaster polyplax*) are well represented (O'Hara 2000). Two pycnogonid species (*Stylopallene dorsospinum* and *Achelia transfugoides*) were found on subtidal reefs and were new records from Victoria (Wilson *et al*. 1983).

Sessile invertebrate fauna including sponges, solitary ascidians, anemones and bryozoans are common at sites deeper than 10 m in the Wilsons Promontory Marine National Park, particularly where cracks between boulders reduce light penetration and algal growth (Wilson *et al*. 1983). The bryozoan fauna found in the south east coast near the Lighthouse and Waterloo Bay is composed of large colonies of *Canda arachnoides, Amathia plumosa, Amathia woodsii*, *Orthoscuticella*, *Euthyroides episcopalis* and *Triphyllozoon munitum* attached either to rock, *Ecklonia radiata* holdfasts or *Ecklonia radiata* fronds (O'Hara 2000).

A significant population of the large and visually striking, but uncommon, trochid mollusc *Clanculus undatus* was observed at Rabbit Island just north of the Marine National Park boundary along with a high abundance of the large mollusc *Cabestana spengleri* (LCC 1994a).

Fish

The fish fauna of Wilsons Promontory is composed primarily of wide-ranging cool temperate species endemic to Southern Australian, with a much smaller proportion of warmer-water temperate species towards the southern limits of their range (Turner and Norman 1998). Wilsons Promontory Marine National Park is considered to have relatively high species richness and high diversity indices along with higher than average abundances for most fish species compared to other central Victorian areas (Edmunds *et al*. 2000). In particular, higher abundances of barber perch *Caesioperca rasor*, long-finned pike *Dinolestes lewini*, silver sweep *Scorpis lineolata*, old wife *Enoplosus armatus* and pencil weed whiting *Siphonognathus beddomei* are characteristic (Edmunds *et al*. 2000).

The fish fauna of Wilsons Promontory is clearly divided into a western and eastern community (Edmunds *et al*. 2000). There is very little overlap in community structure between the eastern and western sites, although two western sites on the points bordering Norman Bay (Pillar Point and Norman Point) appeared to be intermediate in structure between the two groups (Edmunds *et al*. 2000).

Dominant species in the western Wilsons Promontory community were *Caesioperca rasor*, *Notolabrus tetricus*, *N. fucicola*, *Dinolestes lewini* and *Odax cyanomelas* (Edmunds *et al*. 2000). The western community had higher abundances of *Dinolestes lewini*, *Notolabrus fucicola*, *Odax cyanomelas* and southern hulafish *Trachinops caudimaculatus* (Edmunds *et al*. 2000). Other characteristic species are the toothbrush leatherjacket *Acanthaluteres vittiger*, *Enoplosus armatus*, *Cheilodactylus nigripes*, *Scorpis lineolata*, *Atypichthys strigatus*, *Latridopsis forsteri* and *Scorpis aequipinnis* (Edmunds *et al*. 2000).

The eastern Wilsons Promontory community is also dominated by *Caesioperca rasor*, *Notolabrus tetricus, Dinolestes lewini* and *Odax cyanomelas*, but have a higher dominance of *Cheilodactylus nigripes* and *Scorpis lineolata* compared with the western community (Edmunds *et al*. 2000). The eastern community also has higher abundances of silver sweep (*Scorpis lineolata*), *S. aequipinnis*, *Caesioperca rasor*, *N. tetricus*, *Enoplosus armatus* and Mado sweep (*Atypichthys strigatus*) than the western community (Edmunds *et al*. 2000). Other characteristic species for the eastern community were *Acanthaluteres vittiger*, *Enoplosus armatus*, *Cheilodactylus nigripes*, *Scorpis aequipinnis*, *Trachinops caudimaculatus*, *Latridopsis forsteri* (Edmunds *et al*. 2000). More common in sheltered habitats on the east coast were silver belly (*Parequula melbournensis*), slender weed whiting (*Siphonognathus attenuatus*) and pencil weed whiting (*Siphonognathus beddomei*) (Turner and Norman 1998) the last of which occurs in aggregations on reef-flats and slopes (Wilson *et al*. 1983).

Other investigators found common subtidal reef species to include the smooth toadfish (*Tetractenos glaber*) (Turner and Norman 1998) whilst Wilson *et al*., (1983) found *Pictilabrus laticlavius* and *Odax acroptilus* to be common in *Phyllospora-Ecklonia* dominated reef. The weed whiting *Siphonognathus tanyourus* also occurs in the *Phyllospora-Ecklonia* dominated reef (Wilson *et al*. 1983).

Seagrass

Flora

Three species of seagrasses have been recorded from within the Wilsons Promontory Marine National Park: *Halophila ovalis*, *Amphibolis antarctica* and *Heterozostera tasmanica* occur in sheltered environments including Waterloo and Oberon Bays (O'Hara 2000; Roob *et al*. 1999; Wilson *et al*. 1983). Cover of *H. ovalis* is generally sparse and is often replaced by *H. tasmanica* in deeper waters (Wilson *et al*. 1983). Extensive meadows of *H. tasmanica* were recorded down to a depth of 21 m on sand substrate in Oberon Bay on the west coast of Wilsons Promontory (Wilson *et al*. 1983). *Amphibolis antarctica* was recorded on flat coarse sand containing fine shell grit at 8 m depth where it formed approximately 40-50% substrate coverage along with *Halophila australis* (Roob *et al*. 1999). *Amphibolis antarctica* has its eastern distributional limit on the east side of Wilsons Promontory (LCC 1994a). *Posidonia australis* was recorded just outside the Marine National Park in shallow water at Great Glennie Island and Norman Bay (O'Hara 2000; Wilson *et al*. 1983).

No records of epiphytes on seagrass exist from within the Marine National Park, however records from nearby sites including Shellback and Rabbit Islands, indicate that *H. tasmanica* plants support numerous algal epiphytes. Among those recorded were *Lobospira*, *Pachydictyon polycladum*, *Halopteris* spp., *Mychodea*, *Craspedocarpus venosus*, *Polysiphonia decipiens*, *Griffithsia teges* and numerous smaller corallines and filamentous red and green algae (O'Hara 2000)

Invertebrate fauna

Many species of the isopod genus *Neastacilla* and numerous amphipods are associated with *Heterozostera tasmanica* (Wilson *et al*. 1983). Many bryozoan and hydroids are found epizootically on all seagrass species in Wilsons Promontory Marine National Park (Wilson *et al*. 1983).

Few detailed records are available from within the Marine National Park, but invertebrate fauna associated with seagrass have been recorded from Rabbit Island and Norman Bay just beyond the Park boundaries.

Sessile invertebrates epizoic on *H. tasmanica* at Rabbit Island included three hydroid species, 19 bryozoans, and a few small sponges (O'Hara 2000). Motile invertebrates were not diverse. Two molluscs were present, *Diala suturalis* and *Thalotia conica*, a crab, caprellid isopods and numerous tube building amphipods (Cerapes), which fix themselves perpendicular from the seagrass frond (O'Hara 2000). From Norman Bay just to the north of the Marine National Park at Wilsons Promontory, the unusual octocoral *Pseudogorgia godeffroyi* was recorded on two occasions at a depth of 13 m in seagrass communities (Wilson *et al*. 1983). This species was previously only recorded between 30-64 m deep on sand bottoms swept by currents (Grasshoff 1982)

Fish

A variety of fish were recorded on seagrass and associated sand substrate including goatfish Upeneichthys vlamingii, Parequula melbournensis, Stigmatopora nigra, S. argus, Siphonognathus attenuatus, Notolabrus tetricus, Nesogobius spp., Heteroclinus spp., Cristiceps spp. and Acanthaluteres vittiger (Wilson *et al.*. 1983).

Subtidal soft substrata

Flora

Most shallow subtidal soft substrata is dominated by seagrass to a depth of 20 m, red algae is the dominant macrophyte between 20 - 50 m and beyond 50 m red algae no longer occurs (Wilson *et al*. 1983).

Invertebrate fauna

A survey of infauna from within the Wilsons Promontory Marine National Park by Coleman *et al*., (2000) found 75 species from 46 families in a single grab sample off the south-west coast between Glennie Island and Oberon Bay. Faunal composition varies with depth due to decreasing wave action, decreasing competition with macroalgae and changes in sediment composition (Wilson *et al*. 1983). Between 20 m and 50 m shell fragments in coarse sand provide a stable surface for epizoic bryozoans and sponges which increase in abundance beyond 50 m with the increasing mud fraction in the sediments (Wilson *et al*. 1983). Faunal diversity in subtidal soft substrata on the eastern side of Wilsons Promontory Marine National Park may be reduced due to low structural complexity providing fewer shell particles for epizoic attachment (Wilson *et al*. 1983).

Fish

The demersal fish fauna of subtidal soft sediment environments at Wilsons Promontory Marine National Park is typical of much of the shallower parts of Bass Strait (Wilson *et al*. 1983). The most common benthic fish is the sparsely spotted stingaree (*Urolophus paucimaculatus*), but other elasmobranches including Tasmanian numbfish (*Narcine tasmaniensis*), banded stingaree (*Urolophus cruciatus*), angel shark (*Squatina australis*) and saw shark (*Pristiophorus nudipinnis*) were also common (Wilson *et al*. 1983). Boney fishes including sand flathead (*Platycephalus bassiensis*), silver trevally (*Pseudocaranx dentex*), prickly toadfish (*Contusus brevicaudus*) and several leatherjackets are common (Wilson *et al*. 1983).

2.14.4 BIOLOGICAL PROCESSES

Biological processes occurring in the Marine National Park are unknown.

2.14.5 SPECIES DISTRIBUTION INFORMATION

Species of algae, invertebrates and fish that are thought to have their distributional limits at or near the Wilsons Promontory Marine National Park are listed in Table 2.14.3. The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

Table 2.14.3. Biota with distributional limits located at or near the Wilsons Promontory National Park. (PW – presumed to be at or near western limit in the Marine National Park, PE – presumed to be at or near eastern limit in the Marine National Park, RE – eastern limit recorded in Marine National Park, RW – western limit recorded in Marine National Park).

Phylum	Family	Species	Common name	Category
Chlorophyta	Caulerpaceae	*Caulerpa remotifolia*	Green algae	RE
Chordata	Atherinidae	*Kestratherina esox*	Pikehead hardyhead	PE
Chordata	Scyliorhinidae	*Asymbolus analis*	Dark spotted catshark	RW
Chordata	Antennariidae	*Echinophryne reynoldsi*	Sponge anglerfish	PE
Chordata	Gobiidae	*Arenigobius frenatus*	Half bridled goby	RW
Chordata	Sillaginidae	*Sillago bassensis*	Silver whiting	PE
Chordata	Tripterygiidae	*Lepidoblennius haplodactylus*	Jumping joey	PW
Chrysophyta	Vaucheriaceae	*Vaucheria glomerata*	Blue green algae	RE
Crustacea	Dromiidae	*Epipedodromia thomsoni*	Crab	PE
Crustacea	Hymenosomatidae	*Trigonoplax longirostris*	Crab	PE
Crustacea	Majidae	*Anacinetops stimpsoni*	Crab	RE
Crustacea	Majidae	*Huenia halei*	Crab	PE
Crustacea	Alpheidae	*Alpheus astrinx*	Shrimp	RE

Crustacea	Penaeidae	*Penaeus latisulcatus*	Prawn	PW
Crustacea	Callianassidae	*Eucalliax tooradin*	Ghost shrimp	PE
Crustacea	Laomediidae	*Laomedia healyi*	Ghost shrimp	PW
Echinodermata	Phyllophoridae	*Lipotrapeza ventripes*	Sea cucumber	PE
Mollusca	Calyptraeidae	*Cheilea flindersi*	Marine snail	PE
Mollusca	Cancellariidae	*Cancellaria (Nevia) spirata*	Marine snail	PE
Mollusca	Cancellariidae	*Cancellaria (Sydaphera) lactea*	Marine snail	PE
Mollusca	Cancellariidae	*Cancellaria (Sydaphera) purpuriformis*	Marine snail	PE
Mollusca	Cerithiopsidae	*Zaclys angasi*	Marine snail	PB
Mollusca	Columbellidae	*Aesopus plurisulcatus*	Marine snail	PW
Mollusca	Columbellidae	*Anachis smithi*	Marine snail	PW
Mollusca	Eatoniellidae	*Eatoniella victoriae*	Marine snail	PE
Mollusca	Epitoniidae	*Epitonium platypleura*	Marine snail	PE
Mollusca	Olividae	*Zemira australis*	Marine snail	PW
Mollusca	Turridae	*Austrodrillia angasi*	Marine snail	PW
Mollusca	Vermetidae	*Serpulorbis hedleyi*	Marine snail	PW
Mollusca	Lepidopleuridae	*Leptochiton liratus*	Chiton	PE
Phaeophyta	Dictyotaceae	*Dictyota furcellata*	Brown algae	PE
Phaeophyta	Dictyotaceae	*Dilophus gunnianus*	Brown algae	PE
Phaeophyta	Dictyotaceae	*Distromium multifidum*	Brown algae	PE
Phaeophyta	Cystoseiraceae	*Myriodesma integrofolium*	Brown algae	PE
Phaeophyta	Fucaceae	*Xiphophora gladiata*	Brown algae	PN
Phaeophyta	Sargassaceae	*Sargassum paradoxum*	Brown algae	PE
Phaeophyta	Sphacelariaceae	*Sphacelaria carpoglossi*	Brown algae	PE
Rhodophyta	Bangiaceae	*Porphyra lucasii*	Red algae	PE
Rhodophyta	Ceramiaceae	*Anotrichium elongatum*	Red algae	PE
Rhodophyta	Ceramiaceae	*Anotrichium licmophorum*	Red algae	PE
Rhodophyta	Ceramiaceae	*Antithamnion delicatulum*	Red algae	RE
Rhodophyta	Ceramiaceae	*Ballia marina*	Red algae	PE
Rhodophyta	Ceramiaceae	*Bornetia binderiana*	Red algae	PE
Rhodophyta	Ceramiaceae	*Callithamnion violaceum*	Red algae	PE
Rhodophyta	Ceramiaceae	*Ceramium excellens*	Red algae	PE
Rhodophyta	Ceramiaceae	*Crouania shepleyana*	Red algae	RE
Rhodophyta	Ceramiaceae	*Dasythamniella latissima*	Red algae	RE
Rhodophyta	Ceramiaceae	*Gattya pinnella*	Red algae	PE
Rhodophyta	Ceramiaceae	*Gulsonia annulata*	Red algae	PE
Rhodophyta	Ceramiaceae	*Macrothamnion pectenellum*	Red algae	RE

Rhodophyta	Ceramiaceae	*Mazoyerella australis*	Red algae	RE
Rhodophyta	Ceramiaceae	*Medeiothamnion halurus*	Red algae	PE
Rhodophyta	Ceramiaceae	*Medeiothamnion protensum*	Red algae	RE
Rhodophyta	Ceramiaceae	*Shepleya verticillata*	Red algae	PE
Rhodophyta	Ceramiaceae	*Spongoclonium australicum*	Red algae	RE
Rhodophyta	Ceramiaceae	*Spyridia tasmanica*	Red algae	RE
Rhodophyta	Dasyaceae	*Dasya cresens*	Red algae	RE
Rhodophyta	Dasyaceae	*Dasya hookeri*	Red algae	RE
Rhodophyta	Dasyaceae	*Dasya wilsonis*	Red algae	PE
Rhodophyta	Corallinaceae	*Spongites hyperellus*	Red algae	PW
Rhodophyta	Areschougiaceae	*Tikvahiella candida*	Red algae	PE
Rhodophyta	Halymeniaceae	*Cryptonemia undulata*	Red algae	PE
Rhodophyta	Hypneaceae	*Hypnea valentiae*	Red algae	RE
Rhodophyta	Kallymeniaceae	*Austrophyllis alcicornis*	Red algae	PE
Rhodophyta	Kallymeniaceae	*Kallymenia tasmanica*	Red algae	PE
Rhodophyta	Lomentariaceae	*Semnocarpa corynephora*	Red algae	PE
Rhodophyta	Rhodymeniaceae	*Gloiocladia fruticulosa*	Red algae	RE
Rhodophyta	Rhodymeniaceae	*Gloiocladia polycarpa*	Red algae	PE
Rhodophyta	Rhodymeniaceae	*Rhodymeniocolax austrina*	Red algae	RE

2.14.6 SHOREBIRDS

The list of threatened shorebird species recorded in and around the Wilsons Promontory Marine National Park is shown in Table 2.14.4.

There are four recorded Hooded Plover areas in the Marine National Park (M. Weston *pers. comm*.). Waterloo Bay, Little Waterloo Bay and North Waterloo Bay all have observed sightings but it is not considered suitable habitat for breeding and so would rarely be used. At Oberon Bay there is one nesting site for a pair of Hooded Plovers.

There are two breeding colonies of Little Penguins within the boundaries of the Wilsons Promontory Marine National Park, one on Anser Island (400 breeding pairs) and one on Wattle Island (500 breeding pairs). In addition, there are a further four breeding colonies on Great Glennie Island, Dannevig Island, Citadel Island and McHugh Island, all of which lie just west of the Marine National Park boundary.

Three of the islands within the Marine National Park, Wattle, Kanowna and Anser are of State significance as shorebird habitat. Species recorded include the Crested Tern, Sooty Oystercatcher, Silver Gull, Pacific Gull (the only Victorian breeding site for this species), Short-tailed Shearwater, Fairy Prion and Common Diving-Petrel. Similar species are recorded on Great Glennie, Dannevig, Citadel and McHugh Islands to the west of the Marine National Park.

2.14.7 MARINE MAMMALS

Australian Fur Seals and Southern Right Whales have been recorded in and around the waters of the Wilsons Promontory Marine National Park (AVW). A breeding colony of up to 5,500-7,100 Australian Fur Seals is present on Kanowna Island. A 1998 survey recorded approximately 1,575 pups. The seals inhabit the whole island but are found mainly on the northern slopes, eastern shores and offshore rocks (including Anderson Islets). Small numbers of New Zealand Fur Seals have also been observed breeding at this site.

Other marine mammals to have been recorded in and around the Wilsons Promontory Marine National Park include the Humpback Whale, Andrews Beaked Whale, Pilot Whale, Sperm Whale, Common Dolphin and Bottlenose Dolphin (Dept. of Cons. and Environment 1991).

Table 2.14.4. Threatened shorebird records from Wilsons Promontory Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		2001
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		2001
Caspian Tern	*Sterna caspia*	L		Vul	CJ	2001
Crested Tern	*Sterna bergii*			LR		2001
Hooded Plover	*Thinornis rubricollis*	L		End		1999
Pacific Gull	*Larus pacificus*			LR		2001
Pied Cormorant	*Phalacrocorax varius*			LR		1998
Shy Albatross	*Diomedea cauta*		Vul			1981
Southern Giant-Petrel	*Macronectes giganteus*		End	End		1981
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	L		End	C	2000

Table 2.14.5. Threatened marine mammal records from Wilsons Promontory Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1998
Australian Fur Seal	*Arctocephalus pusillus*			Vul		1998

Table 2.14.6. Selection of some animals and plants that may be found in the Wilsons Promontory Marine National Park.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	**Scientific name**
Flora	brown algae	*Durvillaea potatorum, Ecklonia radiata*, *Phyllospora comosa, Seirococcus axillaris*, *Acrocarpia paniculata*
	green alga	*Caulerpa* sp.
	seagrass	*Halophila ovalis*, *Amphibolis antarctica*, *Heterozostera tasmanica*
	lichens	*Lichina confinis*, *Gasparinnia murorum*
Invertebrates	soldier crab	*Mictyris longicarpus*
	mussel	*Brachidontes rostratus*
	barnacles	*Chthamalus antennatus*, *Chamaesipho columna, Catomerus polymerus*, *Austromegabalanus nigrescens*
	anemone	*Actinia tenebrosa*
	limpet gastropods	*Cellana solida*, *C. tramoserica*, *Notoacmea alta*, *N. mayi*, *N. petterdi*, *Patelloida victoriana*, *P. latistrigata, Patella peroni*
	gastropods	*Thais orbita*, *Lepsiella vinosa, Subninella undulata, Nodilittorina unifasciata*, *N. praetermissa, Polinices conicus, P. sordidus*
	sea stars	*Patiriella brevispina*, *Petricia vernicina, Nectria ocellata*, *Nectria macrobrachia, Plectaster decanus, Tosia australis*, *Allostichaster polyplax*
	chiton	*Plaxiphora* spp.
	ascidian	*Pyura stolonifera*.
	sea urchin	*Heliocidaris erythrogramma*
	abalone	*Haliotis rubra*
	feather star	*Cenolia trichoptera*
Fish	Australian Salmon	*Arripis trutta*
	barber perch	*Caesioperca rasor*
	long-finned pike	*Dinolestes lewini*
	silver sweep	*Scorpis lineolata*
	old wife	*Enoplosus armatus*
	pencil weed whiting	*Siphonognathus beddomei*
	wrasse	*Notolabrus tetricus*, *N. fucicola*
	herring cale	*Odax cyanomelas*
	sharks and rays	*Urolophus paucimaculatus, Narcine tasmaniensis*, *Urolophus cruciatus*, *Squatina australis*, *Pristiophorus nudipinnis*
	sand flathead	*Platycephalus bassiensis*
	silver trevally	*Pseudocaranx dentex*

	prickly toadfish	*Contusus brevicaudus*
	leatherjackets	Monacanthidae

2.14.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Wilsons Promontory Marine National Park are listed below (MPV database and Buckley 1993):

- Wilsons Promontory National Park, (National Significance): Wilson's Promontory is a granitic massif formed by multiple injections, each phase having a distinct texture & mineral. Numerous geomorphological & geological sites.
- Norman Point, (State significance): Four major sheet intrusions of granite with different textural & mineralogical characteristics. Example of multiple granite injection within a batholith.
- Great Glennie Island, (Regional/Local Significance): A 25 m deep sea cave is behind the beach in a sheltered cove. Gully on NE side results from collapse of the weathered roof of a sea cave.
- Cleft Island, (State significance): Spectacular sea cave 20 m above sea level with 60 m high roof.

2.14.9 KNOWLEDGE GAPS

Wilsons Promontory Marine National Park has been well studied with several quantitative surveys focusing on all Marine Habitat Classes found in the protected areas, although several habitats (including intertidal reef and soft sediment) lack recent data. The distribution of seagrass in the Marine National Park has not been recently studied.

2.14.10 RESEARCH

Author	Project	Notes
(Arnould and Hindell 2001)	Dive behaviour, foraging locations, and maternal-attendance patterns of Australian fur seals (*Arctocephalus pusillus doriferus*).	
(West *et al*. 2001)	Reproductive patterns of *Caloglossa* species (Delesseriaceae, Rhodophyta) from Australia and New Zealand: Multiple origins of asexuality in *C. leprieurii*. Literature review on apomixis, mixed-phase, bisexuality and sexual compatibility.	
(Arnould and Littnan 2000)	Pup production and breeding areas of Australian fur seals *Arctocephalus pusillus doriferus* at Kanowna Island and The Skerries in northeastern Bass Strait.	
(Edmunds *et al*. 2000)	Marine biogeography of Central Victoria and Flinders bioregions - a preliminary analysis of reef flora and fauna.	Ongoing monitoring program

(O'Hara 2000)	Faunal and floral assemblages associated with rocky reefs along the Victoria coast	
(Turner and Norman 1998)	Fishes of Wilsons Promontory and Corner Inlet, Victoria: composition and biogeographic affinities	
(Wilson *et al*. 1983)	Marine habitats at Wilsons Promontory and the Bunurong Coast, Victoria: Report on a survey.	

2.15 Corner Inlet

Within Corner Inlet the seagrass meadows are of particular value because of their wide extent and particularly high faunal diversity (LCC 1994a). Corner Inlet Marine National Park contains a representative area of the only extensive *Posidonia australis* meadows in Victoria (Morgan 1986). The nearest example of an extensive *P. australis* meadow is in South Australia (LCC 1994a). Invertebrate faunal diversity is considered high with 390 species recorded (Morgan 1986), which is likely to be an underestimate of actual faunal diversity. Surveys in other regions where more species were recorded (*e.g.,*, Coleman *et al*. 1978; Poore 1992) involved more sampling sites, longer sampling time scales and larger sampling devices. Similarly, at least 74 species of fish are present in Corner Inlet (Turner and Norman 1998). The unique species composition of Corner Inlet Marine National Park results in part from overlap of the distributions of warm water species characteristic of the NSW coast and cool water species found throughout Victoria. All of Corner Inlet, including the Marine National Park has been declared a Ramsar site.

2.15.1 PHYSICAL PARAMETERS

This 15.5 km^2 Marine National Park is located approximately six kilometres from Yanakie and to the north of Wilsons Promontory. Its boundary follows nearly eleven kilometres of coastline with habitats including mangroves, mudflats and extensive seagrass meadows.

Corner Inlet is a large submerged plain covered by sand or mud flats, some of which are exposed at low tide, and others which remain permanently covered. A radiating system of deeper channels drain and fill the flats from the entrance on the eastern side (Department of Conservation and Natural Resources 1995). Most of the channels are 3-10 m deep becoming shallower in the northern and western areas of the inlet. Channels near the centre and entrance of the inlet are deeper, reaching depths of about 40 m, although in the Marine National Park the maximum depth is 20 m.

Table 2.15.1. Physical parameters in the Corner Inlet Marine National Parks.

Park Name	**Corner Inlet**
Conservation status	Marine National Park
Biophysical Region	Victorian embayments
Size of Park (ha)	1550
Length of coastline (m)	10817
Exposure rating	Low
Wave Energy	Low
Influential currents	Tidal currents of Franklin, Bennison and Middle Channels

Tidal variation - springs (m)	2.1
Tidal variation - neaps (m)	1.0
Water temp - summer (°C)	20
Water temp - winter (°C)	12
Intertidal (ha)	1225
0 - 2 m (ha)	44
2 - 5 m (ha)	40
5 - 10 m (ha)	60
10 - 15 m (ha)	80
15 - 20 m (ha)	80
20 - 30 m (ha)	30
Discharges	Chinaman Creek discharges into the southern section. Several intermittent creeks. Albert, Tarra, Franklin and Agnes Rivers drain into Corner Inlet outside Marine National Park.
Adjacent catchment	Agricultural, forestry and urban development

2.15.2 MARINE HABITAT CLASSES

The major Marine Habitat Classes in Corner Inlet Marine National Park are saltmarsh, seagrass, unvegetated intertidal flats and subtidal soft sediment. Minor Marine Habitat Classes include small areas of sandy beach and both intertidal and subtidal reef.

Table 2.15.2. Marine Habitat Classes for Corner Inlet Marine National Park (Ball 1998; Department of Natural Resources and Environment 1996; Morgan 1986).

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
	Cliff
Substratum texture	Fine sand
	Muddy sand
	Mud / silt
	Shell rubble / grit
Lithology	Granite
Subtidal soft sediment biota	Sessile invertebrates
	Halophila
	Posidonia
	Heterozostera
	Mixed seagrass/algae
	Mixed Posidonia/Halophila
Intertidal soft sediment biota	Mangrove

	Saltmarsh
	Seagrass
	Mussels
	Barnacles
Posidonia Dominant Seagrass Area (ha)	500
Zostera/Heterozostera Dominant Seagrass (ha)	165
Sediment Area (ha)	870
Mangroves Area (ha)	10
Salt Marsh Area (ha)	4
Land Area (ha)	0.3

2.15.3 MARINE ECOLOGICAL COMMUNITIES

Much of the information on invertebrates in this section is derived from reports by (Morgan 1986) and (O'Hara *et al*. 2002). However, none of the sites sampled by (Morgan 1986) and only two transects (14 and 16) by O'Hara (2002) were taken from directly within Corner Inlet Marine National Park. Analysis by O'Hara (2002) indicates that all *Posidonia australis* beds in the Inlet supported a single floral and faunal community. Both areas surveyed from within the Marine National Park by O'Hara (2002) supported some *P. australis* and one contained *Heterozostera*, *Halophila*, algae and sessile invertebrates and a variety of substrata. It is therefore assumed that the general descriptions of species composition provided by (Morgan 1986; O'Hara *et al*. 2002) are applicable to the Corner Inlet Marine National Park.

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.15.5.

Saltmarsh

Isolated stands of saltmarsh occur in the southern section of the Marine National Park in Corner Inlet.

Flora

Dominant saltmarsh plants include *Sarcocornia quinqueflora*, *Arthrocnemum arbuscula* and *Juncus maritimus* (Morgan 1986).

Invertebrate fauna

Saltmarsh is characterised by low faunal diversity and small numbers of individuals. Of those invertebrates that are present, gastropod molluscs are the most obvious faunal component, particularly the pulmonates *Salinator solida* and *Ophiacardelus ornatus*.

Salinator fragilis also occurs on the saltmarsh, but is usually restricted to more downshore sites, especially in *Zostera muelleri* beds. Gastropods concentrate near the bases of saltmarsh plants and *Salinator solida* frequently burrows into the sediment (Morgan 1986).

The crab *Paragrapsus quadridentatus* can be quite numerous, particularly in downshore areas of the saltmarsh, with hole densities of over 20/m² recorded (Morgan 1986).

Smaller crustaceans are uncommon except in localised areas where algal and seagrass debris retain moisture and provide shelter. Amphipods, particularly *Allorchestes compressa* and *Limnoporeia kingi*, can be locally common in this debris (Morgan 1986). Oligochaetes and chironomid larvae are common, but polychaetes are very rare (Morgan 1986).

Fish

Saltmarsh is the highest of the intertidal zones and is only covered by water for a short period. There are no records of fish associated with this habitat.

Mangrove

The white mangrove *Avicennia marina* is the only species of mangrove present in Victoria and is at the southern extent of its range in this state. Mangrove forests are mainly dominant along the northern shoreline of Corner Inlet, however isolated stands do occur within the southern section of the Marine National Park.

Flora

Algal mats (*e.g.,*, *Bostrychnia, Catanella*) are usually associated with pneumatophores and lower tree stems (Morgan 1986).

Invertebrate fauna

Faunal diversity in the mangrove zone is generally much higher than that of the saltmarsh, although diversity is lower in the upper intertidal and increases towards the mid-intertidal level where sediment moisture is higher and epiphytic algal growths are heavier. Extremely dense populations (exceeding 20,000/m²) of Corophiid amphipods (*Corophium* and *Paracorophium* spp.) are common although spatially heterogeneous (Morgan 1986). Sphaeromatid isopods such as *Sphaeroma quoyana* also occur often burrowing into wood debris in the mangroves. Polychaetes are more common than in saltmarsh though still less abundant than other intertidal habitats. Other dominant species include *Capitella* spp. the syllid *Exogene* spp., the nereid *Neanthes vaalii*, the nephtyid *Nepthys australiensis*. Oligochaetes, chironomid larvae and sipunculids are also present (Morgan 1986). Crab holes are often densely distributed with dominant species being *Paragrapsus quadridentatus*, *Heloecius cordiformis*, *Sesarma erythrodactyla* and the exotic European shore crab *Carcinus maenas* with *Macrophthalmus latifrons* also patchily distributed (Morgan 1986).

Molluscs are very common on hard substrate provided by the mangrove. Gastropods including *Bembicium auratum*, *Austrocochlea constricta* are common and *Zeacumantus diemenensis* and *Velacumantus australis* can be common amongst downshore algae. *Nassarius pauperatus* and juvenile *Salinator solida* and *S. fragilis* occur on the sediment. Bivalves *Legrandina bernardi* and *Melliteryx helmsi* are dominant on downshore sediments. The barnacle *Elminius modestus* is densely distributed on pneumatophores and tree stems and on some gastropod shells (Morgan 1986).

Fish

A recent survey of the fish fauna in mangrove habitat (Jenkins and Hindell FRDC 2001/036) found the following species to be relatively abundant; sandy sprat (*Hyperlophus vittatus*), pike head hardyhead *(Kestratherina esox*), smooth toadfish (*Tetractenos glaber*), yellow-eye mullet (*Aldrichetta forsteri*), silver fish (*Leptatherina presbyteroides*), blue spot goby (*Pseudogobius olarum*) and greenback flounder (*Rhombosolea taprina*).

Unvegetated intertidal flats

Sheltered intertidal flats in Corner Inlet Marine National Park are dominated by bare mud and sand and the southern section of the Marine National Park contains significant areas of this habitat. Unvegetated habitats on the intertidal mudflats are often interspersed with seagrass habitats (Gunthorpe *et al*. 2000).

Flora

This habitat class is defined by its absence of macrophytes, but bare flats frequently grade into seagrass beds, particularly *Zostera muelleri* (Morgan 1986). No other species of algae are recorded as being present in this habitat class.

Invertebrate fauna

The pulmonate gastropod *Salinator fragilis* frequently dominates intertidal flats along with bivalves such as *Mysella donaciformis*, *Macoma* (*Homalina*) *deltoidalis* and *Melliteryx helmsi*. *Nucele pusilla* and *Katelysia scalaria* are less abundant (Morgan 1986).

The faunal assemblage in these areas is highly variable and reflects the considerable variability in sediment size and composition. The polychaete fauna is moderately diverse and is typically dominated by *Barantolla lepte* and *Heteromastus filiformis*. The magelonid *Magelona dakini* and cirratulids occur in some sandy sites. Amphipods appear more common in flats with a high proportion of sand with phoxocecephalids and oedicerotids often being numerous. Molluscs are frequently the dominant fauna of bare flat sites. In sand, *Mysella donaciformis* is often common and *Salinator fragilis* can be numerous adjacent to *Zostera* beds. The asteroids *Patiriella exigua* and *P. calcar* are also relatively common (Morgan 1986).

Fish

Samples taken during high tide from nearby the Marine National Park in Corner Inlet found the long-finned goby (*Favonigobius lateralis*) was a dominant species on unvegetated habitats, co-dominating with hardyheads (*Atherinosoma microstoma* and *Leptatherina presbyteroides*), with gobies (*Arenigobius frenatus* and *Pseudogobius olorum*), and pipe fish (*S. nigra*), also important components (Jenkins *et al*. 1997). Yellow-eye mullet (*Aldrichetta forsteri*) feed on algae which may occur in this habitat and King George whiting (*Sillaginodes punctata*) feed on callianasids which typically occur in bare areas between seagrass patches (G. Parry pers. comm.).

Unvegetated intertidal flats were recently sampled as part of an ongoing project in Corner Inlet (Jenkins and Hindell FRDC 2001/036). In addition to the species mentioned above, the common species in this habitat included smooth toadfish (*Tetractenos glaber*), greenback flounder (*Rhombosolea taprina*) and sandy sprat (*Hyperlophus vittatus*).

Sandy beaches

Small areas of sandy beach occur in the northern and southern sections of the Corner Inlet Marine National Park.

Flora

This habitat is defined by the absence of macrophytes.

Invertebrate fauna

Very little data are available from this habitat, but inferences can be drawn from data collected by (Morgan 1986). The polychaete *Nepthys longipes* is common in sand sites along with the amphipod *Limnoporeia kingi* and the urohaustoriid *Urohaustorius metungi*. The molluscan fauna is heavily dominated by the small bivalve *Mysella donaciformis* with lesser numbers of *Legrandina bernardi*. The dominant decapod is the soldier crab *Mictyris platycheles* (Morgan 1986).

Fish

Fish species that occur in this habitat class have not been recorded, although work by J. Hindell is currently in progress.

Intertidal reef

Small sections of this habitat type occur near Tin Mine Cove and Freshwater Cove in the northern section of the Corner Inlet Marine National Park and near Bennison Island in the southern section. Faunal diversity sampled by Morgan *et al.* (1986) in similar habitats nearby was high and showed affinities with both mangrove epifauna and nearby Wilsons Promontory Rocky Shores.

Flora

No macrophytes are recorded from this habitat class.

Invertebrate fauna

Morgan *et al*., (1986) found invertebrates including molluscs, polychaetes and crustaceans dominated the intertidal rocky platforms. The dominant fauna includes gastropods (*Nerita atramentos*a, *Nodilittorina unifasciata*, *Bembicium nanum*, *Siphonaria diemenensis*, *Austrocochlea constricta*) polychaetes (*Galeolaria caespitosa*), seastars (*Pateriella exigua* and *P. brevispina*) and ascidians (*Pyura stolonifera*). The barnacles (*Chthamalus antennatus* and *Elminius modestus*) and the anemone *Actinia tenebrosa* are common on the rock surface and in crevices and the shrimp *Alpheus euphrosyne* is often found in rock pools (Morgan 1986).

Areas of fallen rocks and coarse sand/gravel adjacent to the intertidal bedrock substrate are dominated by amphipods (including Phoxocephalids, oedicerotids, dexaminids and aorids), cumaceans (*Cyclaspis cottoni*, *Gynodiastylis* sp.2) and polychaetes (*Nepthys australiensis*, *Lumbrineris latreilli*, *Barantolla lepte*, *Magelona dakini* and *Armandia intermedia*). Crabs (*Halicarcinus ovatus*, *Carcinus maenas*) are also common (Morgan 1986).

Fish

No records of fish for this habitat

Subtidal reef

Bennison Island in the southern section of the Corner Inlet Marine National Park has a small section of subtidal reef.

Flora

No records describing the composition of subtidal macrophytes were found.

The distribution, composition and ecological importance of benthic macroalgae in Corner Inlet Marine National Park is unknown, though some algae are found dispersed within seagrass meadows (Gunthorpe *et al*. 1997). Filamentous algal scums appear at certain times of the year within the inlet. It is not known whether the occurrence of these scums is a natural phenomena or appears in response to periodic inputs of nutrients originating from the catchment (Gunthorpe *et al*. 1997).

Invertebrate fauna

The ascidian *Pyura stolonifera* is common on shallow reef along with larger crustaceans including the crabs including *Halicarcinus ovatus* and (the exotic) *Carcinus maenas* and the shrimp *Alpheus euphrosyne* are often found in rock pools (Morgan 1986). The seastars *Patiriella exigua* and *P*. *brevispina* are conspicuous (Morgan 1986).

Fish

Biogenic reef appears to provide important habitat for some juvenile fishes in the inlet (Hamer, unpublished data). Cunjevoi (*Pyura stolonifera*), sponges and oysters shells (*Ostrea angasi*) provide complex three dimensional structures which are used by fishes (Gunthorpe *et al*. 1997). The reliance of fish communities on macroalgae and subtidal reef in Corner Inlet is unknown (Gunthorpe *et al*. 1997).

Seagrass

The north section of the Corner Inlet Marine National Park is dominated by *Posidonia australis*, and contains smaller dense and sparse patches of *Heterozostera tasmanica*. In the southern section of the Marine National Park *P. australis* was not observed, with the majority of the habitat being bare intertidal mud-sand, but there are smaller patches of *Zostera/Heterozostera* at various densities (Ball 1998; Roob *et al*. 1998).

The distribution of seagrass in Corner Inlet may be related partly to effects of water turbidity reducing light penetration and to the scouring effect of strong currents in the channels preventing seagrass colonisation at deeper sites (LCC 1994a).

P. australis dominates the seagrass of Corner Inlet and provides one of the few “hard” substrates available to smaller plants and animals in the expanse of sand and mud. The rhizomes of the seagrass play a fundamental role in stabilising the fine sediment, keeping the waters of the Inlet relatively clear (O'Hara *et al*. 2002). Additionally, as it decomposes, seagrass serves as a food source for both burrowing animals and for those that filter the water as it streams past (O'Hara *et al*. 2002).

Flora

Four species of seagrass have been recorded in Corner Inlet Marine National Park. Generally, seagrass is found along the 0-4 m depth contour and also at depths of 6 m at the base of plunging cliffs (Roob *et al*. 1998). The restriction of seagrasses to shallow water could be due to higher turbidity blocking out light to deeper water and also the scouring effect of currents in channels (Morgan 1986). *Heterozostera tasmanica*, and *Posidonia australis* occur in shallow subtidal waters, while *Zostera muelleri* occurs on intertidal mud banks. *Halophila australis* occurs within the inlet in mixed beds with other seagrass species (Roob *et al*. 1998), sparsely around *P. australis* beds, or across sand patches (O'Hara *et al*. 2002). *P. australis* dominates submerged banks, whilst *H. tasmanica* is common on the top and around the base of the banks (O'Hara *et al*. 2002).

Seagrass composition and distribution is known to fluctuate seasonally (*e.g.,*O'Hara *et al*. 2002; Roob *et al*. 1998). The most recent survey didn't find *Z. muelleri* present in the Corner Inlet Marine National Parks in either summer or winter (O'Hara *et al*. 2002). The cover of the dominant seagrass *P. australis* in Corner Inlet has also fluctuated considerably historically. *P. australis* cover declined significantly (20% to 25%) between 1976 and 1984 which followed a previous period of decline (Poore 1978).

Algae including some green algal species such as *Caulerpa trifaria*, *Codium fragile* (possibly the exotic *Codium fragile* subsp. *tomentosoides*) occur in seagrass beds where they attach to the seagrass rhizomes or onto other hard substrata (*e.g.,* sponges, ascidians, or empty shells). During summer (December to February), the tips of seagrass support a heavy load of epiphytes including filamentous and foliose brown and red algae (O'Hara *et al*. 2002).

P. australis often supports epiphytic algal communities including brown algae such as *Ectocarpus* sp, red algae such as *Ceramium* sp. and corallines, and greens such *Enteromorpha* sp. (Morgan 1986).

Invertebrate fauna

Posidonia australis meadows are the most faunally diverse habitat in Corner Inlet (Morgan 1986). Corner Inlet Marine National Park supports a rich and abundant fauna of polychaetes and amphipods along with less abundant and diverse molluscan population.

Larger common invertebrates include seastars (*Patiriella calcar*, *P. brevispina*, *Coscinasterias muricata*), urchins (*Amblypneustes ovum*), crabs (*Naxia aurita*, *Nectocarcinus* *integrifrons*), gastropods (predominantly *Thalotia conica* and *Astralium aureum*), ascidians and various bryozoans and sponges (O'Hara *et al.* 2002). The rock crab (*Nectocarcinus integrifrons*) is important in the community because this crab eats and assimilates seagrass fronds allowing other animals that prey on this crab, such as fish, access to the nutrients (Klumpp and Nichols 1983a).

Less commonly seen were other seastars (*Tosia australis*, *T. magnifica*, *Uniophora granifera*, *Luidia australiae*, *Allostichaster polyplax*), brittle stars (*Ophiopeza cylindrica*, *Ophiacantha alternata*, *Ophiothrix spongicola*), holothurians (*Paracaudina* sp, *Trochodota shepherdi*), gastropods (*Phasianella australis*, *Cacozeliana granaria*), urchins (*Amblypneustes ovum*, *Echinocardium cordatum*), the pearl oyster (*Electroma georgiana*), the doughboy scallop (*Chlamys asperrimus*), pycnogonids (*Anoplodactylus evansi*) and the blue-ringed octopus (*Hapalochlaena maculosa*) (O'Hara *et al.*. 2002).

Anemones, especially *Epiactis* sp., have been observed attached to stems and roots of the *Zostera muelleri* and hydroids (*Sertularia* sp., *Clytia* sp., *Plumularia setaceoides*) and encrusting bryozoans (*Celleporella aporosa*, *Porella marsupium*) often cover a considerable proportion of the leaves of *Heterozostera* (Morgan 1986).

The southern pygmy squid (*Idiosepius notoides*), and the iridescent southern dumpling squid (*Euprymna tasmanica*), inhabit the *Posidonia australis*, beds although they are mainly seen at night (O'Hara *et al*. 2002).

Smaller invertebrates such as polychaetes are particularly diverse in uniform *Zostera muelleri* beds with *Lumbrineris latreilli* very common. Capitellids (*Barantolla lepte* and *Heteromastus filiformis*) and spionids (*Prionospio aucklandica*, *Owenia fusiformis* and *Magelona dakini*) are also present (Morgan 1986).

Crustaceans, including the ostracod *Euphilomedes* spp., the cumacean *Sympodomma bakeri* and the isopods *Exosphaeroma* spp. and *Crabyzos longicaudatus* are locally common especially in *Heterozostera*. The small crabs *Halicarcinus ovatus* and *Philyra laevis* are common. Amphipods including the talitoid *Allorchestes compressa*, *phoxocephalids* and aorids including *Aora* sp.1 are dominant in *Zostera* muelleri beds, while the eusirid *Tethygeneia* sp. may be commonest in *Heterozostera*. Caprellid amphipods appear more common in *Heterozostera*, particularly *Paracaprella* sp.1 and *Caprella* cf *danilevskii* (Morgan 1986).

A small boring isopod (*Lynseia annae*) which depends directly on the locally abundant *Posidonia australis* is rare throughout the rest of Victoria because of the low abundance of this seagrass elsewhere (Morgan 1986). Other species such as the small black sea-cucumber (*Trochodota shepherdi*) and the seagrass brittlestars (*Ophiocomina australis* and *Amphiura triscantha*) are also unusual (O'Hara *et al*. 2002).

Fish

Seagrass meadows are habitats for both commercial and recreational fish species. The diversity, biomass and abundance of fish is usually higher in seagrass beds rather than adjacent unvegetated habitats (Jenkins *et al*. 1997). Seagrass meadows serve as nursery areas for juvenile marine fauna providing food and shelter from predators (Jenkins *et al*. 1997).

A recent survey of fish associated with seagrass in Corner Inlet found fish assemblages similar to those described for many other seagrass areas in Australia (Jenkins *et al*. 1997), although none of the sampling was conducted within the Marine National Park. Abundant fish species in the intertidal *Zostera* community in Corner Inlet included gobies (*Pseudogobius olorum* and *Arenigobius frenatus*) and pipe fish (*Urocampus carinirostris* and *Stigmatopora nigra*) (Jenkins *et al*. 1997). Also important were small juveniles of the luderick (*Girella tricuspidata*) in December and sandy sprat (*Hyperlophus vittatus*) in February (Jenkins *et al*. 1997). Similarly, on shallow *Heterozostera* habitat, significant abundances of blue spot goby (*P. olorum*) and pipe fish (*U. carinirostris*) occurred, with the soldierfish (*Gymnapistes marmoratus*), the leatherjacket (*Acanthaluteres spilomelanurus*) and the goby (*Favonigobius lateralis*) also important (Jenkins *et al*. 1997). On deeper *Heterozostera* leatherjacket (*A. spilomelanurus*), pipefish (*S. nigra* and *S. argus*), Wood's siphon fish (*Siphaemia cephalotes*) and rock whiting (*Neodax balteatus*) were dominant (Jenkins *et al*. 1997).

Various species of fish were observed during diver transects conducted in Corner Inlet (O'Hara *et al*. 2002). Smaller fish including weed and rock whiting (*Haletta semifasciata*, *Neodax balteatus*), southern gobbleguts (*Vincentia conspersa*), marine gobies (*Tasmanogobius gloveri*), toadfish (*Tetractenos glaber*), globefish (*Diodon nicthemerus*) and pygmy leatherjacket (*Brachaluteres jacksonianus*) are present. Larger fish including sparsely-spotted and cross-backed stingarees (*Urolophus paucimaculatus*, *U. cruciatus*), southern fiddler rays (*Trygonorrhina guanerius*), rock and sand flatheads (*Platycephalus laevigatus*, *P. bassensis*), and greenback flounders (*Rhombosolea tapirina*) were also found (O'Hara *et al*. 2002). The little scorpion fish (*Maxillicosta scabriceps*) is at the far east of its range in Corner Inlet.

Species common in the commercial and recreational catch taken from Corner Inlet include King George whiting (*Sillaginodes punctata*), sea garfish (*Hyporhamphus melanochir*), gummy shark (*Mustelus antarcticus*), snapper (*Pagrus auratus*), estuary perch (*Macquaria colonorum*) and yank flathead (*P. speculator*) (Gunthorpe *et al*. 2000).

Many species are known to depend directly or indirectly on seagrass in Corner Inlet, although few species consume it directly. Sub-adult garfish (*Hyporhamphus melanochir*) eat seagrass (*H. tasmanica*) during the day and then nocturnally emergent crustaceans at night (Klumpp and Nichols 1983a). Rock flathead (*Leviprora laevigata*) juveniles eat rock crab (*Nectocarcinus integrifrons*) which assimilate seagrass (*P. australis*) fronds (Klumpp and Nichols 1983b).

Unvegetated subtidal sediment

The channel areas in the northern section of the Corner Inlet Marine National Park drain extensive intertidal areas and are subject to strong tidal currents (Roob *et al*. 1998).

Flora

This habitat is defined by the absence of macrophytes.

Invertebrate fauna

Species diversity in deep channels with shell grit and sand beds is high and in a site sampled just outside the Corner Inlet Marine National Park, species richness was as high as *Posidonia* meadows (Morgan 1986).

The deep channels that drain the seagrass beds slope quite steeply at their margins and sometimes support large numbers of brittle-stars (*Amphiura elandiformis* and *Ophiocentrus pilosa*) that feed on tidal flows (O'Hara *et al*. 2002). Clumps of sponges and sea squirts (especially *Pyura stolonifera*) are sometimes present at the base of channels (6-15 m). These clumps may support fauna including sponges like the pink spiny *Dendrilla rosea*, encrusting ascidians, soft-corals, orange bryozoans, large orange anemones, some red algae and various hydroids (O'Hara *et al*. 2002). Mobile invertebrates sheltering on the reefs include the banded brittle star (*Ophionereis schayeri*) and sponge brittle-stars (*Ophiothrix spongicola*), the brown knobbed sea cucumber (*Stichopus mollis*), the doughboy scallop (*Chlamys asperrimus*), the eleven-armed seastar (*Coscinasterias muricata*) and the large biscuit seastar (*Tosia magnifica*) (O'Hara *et al*. 2002). Polychaete diversity from sites near the Marine National Park was moderately high with the opheliid (*Armandia intermedia*), terebellids (especially *Amaeana trilobata*) and cirratulids common. Just outside the northern section of the Marine National Park the eunicid (*Eunice australis*), the polynoid (*Harmothoe praeclara*), capitellids (especially *Heteromastus filiformis*) and syllids were very common (Morgan 1986).

Fish

In areas sampled outside the Marine National Park, O'Hara (2002) observed a few larger fish in bare patches of sand, sparse seagrass, or within the channels, including the sparsely-spotted and cross-backed stingarees (*Urolophus paucimaculatus*, *U. cruciatus*), southern fiddler Rays (*Trygonorrhina guanerius*), rock and sand flatheads (*Platycephalus laevigatus*, *P. bassensis*), and greenback flounders (*Rhombosolea tapirina*). Small schools of juvenile silver trevally (*Pseudocaranx dentex*) were also common.

2.15.4 BIOLOGICAL PROCESSES

The habitats important to fish species in Corner Inlet are estuarine, pelagic, seagrass, unvegetated sediment, reef, mangroves and possibly sandy beaches. These habitats provide food, shelter and spawning areas for fish targeted by fishers in the Inlet. Seagrass meadows, particularly *Posidonia* beds are very important to the fish and invertebrate species in Corner Inlet. Some commercial species are known to use the pelagic environment during gamete and larval life history stages (Gunthorpe *et al*. 1997) pp. 23. Estuarine areas also provide food and shelter for important recreational and commercial fish (Gunthorpe *et al*. 2000).

High invertebrate diversities were recorded for subtidal *Posidonia* meadows and channel sites adjacent to *Posidonia* meadows with several species common in the seagrass also occurring in the non-vegetated substrates. Input of detritus from *Posidonia* beds may increase the available food supply and/or structural complexity of sediments near the seagrass, permitting a more diverse benthic infauna (LCC 1994b).

The fauna of any seagrass beds and to a lesser extent, the seagrass itself constitute a major component in the diets of many fish including commercially exploited species (Morgan 1986) and are also important as nursery grounds for many juvenile individuals (LCC 1994a).

2.15.5 SPECIES DISTRIBUTION INFORMATION

No marine species that are known to have their distributional limits near or within the Marine National Park.

2.15.6 SHOREBIRDS

The Corner Inlet/Nooramunga marine embayment is the highest ranked site in Victoria for internationally significant habitat listed under the Ramsar convention. Threatened shorebird species recorded within and around the Corner Inlet Marine National Park are listed in Table 2.15.3. Both the Marine National Park sites enclose intertidal flats that form part of the internationally significant feeding areas for migratory waders.

A high tide duck roost is present on the shore of the southern site, with up to 400 Chestnut Teal and limited Grey Teal in October to June (I. Norman pers. comm.). Benison and Granite Islands have breeding colonies of Short-tailed Shearwaters, holding 7,200 and 2,100 birds respectively (1978 estimates Harris & Norman 1981). This species arrives in Victoria to breed in September with egg laying commencing in November. The entire population leaves in May and is then absent until September.

A major high tide roosting site is present on Twin Mangroves Islands with species recorded including the White-faced Heron, Chestnut Teal, Black Swan, Pacific Gull and Great Cormorant. Minor roosts are present at Chinamans Long Beach (South) and Tin Mine Cove with species recorded including the Sooty Oystercatcher, Eastern Curlew and Masked Lapwing (Martindale 1982 and C. Minton pers. comm.).

2.15.7 MARINE MAMMALS

There is a single record of a Southern Right Whale near Bennison Island in the AVW. It seems unlikely that a whale would be over the shallow intertidal flats present in that area so the sighting may relate to Bennison Channel further to the north. No other recorded sightings of threatened marine mammals in the Corner Inlet Marine National Park are listed in the AVW.

Table 2.15.3. Threatened shorebird records from Corner Inlet Marine National Park and surrounds (AVW and listed references).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Shoveler	*Anas rhynchotis*			Vul		1987
Bar-tailed Godwit	*Limosa lapponica*				CJ	Watkins 1987
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		Emison *et al.*. 1987
Cape Barren Goose	*Cereopsis novaehollandiae*			Vul		1980
Caspian Tern	*Sterna caspia*	L		Vul	CJ	1980
Crested Tern	*Sterna bergii*			LR		1980
Common Greenshank	*Tringa nebularia*				CJ	Watkins 1987
Curlew Sandpiper	*Calidris ferruginea*				CJ	Watkins 1987
Eastern Curlew	*Numenius madagascariensis*			LR	CJ	Watkins 1987
Fairy Prion	*Pachyptila turtur*		Vul	LR		1994
Fairy Tern	*Sterna nereis*	L		Vul		1980
Grey Plover	*Pluvialis squatarola*				CJ	Watkins 1987
Hooded Plover	*Thinornis rubricollis*	L	Vul	End		Watkins 1987

Little Egret	*Egretta garzetta*	L		CEn		1980
Little Tern	*Sterna albifrons*	L		Vul	CJ	1987
Musk Duck	*Biziura lobata*			Vul		1991
Orange-bellied Parrot	*Neophema chrysogaster*	L	End	CEn		1987
Pacific Golden Plover	*Pluvialis fulva*				CJ	Watkins 1987
Pacific Gull	*Larus pacificus*			LR		Emison *et al.*. 1987
Pied Cormorant	*Phalacrocorax varius*			LR		Emison *et al.*. 1987
Red Knot	*Calidris canutus*				CJ	Watkins 1987
Red-necked Stint	*Calidris ruficollis*				CJ	Watkins 1987
Ruddy Turnstone	*Arenaria interpres*				CJ	Watkins 1987
Sanderling	*Calidris alba*				CJ	Watkins 1987
Shy Albatross	*Diomedea cauta*		Vul			1991
Short-tailed Shearwater	*Puffinus tenuirostris*				J	ARI 1999
White-bellied Sea-Eagle	*Haliaeetus leucogaster*		L	End	C	Emison *et al.*. 1987

Table 2.15.4. Threatened marine mammal records from Corner Inlet Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1993

Table 2.15.5. Selection of some animals and plants that may be found in the Corner Inlet Marine National Park.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	saltmarsh plants	*Sarcocornia quinqueflora, Arthrocnemum arbuscula* and *Juncus maritimus*
	seagrass	*Posidonia australis, Heterozostera tasmanica Halophila australis*, *Zostera muelleri*
	white mangrove	*Avicennia marina*
	green algae	*Caulerpa trifaria*, *Codium fragile*
Invertebrates	amphipods	*Allorchestes compressa* and *Limnoporeia kingi*
	ascidians	
	barnacle	*Elminius modestus*
	bivalve	*Mysella donaciformis*
	bivalves	*Legrandina bernardi* and *Melliteryx helmsi*

	blue spot goby	*Pseudogobius olarum*
	corophiid amphipods	*Corophium* and *Paracorophium* spp.
	syllid	*Exogene* spp
	crab	*Paragrapsus quadridentatus, Naxia aurita*, *Nectocarcinus integrifrons, Mictyris platycheles, Paragrapsus quadridentatus*, *Heloecius cordiformis*, *Sesarma erythrodactyla*
	nephtyid	*Nepthys australiensis*.
	nereid	*Neanthes vaalii*
	oligochaetes and chironomid larvae	
	urchins	*Amblypneustes ovum*
	polychaete	*Capitella* spp. *Nepthys longipes, Lumbrineris latreilli*
	various bryozoans and sponges	
	seastars	*Patiriella calcar*, *P. brevispina Coscinasterias muricata*
	gastropods	*Thalotia conica* and *Astralium aureum, Bembicium auratum*, *Austrocochlea constricta*, *Zeacumantus diemenensis* and *Velacumantus australis, Salinator solida* and *Ophiacardelus ornatus*
Fish	flatheads	*Platycephalus laevigatus*, *P. bassensis*, *P. speculator*
	estuary perch	*Macquaria colonorum*
	globefish	*Diodon nicthemerus*
	gobies	*Arenigobius frenatus* and *Pseudogobius olorum, Favonigobius lateralis, Tasmanogobius gloveri*
	greenback flounder	*Rhombosolea tapirina*
	gummy shark	*Mustelus antarcticus*
	hardyheads	*Atherinosoma microstoma* and *Leptatherina presbyteroides*
	King George whiting	*Sillaginodes punctata*
	leatherjacket	*Acanthaluteres spilomelanurus*
	long-finned goby	*Favonigobius lateralis*
	luderick	*Girella tricuspidata*
	pike-head hardyhead	*Kestratherina esox*
	pipefish	*Urocampus carinirostris*, *Stigmatopora nigra, S. argus*
	pygmy leatherjacket	*Brachaluteres jacksonianus*
	sandy sprat	*Hyperlophus vittatus*
	sea garfish	*Hyporhamphus melanochir*
	silver fish	*Leptatherina presbyteroides*
	smooth toadfish	*Tetractenos glaber*

	snapper	*Pagrus auratus*
	soldierfish	*Gymnapistes marmoratus*
	southern gobbleguts	*Vincentia conspersa*
	sparsely-spotted and cross-backed stingarees	*Urolophus paucimaculatus*, *U. cruciatus*, *Trygonorrhina guanerius*
	toadfish	*Tetractenos glaber*
	whiting	*Haletta semifasciata*, *Neodax balteatus*
	Wood's siphon fish	*Siphaemia cephalotes*
	yellow-eye mullet	*Aldrichetta forsteri*

2.15.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Corner Inlet Marine National Park are listed below (MPV database and Buckley 1993):

- Chinaman Creek Delta, (Regional/Local Significance): Major deltaic feature indicating environmental change.
- Barrys Hill - Bennison Point, (Regional/Local Significance): A recent and rapidly changing coastline.
- Bennison Island & Tidal Flats, (Regional/Local Significance): Weathering feature unusual on granitic coasts.
- Corner Inlet - tidal drainage features, (Regional/Local Significance): A large shallow embayment with extensive sand & mud flats exposed at low tide. Movement of mobile dunes. Tidal drainage topography on the floor of Corner Inlet.

2.15.9 KNOWLEDGE GAPS

Corner Inlet is generally well studied, although much of the data used in this report comes from sampling sites outside the Marine National Park boundaries. Only two transects (14 and 16) by O'Hara (2002) were taken from directly within Corner Inlet Marine National Park and no quantitative data are available for the sandy beaches in the protected area. No data were available on intertidal reef algae anywhere within Corner Inlet.

2.15.10 RESEARCH

Author	Project	Notes
(O'Hara *et al*. 2002)	Baseline monitoring of Posidonia seagrass beds in Corner Inlet, Victoria.	
(Jenkins and Hindell FRDC 2001/036)	Assessment of the importance of different nearshore habitats to commercial and recreational fish in Victoria.	FRDC 2001/036
(Ball 1998)	Corner Inlet/Nooramunga coastal resource atlas descriptive report produced for the Victorian (National Plan) Marine Pollution Committee.	
(Turner and Norman 1998)	Fishes of Wilsons Promontory and Corner Inlet, Victoria: composition and biogeographic affinities.	
(Jenkins *et al*. 1997)	Comparison of fish assemblages associated with seagrass and adjacent unvegetated habitats of Port Phillip Bay and Corner Inlet, Victoria, Australia, with emphasis on commercial species.	
(Stevens and West 1997b)	Investigation of school and gummy shark nursery areas in south eastern Australia.	
(Conron and Coutin 1995)	A survey of the recreational fishery in Nooramunga and Corner Inlet. Progress Report	
(Morgan 1986)	A survey of macrobenthos in the waters of Corner Inlet and the Nooramunga, Southern Victoria, with an assessment of the extent of *Posidonia* seagrass.	
(Klumpp and Nichols 1983b)	A study of food chains in seagrass communities. 2. Food of the rock flathead, *Platycephalus laevigatus* Cuvier, a major predator in *a Posidonia australis* seagrass bed.	

2.16 Ninety Mile Beach Marine National Park

The Ninety Mile Beach Marine National Park is part of the Twofold Shelf Bioregion. Along Ninety Mile Beach there is a transition to the warm temperate waters of New South Wales as water temperatures increase and the biota typical of Victoria's coast are replaced by warm temperate flora and fauna (LCC 1993). A periodic upwelling between Lakes Entrance and Gabo Island (Parry *et al*. 1990) results in coastal waters being about 5°C colder than adjacent surface waters and may contribute to the possibly distinct fauna off East Gippsland (LCC 1993)

2.16.1 PHYSICAL PARAMETERS

Ninety Mile Beach Marine National Park runs adjacent to the McLaughlans Beach Coastal Reserve

Table 2.16.1. Physical parameters of the Ninety Mile Beach Marine National Park.

Park Name	Ninety Mile Beach
Conservation status	Marine National Park
Biophysical Region	Twofold Shelf
Size of Park (ha)	2750
Length of coastline (m)	5065
Exposure rating	high
Wave Energy	high
Influential currents	None
Tidal variation - springs (m)	0.9
Tidal variation - neaps (m)	0.6
Water temp – summer (°C)	18
Water temp – winter (°C)	13
0 - 10 m (ha)	1340
10 - 20 m (ha)	1260
20 - 30 m (ha)	50
Discharges	Mason Creek and drain. Merriman Creek discharges 550 metres along coast to northeast
Adjacent catchment	Agricultural, Urban

2.16.2 MARINE HABITAT CLASSES

The major marine habitat classes in the Ninety Mile Beach Marine National Park are sandy beach, subtidal soft sediment and low profile calcarenite reef (LCC 1993) (Figure A1.16a).

Table 2.16.2. Marine Habitat Classes for Ninety Mile Beach Marine National Park (Bird 1993; Parry *et al*. 1990).

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
Substratum relief	Low profile reef
Substratum texture	Coarse sand
	Medium sand
	Shell rubble / grit
Lithology	Calcarenite
Dominant subtidal biota	Sessile invertebrates
Low Profile Reef Area (ha)	8
Total Reef Area (ha)	8
Sediment Area (ha)	1780
Undefined Area (ha)	870

2.16.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.16.6.

Intertidal sandy beach

Invertebrate fauna

High energy beaches of Ninety Mile Beach support few organisms, mainly amphipods and isopods in the swash zone and the bivalve pipi in the lower intertidal zone. Another bivalve *Paphies angusta*, and a number of polychaetes can occur in the sand at the lower edge of the intertidal zone (LCC 1993).

Organic matter washed up on sandy beaches, primarily drift algae, provides a microhabitat and food resource for mobile beach organisms including tenebrionid beetles (*Sphargeris physodes*), sand hoppers (*Talorchestia* spp.) and kelp flies, as well as small amphipods and isopods (LCC 1993).

Detailed surveys have not been undertaken within the Marine National Park, but the intertidal sandy McGaurans Beach (which is approximately five kilometres east of the Marine National Park) was sampled between 1983-1990 and was found to have depauperate invertebrate infauna (MSE 1989). In 1990, nine species contributed 86% of the total number of organisms (MSE 1989). Four of these species were isopods of the genera *Cirolana*, *Scyphax*, and *Armadilloniscus*, the remaining organisms included bivalves, polychaetes, amphipods and insect larvae (LCC 1993). The mean number of organisms per m^2 varied from 5 to 102 individuals over the 8 year period. The densities of organisms varied greatly during the sampling period and may have been the result of storms transporting large volumes of sand offshore, and organic detritus (chiefly algae and sponges) being transported onto beaches from offshore reefs (LCC 1993).

The most common organisms in the upper half of the intertidal zone are isopods which tended to congregate around the most recent high tide mark (MSE 1987). Amphipods were also abundant (MSE 1989). The mean number of organisms at McGaurans beach was 48 (sd. $\pm$ 24) (MSE 1988) with a 1341 organisms altogether, although large fluctuations in intertidal population densities were noted in previous surveys (MSE 1988).

Subtidal reef

Low profile wave swept Tertiary calcarenite reefs exist off Ninety Mile Beach to four kilometres offshore at between 15-20 m depth (LCC 1993). (Figure A1.16a)

Flora

Macrophytes are not common on subtidal reefs in East Gippsland possibly due to degree of exposure, the poor light levels and abrasion by moving sand (LCC 1993).

Invertebrate fauna

Subtidal reef biota in East Gippsland is dominated by invertebrates including large sponges (*Lophon laevistylis*, *Phyllospongia caliciformis*, *Crella* sp., *Clathria* sp., *Raspallia* sp.), ascidians (*Polycitor gigantea*, *Botrylloides magnoecius*, *Sycozoa cerbriformis*, and, very commonly, the stalked ascidian (*Pyura australis*), bryozoans (*Amathia tortuosa*, *A. biseriata*, *Scuticella* sp.), and hydroids (the black feathery *Aglaophenia divaricata*, the white feathery *A. campanula*, the orange *Halopteris campanula*, and the red *H. buskii*) (LCC 1993).

Fish

No records of subtidal reef fish are available.

Unvegetated subtidal sediment

Flora

This habitat class is defined by its absence of macrophytes and macrophytes are not common in East Gippsland, possibly due to degree of exposure and the poor light levels (LCC 1993).

Invertebrate fauna

The recorded diversity of invertebrates within the Marine National Park is anticipated to become higher since other surveys of subtidal invertebrates throughout northern Bass Strait reveal an extraordinarily high diversity in the region that exceeds that recorded anywhere in the world (*e.g.,*., Coleman *et al*. 1997; Parry *et al*. 1990)

The mean number of species present between 6.5 and 9.5 m depth, per 0.1 m^2 site, ranged between 41 and 69 offshore of McGaurans Beach (MSE 1987; MSE 1988). The dominant species were the bivalves *Mysella* sp. and *Lutraria* sp., and the amphipod *Urohaustorius* sp. which together accounted for approximately two-thirds of the total population. The mean number of organisms per site was 2342 (sd. ± 882) (MSE 1987; MSE 1988). Significant negative correlations with sediment size for *Mysella* sp. and the amphipod *Urohaustorius* sp. (but not *Lutraria*), suggest that infauna was considerably influenced by the grain size of sediments (MSE 1988). Also present in the samples were cumaceans, holothurians, ostracods, polychaetes, amphipods and bivalves (MSE 1988).

Another infaunal data sample available is a single 0.1 m^2 Smith McIntyre grab taken at 40 m depth approximately 20 km offshore of the Ninety Mile Beach Marine National Park. A total of 85 species from 54 families was recorded from a sample with 305 individual organisms (Coleman *et al*. 2002). Analysis of gut contents of fish from trawl samples taken approximately 100 kilometres east of the Marine National Park indicates that numerous polychaetes, isopods, gastropods, euphasids, ophiuroids, bivalves, amphipods, cumaceans and cephalopods formed the diet of the fish collected (Bird and Watson 1993). Due to the nature of gut contents analysis, only a some species were identifiable including the polychaete *Travisia* spp., the cumacean *Pomacuma australiae*, the pagurid *Paguristes brevirostris*, and the amphipods *Cheiriphotis* sp. and *Ampelisea* sp. nov. (Bird and Watson 1993).

Sand bottom epibenthos further offshore is dominated by the strap-like mauve coloured alcyonarian (*Pseudogorgia goddfroeyi*). The large pink seapen (*Sarcoptilus grandis*) can be found on coarse sediments along the open coast such as Waratah Bay (LCC 1993).

Fish

No information was available from within the Marine National Park, but recreational fishing guides indicate that Seaspray beach, (which is less than two kilometres east of the Marine National Park), is known for populations of salmon, flathead, snapper and tailor which sometimes may move inshore during the day and gummy shark which may move inshore during the night (Classon and Wilson 2002). Trawl samples from habitat similar to Ninety Mile Beach off Lake Tyers are summarised in Table 2.16.3.

Table 2.16.3. Abundance of fish species collected in February and June during three trawls covering 1700-1800 m at between 20 and 48 m depth off Lake Tyers approximately 100 kilometres east of Ninety Mile Beach Marine National Park (Bird and Watson 1993). Fish species are arranged in decreasing average abundance. Survey from offshore of Lake Tyers nearly 100 kilometres away.

Common Name	Scientific name
Jack mackerel juvenile	*Nemadactylus macropterus*
Silverbelly	*Urolophus paucimaculatus*
Common gurnard perch	*Neosebastes scorpaenoides*
Gurnard	*Lepidotrigla spp.*
Flathead	*Platycephalus spp.*
Spiky globefish	*Diodon nicthemerus*
Sparsely spotted stingaree	*Urolophus paucimaculatus*
Red mullet	*Upenichtys sp.*
Swell shark	*Cephaloscyllium laticeps*
Morwong	*Nemadactylus macropterus*
Banded stingaree	*Urolophus cruciatus*

2.16.4 BIOLOGICAL PROCESSES

Neira *et al.* (2000) also found elevated larval fish concentrations and a high species diversity in the region of Ninety Mile Beach. They attributed this partly to the abundance of the nearshore rocky reef habitats at Wilsons Promontory, but also to the presence of an inshore anticyclonic eddy, with the prevailing eastward current and the protruding topography of Wilsons Promontory combining to favour the retention of ichthyoplankton in this area during summer.

2.16.5 SPECIES DISTRIBUTION INFORMATION

No marine invertebrates, fish or algae are known to have their distributional limits near or within the Marine National Park.

Reptilian species

There are five marine reptiles that occur as vagrants along our eastern shores: Loggerhead Turtle (*Caretta caretta*), Green Turtle (*Chelonia mydas*), Pacific Ridley (*Lepidochelys olivacea*) Leathery Turtle (*Dermochelys coriacea*), Yellow-bellied sea snake (*Pelamis platurus*) (G. Gillespie pers. comm.).

2.16.6 SHOREBIRDS

A list of threatened shorebird species recorded in and around the Ninety Mile Beach Marine National Park from the AVW is shown in Table 2.16.4.

Within 4 km of the eastern border of the Marine National Park lies the start of the Gippsland Lakes. This area is recognised as a Ramsar area and it is probable that many species of shorebird that utilise this area may be recorded moving through the Marine National Park.

2.16.7 MARINE MAMMALS

The only threatened marine mammals recorded in the AVW for the area around the Ninety Mile Beach Marine National Park are the Southern Elephant Seal and Southern Right Whale.

Table 2.16.4. Threatened shorebird records from Ninety Mile Beach Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Hooded Plover	*Thinornis rubricollis*	L		End		1981
Little Egret	*Egretta garzetta*	L		CEn		1980
Little Tern	*Sterna albifrons*	L		Vul	CJ	1981
Royal Spoonbill	*Platalea regia*			Vul		1980
Whiskered Tern	*Chlidonias hybridus*			LR		1993

Table 2.16.5. Threatened marine mammal records from Ninety Mile Beach Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Southern Elephant Seal	*Mirounga leonina*		Vul			1992
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1993

Table 2.16.6. Selection of some animals and plants that may be found in the Ninety Mile Beach Marine National Park.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Invertebrates	amphipod	*Urohaustorius* sp.
	isopods	*Cirolana*, *Scyphax*, and *Armadilloniscus*
	bivalve	*Paphies angusta*
	tenebrionid beetles	*Sphargeris physodes*
	sand hoppers	*Talorchestia* spp.
	sponges	*Lophon laevistylis*, *Phyllospongia caliciformis*, *Crella* sp.,

		Clathria sp., *Raspallia* sp.
	ascidians	*Polycitor gigantea*, *Botrylloides magnoecius*, *Sycozoa cerbriformis*,
	stalked ascidian	*Pyura australis*
	bryozoans	*Amathia tortuosa*, *A. biseriata*, *Scuticella* sp.
	hydroids	*Aglaophenia divaricata*, *A. campanula*, *Halopteris campanula*, *H. buskii*
	bivalves	*Mysella* sp., *Lutraria* sp.
	alcyonarian	*Pseudogorgia goddfroeyi*
	pink seapen	*Sarcoptilus grandis*

2.16.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Ninety Mile Beach Marine National Park are listed below (MPV database and Buckley 1993):

- Merriman Creek, Seaspray, (Undefined Significance): At the west end of Lake Reeve between an inland fossil cliff and the outer barrier, Merriman Creek has built its delta.
- Lake Denison - Barrier and lagoon evolution, (Regional/Local Significance): Lake, barrier, bluff and lagoon channel evolution.

2.16.9 KNOWLEDGE GAPS

Quantitative surveys for all habitat classes other than soft sediment environments in the Ninety Mile Beach Marine National Park are unavailable. Knowledge of fish on both subtidal soft sediment and subtidal reef areas in the Marine National Park is poor with information in this report derived from sampling outside the protected area and anecdotal reports.

2.16.10 RESEARCH

Author	**Project**	**Notes**
(Carey 2002)	An investigation of hypothesis testing and power analysis in impact assessment using case studies of marine infauna	
(Carey and Keough 2002)	Compositing and sub-sampling to reduce costs and improve power in benthic infaunal monitoring programs	
(Gippsland Water 2001)	AWT Saline Water Outfall Pipeline - Review of Environmental Performance (Draft- July 2001)	
(Gippsland Water 2001)	AWT Latrobe Valley Ocean Outfall - Review of Environmental Performance (Draft- July 2001)	
(Coleman *et al*. 2000)	Species diversity within the sediments of Victoria's seashore soft benthic ecosystem	
(Neira *et al*. 2000)	Spawning and larval recruitment processes of commercially important species in coastal waters off Victoria 1997-1998	

(Haynes and Toohey 1998)	The use of transplanted, cultured mussels (*Mytilus edulis*) to monitor pollutants along the Ninety Mile Beach, Victoria, Australia III. Heavy metals.	
(Coleman *et al*. 1997)	High species richness in the shallow marine waters of south-eastern Australia	
(Haynes *et al*. 1997)	A comparison of the bivalve species *Donax deltoides* and *Mytilus edulis* as monitors of metal exposure from effluent discharges along the ninety mile beach, Victoria, Australia	
(Haynes *et al*. 1996)	Long term variability in pollutant concentrations in coastal sediments from the ninety Mile Beach, BassStrait, Australia.	
(Haynes *et al*. 1995c)	The use of transplanted cultured mussels (*Mytilus edulis*) to monitor pollutants along the Ninety Mile Beach, Victoria, Australia: II. Polychlorinated dibenzo-p-dioxins and dibenzofurans	
(Haynes *et al*. 1995b)	The use of transplanted cultured mussels (*Mytilus edulis*) to monitor pollutants along the Ninety Mile Beach, Victoria, Australia.	
(Haynes *et al*. 1995d)	Temporal and spatial variation in concentrations of trace metals in coastal sediments from the Ninety Mile Beach, Victoria, Australia	
(Haynes *et al*. 1995a)	Temporal and spatial variation in heavy metal concentrations in the bivalve Donax deltoides from the ninety mile beach, Victoria, Australia	
(Parry *et al*. 1990)	Marine resources off east Gippsland, southeastern Australia	
(MSE 1989)	Biological monitoring of saline waste water outfall pipeline Survey 11, 1989 for Latrobe Valley Water and Sewerage Board by Marine Science and Ecology	
(MSE 1988)	Biological monitoring of saline waste water outfall pipeline Survey 9, 1987 for Latrobe Valley Water and Sewerage Board by Marine Science and Ecology	
(MSE 1987)	Biological monitoring of saline waste water outfall pipeline 1982-1986 for Latrobe Valley Water and Sewerage Board by Marine Science and Ecology	

2.17 Point Hicks Marine National Park

The Point Hicks Marine National Park is representative of the Twofold Shelf Bioregion and includes sandy beaches, intertidal and subtidal reefs and subtidal soft sediments. The granite coastline has areas exposed to moderate to high wave energy and has a high intertidal and shallow subtidal invertebrate species richness with a particularly diverse and colourful sessile invertebrate community. A survey of a reef just outside the Marine National Park boundary found more species than anywhere else on the Victorian coastline (O'Hara 2000). The granite cliffs of Point Hicks were also the first point on the Australian coastline seen from Captain Cook's ship the Endeavour in 1770.

2.17.1 PHYSICAL PARAMETERS

The Point Hicks Marine National Park is located about twenty-five kilometres south of Cann River and follows approximately eight kilometres of coastline adjacent to the large, relatively unspoilt Croajingolong National Park and the Point Hicks Lighthouse Reserve. The Marine National Park boundary extends from the east of Clinton Rocks around Point Hicks to the eastern edge of Stab Bay and offshore to three nautical miles (Figure A1.17a).

Table 2.17.1. Physical parameters for Point Hicks Marine National Park (Bird 1993; Ferns and Hough 2000; Kraft 2001)**.**

Park Name	Point Hicks
Conservation status	Marine National Park
Biophysical Region	Twofold Shelf
Size of Park (ha)	4000
Length of coastline (m)	9500
Exposure rating	High
Wave Energy	High
Influential currents	None
Tidal variation - springs (m)	0.9
Tidal variation - neaps (m)	0.6
Water temp - summer (°C)	19
Water temp - winter (°C)	14
0 - 10 m (ha)	330
10 - 20 m (ha)	340
20 - 30 m (ha)	660
30 - 40 m (ha)	400
40 - 50 m (ha)	280
50 - 60 m (ha)	490
70 - 80 m (ha)	490

80 - 90 m (ha)	160
Discharges	None
Adjacent catchment	Croajingalong National Park

2.17.2 MARINE HABITAT CLASSES

The Point Hicks Marine National Park is a medium to high-energy coastline with a steep shoreline of rocky cliffs. The major habitat classes are sandy beaches, subtidal soft sand sediments, intertidal reef and subtidal reef. The adjacent Croajingolong National Park contains large sand dunes, tidal inlets, lagoons, interdune lakes, coastal heathland and swamp systems.

The Marine National Park incorporates some significant subtidal reefs including Whaleback Rock and Satisfaction Reef. Between Whaleback Rock and Point Hicks, subtidal granite reefs are common with large granite boulders surrounded by clusters of smaller rocks and stones at about 10 m depth (O'Hara 2000).

Subtidal sediment characteristics vary with depth in the Point Hicks Marine National Park with higher silt fractions being found with increased depth (Roob and Currie 1996). Between 62 m and 83 m depth silty sand and shell rubble are common, whereas at 46 m depth, coarser sand fractions are more common (Roob and Currie 1996). The Marine National Park includes areas of subtidal soft sediment with a mixture of fine, medium and coarse sand with some silt, pebbles and shell (ECC 2000). There are no reef structures between 2.5 and 5.5 kilometres offshore from Point Hicks and the seafloor is bare hard-packed sand/silt and shell rubble (Roob and Currie 1996).

Table 2.17.2. Marine Habitat Classes for Point Hicks Marine National Park (Bird 1993; Ferns and Hough 2000; Kraft 2001).

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
	Platform
	Beach / Platform
	Cliff
Substratum relief	Low profile reef
	High profile reef
Substratum texture	Solid reef
	Broken reef
	Coarse sand
	Fine sand

	Shell rubble / grit
Lithology	Basalt
	Granite
	Calcarenite
Subtidal reef biota	Kelp - Phyllospora dominated
	Kelp - Macrocystis dominated
	Kelp - Durvillaea dominated
	Kelp - Ecklonia dominated
	Kelp - mixed Phyllospora / Ecklonia
Subtidal understorey reef biota	Mixed algae - brown dominated
	Mixed algae – green
	Cystophora
	Sessile invertebrates
	Red algae dominated
	Urchin barrens
	Caulerpa
Intertidal reef biota	Durvillaea
	Coralline algae
	Pyura
	Mussels
	Barnacles
Heavy reef Area (ha)	40
Total Reef Area (ha)	40
Sediment Area (ha)	1750
Undefined Area (ha)	2010

2.17.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.17.3.

Sandy beach

No information on the invertebrate fauna of the sandy beaches within or nearby to the Point Hicks Marine National Park was found during the literature search.

Intertidal reef

No data are available on intertidal reefs in the Marine National Park.

Intertidal soft sediment

No data area available on intertidal soft sediment or sandy beaches in the Marine National Park.

Unvegetated subtidal sediment

Flora

This habitat class is defined by its absence of macrophytes and a video survey of subtidal soft sediment areas (Roob and Currie 1996).

Invertebrate fauna

A video survey of subtidal soft sediment areas found no attached macrofaunal in water of 83 m and 62 m depth although in shallower water at a depth of 46 m large numbers of Cerith molluscs (>30 m/^{2}) were observed (Roob and Currie 1996).

The nearest infaunal data available consists of a single 0.1 m^2 Smith McIntyre grab sample taken at 10 m depth to the west of Point Hicks Marine National Park. A total of 167 individuals and 13 species were recorded from this sample (Coleman *et al*. 2002).

Fish

Trawl surveys conducted off Point Hicks on indicate that the dominant fish species on subtidal soft sediment are school whiting (*Sillago flindersi*), sparsely spotted stingaree (*Urolophus paucimaculatus*), piked dog shark (*Squalus megalops*), jack mackerel (*Trachurus declivis*), round snouted gurnard (*Lepidotrigla mulhalli*), red rock cod (*Scorpaena papillosus*) and cocky gurnard (*Lepidotrigla vanessa*) (Parry *et al*. 1990). Other important species include banded stingaree (*Urolophus cruciatus*), short finned gurnard, scaber leatherjacket (*Parika scaber*) and gurnard perch (*Neosebastes scorpaenoides*) (Parry *et al*. 1990).

Nearby inshore areas have been identified in recreational fishing guides as hosting gummy sharks, salmon and tailor (Classon and Wilson 2002). Newborn pups of gummy sharks inhabit shallow inshore areas and there is some evidence to suggest that the inshore sandy areas east of Wilsons Prom may be important feeding areas for gummy shark pups (Stevens and West 1997b; Walker *et al*. 2000). The commercial catch data also indicates that the general area provides suitable habitat for gummy sharks, saw sharks and elephant sharks (Walker *et al*. 2001). These shark species are all demersal and so the subtidal soft sediment environment within and adjacent to Point Hicks Marine National Park may provide an important feeding ground for these species.

Subtidal reef

Subtidal reef exists mainly close to the shore in the Point Hicks Marine National Park, although other significant reefs include Whaleback Rock near the eastern Marine National Park boundary and Satisfaction reef near the western Marine National Park boundary.

Flora

Halfway between Whaleback Rock and Point Hicks at 10 m depth, the seafloor consists of large granite boulders where the dominant kelp has been recorded as *Ecklonia radiata,* with *Phyllospora comosa* also present on top of the larger boulders. The *Ecklonia radiata* had a thick central stipe to 1.5 m with canopy forming foliage restricted to the apex (O'Hara 2000). Algae were restricted to smaller epiphytic and epizoic species including *Halopteris* spp, *Delisea plumosa* and *Plocamium costatum*.

Kraft (2001) has conducted the most detailed survey of algae within the Marine National Park on Satisfaction Reef to the west of Whaleback Rock. *Ecklonia radiata* was found to dominate the narrow flats in between boulder crests where it was interspersed by occasional large individual clumps of the *Phyllospora comosa*, *Carpomitra costata* and less often by the shaggy brown tufts of *Halopteris paniculata* (Kraft 2001). Both the latter species bore diverse epiphytes. Other conspicuous but less frequently occurring brown seaweeds were *Sporochnus comosus* and *Dictyota dichotoma* (Kraft 2001). The largest and most striking red alga around *Ecklonia radiata* stands was *Rhodymenia obtusa*. Other large reds present as isolated stands were *Asparagopsis armata*, *Callophyllis rangiferina*, *Thamnoclonium dichotomum*, *Plocamium dilatatum* and *Spyridia dasyoides* (Kraft 2001). Very common as an epiphyte of larger brown algae and epizoic on sponges was an undescribed species of *Apoglossum*. Other conspicuous epiphytes being *Ceramium rubrum* and *Ceramium pusillum* (Kraft 2001).

Some rarely encountered algae species (*Deucalion levringii, Griffithsia elegans, Halicnide similans, Hemineura frondosa and Rhodymenia leptophylla*) found in the Marine National Park were outside their previously known range (Kraft 2001). A specimen of *Porphyropsis minuta* was the first Victorian record other than Lawrence Rocks near Portland and *Erythronaema ceramoides* has not been recorded in Victoria since its original discovery at Port Phillip Heads in 1880 (Kraft 2001). The first Victorian record of the genus *Gelidiella* was an undescribed species and the rare *Scageliopsis patens* was previously only known from Adelaide (Kraft 2001).

Invertebrate fauna

A survey by O'Hara (2000) found a diverse and colourful assemblage of sessile invertebrates including sponges, bryozoans, corals, gorgonians, octocorals (*Capnella* sp.) and ascidians halfway between Whaleback rock and the Point Hicks at 10 m where the seafloor consists of large granite boulders (O'Hara 2000). A similar faunal assemblage appears in other areas of Marine National Park such as Satisfaction Reef where similar groups were observed to dominate (Kraft 2001) although there are some areas of subtidal reef (>5 m^2) with only bare granite and no sessile invertebrates (Roob and Currie 1996). These bare areas may have been urchin barrens formed by the large purple urchin *Centrostephanus rodgersii* (O'Hara 2000). Within the holdfasts of *Ecklonia radiata*, a rich assemblage of bryozoans (47 species) and hydroids (8 species) was present and between the holdfasts numerous species of sponge and ascidians were present (O'Hara 2000).

The same survey by O'Hara (2000) also recorded large invertebrates including the seastar, several ophiuroids, crinoids, gastropods, fan worms and nudibranchs. The motile invertebrate fauna was species-rich and abundant and included 37 species of polychaetes from 14 families (O'Hara 2000). The most numerous of these were the nereid (*Nereis maxillodentata*), the sabellid worm (*Branchiomma* sp.), several syllid worms including the purple syllid (*Trypanosyllis* sp.) and abundant terebellid worms. Ophiuroids were very abundant, particularly the suspension feeding *Ophiactis resiliens* and the sponge associate *Ophiothrix caespitosa*. Other echinoderms included several crinoids (*Cenolia* spp, *Antedon* spp), holothurians (*Pentacta ignava*, *Cucuvitrum rowei*), the seastar (*Nectria* sp.) and the eleven armed seastar (*Coscinasterias muricata*). The molluscan fauna was species rich and included Blacklip abalone (*Haliotis rubra*), 6 species of chiton, 5 trochids, several gastropods and several species of mussels found under the *Phyllospora comosa* on top of the boulders. The NSW species *Chiton* (*Rhyssoplax*) *jugosus* was found here. Hermit crabs (*Paguristes*) made use of the numerous large dead gastropod shells. Other abundant invertebrates included sipunculids, nudibranchs, isopods, amphipods and anemones (O'Hara 2000).

Fish

An abundance of reef fish were observed halfway between whaleback rock and the Point Hicks at 10 m where the seafloor consists of large granite boulders (O'Hara 2000). Fish commonly taken by recreational anglers prior to the establishment Marine National Park included salmon (*Arripis trutta*), barracouta (*Thyrsites atun*) and sweep (*Scorpis aequipinnis*) off rocks on Point Hicks (Classon and Wilson 2002).

2.17.4 BIOLOGICAL PROCESSES

Biological processes occurring in the Marine National Park are unknown.

2.17.5 SPECIES DISTRIBUTION INFORMATION

No marine invertebrates, fish or algae are known to have their distributional limits near or within the Marine National Park.

Reptilian species

There are five marine reptiles that occur as vagrants along our eastern shores: Loggerhead Turtle (*Caretta caretta*), Green Turtle (*Chelonia mydas*), Pacific Ridley (*Lepidochelys olivacea*) Leathery Turtle (*Dermochelys coriacea*), Yellow-bellied sea snake (*Pelamis platurus*) (G. Gillespie pers. comm.).

2.17.6 SHOREBIRDS

The list of threatened shorebird species recorded in and around the Point Hicks Marine National Park is shown in Table 2.17.3. Hooded Plover nesting sites have been recorded along the stretch of coast to the east of the Marine National Park, at the mouth of the Mueller and Thurra Rivers (M. Weston pers. comm.), and it is possible that they may forage along the Marine National Park's shore.

2.17.7 MARINE MAMMALS

The Australian Fur Seal, Humpback Whale and Southern Right Whale have all been recorded in and around the boundaries of the Point Hicks Marine National Park.

Table 2.17.3. Selection of some animals and plants that may be found in the Point Hicks Marine National Park.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Ecklonia radiata,* with *Phyllospora comosa, Carpomitra costata*
Invertebrates	octocoral	*Capnella* sp.
	urchin	*Centrostephanus rodgersii*
	polychaetes	*Nereis maxillodentata, Branchiomma* sp., *Trypanosyllis* sp. and terebellid species
	brittle stars	*Ophiactis resiliens, Ophiothrix caespitosa*
	feather stars	*Cenolia* spp, *Antedon* spp.
	holothurians	*Pentacta ignava*, *Cucuvitrum rowei*

	seastars	*Nectria* sp., *Coscinasterias muricata*
	blacklip abalone	*Haliotis rubra*
	hermit crabs	*Paguristes* sp.
	sipunculids	Sipunculacea
	isopods	Isopoda
	amphipods	Amphipoda
Fish	school whiting	*Sillago flindersi*
	sparsely spotted stingaree	*Urolophus paucimaculatus*
	piked dog shark	*Squalus megalops*
	jack mackerel	*Trachurus declivis*
	round snouted gurnard	*Lepidotrigla mulhalli*
	red rock cod	*Scorpaena papillosus*
	cocky gurnard	*Lepidotrigla vanessa*
	banded stingaree	*Urolophus cruciatus*
	short finned gurnard	
	scaber leatherjacket	*Parika scaber*
	gurnard perch	*Neosebastes scorpaenoides*
	salmon	*Arripis trutta*
	barracouta	*Thyrsites atun*
	sweep	*Scorpis aequipinnis*

2.17.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Point Hicks Marine National Park are listed below (MPV database and Buckley 1993):

- Point Hicks and Thurra River, (State significance): Important dune stratigraphic sequence.

2.17.9 KNOWLEDGE GAPS

The only quantitative surveys from within the Marine National Park are the survey of Satisfaction Reef by Kraft (2001) which was restricted to one location within the Park. A survey on invertebrates, algae and fish species was conducted by Australian Marine Ecology for the Abalone Cooperative but was unavailable to us. The survey monitoring sites are marked on Figure A1.17a. There are no other quantitative data available for any marine habitat class in the Point Hicks Marine National Park. All information in the report is derived from qualitative surveys or anecdotal reports. Intertidal reef and sandy beach habitat classes are particularly poorly studied. The only quantitative survey associated with the Marine National Park is the a grab sample of subtidal soft sediment from outside the protected area.

2.17.10 RESEARCH

Author	Project	Notes
(Kraft 2001)	A Survey of subtidal marine benthic algae from the Point Hicks Region of East Gippsland	
(O'Hara 2000)	Faunal and floral assemblages associated with rocky reefs along the Victoria coast	
(Walker-Smith 1998)	A review of Nebaliella (Crustacea: Leptostraca) with the description of a new species from the continental slope of southeastern Australia.	

2.18 Cape Howe Marine National Park

Cape Howe Marine National Park is located on the far eastern point of the Victorian coastline adjacent to the Cape Howe Wilderness Area and the Croajingolong National Park. Cape Howe is representative of the Twofold Shelf Bioregion. Many species are at their most southerly and easterly limits here and distinctive assemblages of reef fish, echinoderms, gastropods and bivalves are present (ECC 2000).

The subtidal reefs in the Cape Howe Marine National Park are dominated by warm temperate species that are common in southern NSW, but rare elsewhere in Victoria. The large urchin *Centrostephanus rodgersii*, which removes macroalgae from shallow reefs creating a coralline algal encrusted habitat, is uncommon elsewhere in the State (ECC 2000). Migrating Humpback Whales are sometimes sighted off the coast and penguins and many bird species nest in the nearby rookeries on Gabo Island.

2.18.1 PHYSICAL PARAMETERS

The Cape Howe Marine National Park is located fifteen kilometres east of Mallacoota and runs adjacent to the Cape Howe Wilderness Zone and the Croajingolong National Park east of Gabo Island Lighthouse Reserve and offshore to three nautical miles. The Iron Prince headland reef is excluded from the Marine National Park. Paleozoic pink granite, purple sandstone and Quaternary dunes and dune sediments are characteristic of the Cape Howe region (ECC 2000).

Table 2.18.1. Physical parameters for Cape Howe Marine National Park (Bird 1993; Ferns and Hough 2000; Kraft 2001).

Park Name	Cape Howe
Conservation status	Marine National Park
Biophysical Region	Twofold Shelf
Size of Park (ha)	3890
Length of coastline (m)	4714
Exposure rating	High
Wave Energy	High
Influential currents	None
Tidal variation – springs (m)	0.9
Tidal variation – neaps (m)	0.6
Water temp - summer (°C)	19
Water temp - winter (°C)	14
0 - 10 m (ha)	320
10 - 20 m (ha)	350

20 - 30 m (ha)	310
30 - 40 m (ha)	540
40 - 50 m (ha)	490
50 - 60 m (ha)	210
70 - 80 m (ha)	230
80 - 90 m (ha)	570
90 - 100 m (ha)	830
100 - 110 m (ha)	40
Discharges	Intermittent creeks
Adjacent catchment	Cape Howe Wilderness Zone and Gabo Island Lighthouse Reserve.

2.18.2 MARINE HABITAT CLASSES

The major Marine Habitat Classes in Cape Howe Marine National Park are sandy beach, intertidal and subtidal reef and subtidal soft sediment (LCC 1993). Significant areas of high profile granite reef with a mixture of flats, bommies and gutters are incorporated into the Marine National Park on either side of Cape Howe (Figure A1.18a).

Low profile sandstone reefs occur between 34-40 m depth out to 2.5 km offshore on both the western and eastern side of the Marine National Park (Roob *et al*. 1999). Offshore, the continental shelf is narrow with a steep inshore profile (0-20 m) and a less steep inner- to mid-shore profile (20-120 m), with the outer-shelf being relatively flat (ECC 2000). Sediments in the Marine National Park are composed of organic material with a median of 64.5% calcium carbonate content and are poorly sorted with median of 92% sand and 8% gravel (ECC 2000). A sample of sediment at 78 m found very coarse sand whilst a fine sand was found at 12 m (Roob and Currie 1996).

Table 2.18.2. Marine Habitat Classes for Cape Howe Marine National Park (Ferns and Hough 2000).

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
	Platform
	Beach / Platform
Substratum relief	Low profile reef
	High profile reef
Substratum texture	Solid reef
	Broken reef
	Gutters

	Fine sand
	Shell rubble / grit
Lithology	Basalt
	Granite
	Sandstone
	Calcarenite
Subtidal reef biota	Kelp - Phyllospora dominated
	Kelp - Macrocystis dominated
	Kelp - Durvillaea dominated
	Kelp - Ecklonia dominated
Subtidal reef understorey biota	Mixed algae - brown dominated
	Mixed algae - other
	Cystophora
	Sessile invertebrates
	Red algae dominated
	Urchin barrens
	Caulerpa
Intertidal reef biota	Durvillaea
	Coralline algae
	Pyura
	Mussels
	Barnacles
Heavy reef Area (ha)	10
Low Profile Reef Area (ha)	140
Total Reef Area (ha)	150
Sediment Area (ha)	1840
Undefined Area (ha)	1900

2.18.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine National Park, refer to Table 2.18.5.

Sandy beaches

No records of invertebrates, macrophytes or fish are available for sandy beaches in the Cape Howe Marine National Park.

Intertidal rocky shore

Flora

The dominant intertidal algae in the Marine National Park are sea lettuce (*Ulva australis*), neptune's necklace (*Hormosira banksii*) and various coralline red algae (Corallinacea). The bull kelp (*Durvillaea potatorum*) occurs on the intertidal fringe and most of the upper intertidal rocks are unvegetated (J. Rudge pers. comm.).

Invertebrate fauna

The upper intertidal is dominated by barnacles (*Tesseropora rosea*, *Chthamalus antennatus*) and mussels (*Xenostrobus pulex*) with Sydney rock oyster (*Saccostrea glomerata*), red bait crabs (*Plagusia chabrus*), keyhole limpets (Fissurellidae) and hermit crabs (Paguridae) are also present in rock pools (John Rudge pers. comm.). In deeper pools, the elephant snail (*Scutus antipodes*), abalone (*Haliotis rubra* and *Haliotis coccoradiata*), seastars (*Patiriella* spp.) and swift-footed crab (*Leptograpsus variegatus*) are common (J. Rudge pers. comm.).

Fish

Little is known about intertidal fish, although sea mullet (*Mugil cephalus*) are sometimes caught in rockpools in Cape Howe Marine National Park (J. Rudge pers. comm.).

Subtidal reef

Flora

The shallow water macrophyte community (5-12 m) on the high profile granite reef is dominated by a dense canopy of *Phyllospora comosa* which sometimes grows up to 2 m high (O'Hara 2000) and covers up to half the substrate along with a much smaller component of *Cystophora* sp. (Roob and Currie 1996). Encrusting coralline algae grows sparsely beneath the macroalgae, but forms a dense cover elsewhere excluding all macroalgae, except for approximately 20% of the substrate which is bare (Roob and Currie 1996).

Other algae species present in shallow water high profile reefs include the brown algae (*Zonaria* spp., *Halopteris* spp., and *Cladostephus spongiosus*) the greens (*Ulva* spp.,) and the red algae *Galaxaura maginata*, *Plocamium angustum*, *P*. *leptophyllum* and various corallines (O'Hara 2000). No macroflora was recorded deeper than 34 m where sparse red algae was found on a low profile sandstone reef (Roob and Currie 1996).

Invertebrate fauna

Faunal composition varies with depth and substrate in the Cape Howe Marine National Park. A survey of shallow subtidal (5 m) high-profile granite reef found the dominant sessile invertebrates to include sponges, bryozoans and several ascidians (including the sea tulip *Pyura gibbosa*) many of which supported a diverse epifauna (O'Hara 2000). Motile invertebrates included large gastropods (including *Cabestana spengleri*), seastars (including *Patiriella calcar*), and several syllid polychaetes, ophiuroids and crabs (O'Hara 2000). At a deeper (12 m) high profile granite reef site echinoids including *Heliocidaris erythrogramma* and *Heliocidaris tuberculata* were observed along with the red bait crab *Plagusia chabrus* and juvenile blacklip abalone *Haliotis rubra* (Roob and Currie 1996).

Both eastern rock lobster (*Jasus verreauxi*) and southern rock lobster (*Jasus edwardsii*) are present in the Marine National Park (J. Rudge pers. comm.).

A diverse assemblage of sessile invertebrates including sponges, hydroids, bryozoans and gorgonians including the sea-whip *Primnoella australasiae* were found on low profile subtidal sandstone reefs in 34 m – 40 m water (Roob and Currie 1996). No epifauna were present on an area of flat shell and rubble substrate covered by a thin layer of fine silt at 87 m depth (Roob and Currie 1996).

A checklist of marine invertebrate fauna was prepared for nearby Gabo Island which is just over one kilometre from the Marine National Park and found a high diversity of species (Appendix 6).

Fish

A checklist of fish was prepared for nearby Gabo Island located just over a kilometre from the Marine National Park boundary and identifies a high diversity of fish (Appendix 5). Many species of morwong (*Cheilodactylus* spp.), wrasse (Labridae) and leatherjacket (Monacanthidae) were observed in addition to Port Jackson (*Heterodontus portusjacksoni*) and wobbegong sharks (*Orectolobus maculatus*).

Subtidal soft substrata

No records of invertebrates, macrophytes or fish are available for subtidal soft substrata in the Cape Howe Marine National Park.

2.18.4 BIOLOGICAL PROCESSES

Intermittent upwellings occur along the east Gippsland coast (IMCRA Technical Group 1998) and upwellings are usually associated with increased nutrients and often an entrainment of plankton including ichthyoplankton.

2.18.5 SPECIES DISTRIBUTION INFORMATION

No marine invertebrates, fish or algae are known to have their distributional limits near or within the Marine National Park.

Reptilian species

There are five marine reptiles that occur as vagrants along our eastern shores: Loggerhead Turtle (*Caretta caretta*), Green Turtle (*Chelonia mydas*), Pacific Ridley (*Lepidochelys olivacea*) Leathery Turtle (*Dermochelys coriacea*), Yellow-bellied sea snake (*Pelamis platurus*) (G. Gillespie pers. comm.).

2.18.6 SHOREBIRDS

Very few threatened, or non-threatened, shorebird sightings are recorded in the AVW within the Cape Howe Marine National Park. However, the surrounding waters and nearby Gabo Island produced the list of threatened species shown in Table 2.18.3. It is probable that many of these species would be seen within the boundaries of the Marine National Park.

The Hooded Plover has been observed along the shoreline of the Marine National Park but it is not clear whether this was a breeding area or not.

Gabo Island has a large colony of breeding Little Penguins. There are an estimated 35,000 breeding pairs, with nesting occurring from May to January, peak laying from August to October and moulting occurring from February to March. Little Penguins can be seen feeding within the boundaries of the Marine National Park.

2.18.7 MARINE MAMMALS

Australian Fur Seals have been recorded within and around the Cape Howe Marine National Park. Migrating Humpback Whales, sometimes followed by pods of Killer Whales, have also been observed passing through the Marine National Park area on their migration between warm tropical waters and cold Antarctic waters.

Table 2.18.3. Threatened shorebird records from Cape Howe Marine National Park surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		1998
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		2000
Buller's Albatross	*Diomedea bulleri*		Vul			1998
Caspian Tern	*Sterna caspia*	L		Vul	CJ	1994
Crested Tern	*Sterna bergii*			LR		1998
Eastern Curlew	*Numenius madagascariensis*			LR	CJ	1978
Fairy Prion	*Pachyptila turtur*		Vul	LR		1993
Hooded Plover	*Thinornis rubricollis*	L		End		1998
Little Tern	*Sterna albifrons*	L		Vul	CJ	1991
Pacific Gull	*Larus pacificus*			LR		1998
Pied Cormorant	*Phalacrocorax varius*			LR		1998
Pomarine Jaeger	*Stercorarius pomarinus*			Ins	CJ	1996
Shy Albatross	*Diomedea cauta*		Vul			1991
Wandering Albatross	*Diomedea exulans*		Vul	CEn	J	1996
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	L		End	C	1998
White-faced Storm-Petrel	*Pelagodroma marina*			Vul		1993

Table 2.18.4. Threatened marine mammal records from Cape Howe Marine National Park and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australian Fur Seal	*Arctocephalus pusillus*			Vul		1991
Humpback Whale	*Megaptera novaeangliae*		Vul	End		1988
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1993

Table 2.18.5. Selection of some animals and plants that may be found in the Cape Howe Marine National Park.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Phyllospora comosa, Zonaria* spp., *Halopteris* spp.,
	green algae	*Ulva australis, Ulva* spp.,
	red algae	*Galaxaura maginata*, *Plocamium angustum*, *P. leptophyllum*
	coralline red algae	Corallinacea
Invertebrates	barnacles	*Tesseropora rosea*, *Chthamalus antennatus*

	mussels	*Xenostrobus pulex*
	Sydney rock oyster	*Saccostrea glomerata*
	red bait crab	*Plagusia chabrus*
	keyhole limpets	Fissurellidae
	hermit crabs	Paguridae
	elephant snail	*Scutus antipodes*
	abalone	*Haliotis rubra* and *Haliotis coccoradiata*
	seastars	*Patiriella* spp.
	swift-footed crab	*Leptograpsus variegatus*
	sponges	
	bryozoans	
	ascidian	*Pyura gibbosa*
	gastropod	*Cabestana spengleri*
	seastars	*Patiriella calcar*
	syllid polychaetes	
	ophiuroids	
	urchin	*Heliocidaris erythrogramma* and *Heliocidaris tuberculata*
	red bait crab	*Plagusia chabrus*
	blacklip abalone	*Haliotis rubra*

2.18.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Cape Howe Marine National Park are listed below (MPV database and Buckley 1993):

- Telegraph Point (National Significance): Large cuspate foreland with active transverse dune ridges.
- Iron Prince Reef (Cape Howe) (State significance): Active transverse dune ridges and Merimbula Group outcrop.

2.18.9 KNOWLEDGE GAPS

A quantitative survey on invertebrates, algae and fish species was conducted by Australian Marine Ecology for the Abalone Cooperative but was unavailable to us. The survey monitoring sites are marked on Figure A1.18a. There are no other quantitative data available for any marine habitat class in the Cape Howe Marine National Park. All information in the report is derived from qualitative surveys or anecdotal reports. Intertidal reef and sandy beach habitat classes are particularly poorly studied. There is no information on the sandy beaches or subtidal soft sediment available for the Marine National Park.

2.18.10 RESEARCH

Author	Project	Notes
(O'Hara 2000)	Faunal and floral assemblages associated with rocky reefs along the Victoria coast	

3.1 Merri Marine Sanctuary

The Merri Marine Sanctuary includes a large intertidal platform in an area that experiences significant numbers of visitors. The Marine Sanctuary contains two offshore islands and a diverse range of habitats including unvegetated soft sediments, sand beaches and both intertidal and subtidal reef.

3.1.1 PHYSICAL PARAMETERS

The Merri Marine Sanctuary is approximately two kilometres from the centre of Warrnambool and surrounds two small offshore Islands (Merri and Middle Island). The most significant discharge into the Marine Sanctuary is the Merri River after which the Sanctuary is named.

Table 3.1.1. Physical parameters for the Merri Marine Sanctuary.

Park Name	Merri
Conservation status	Marine Sanctuary
Biophysical Region	Otway
Size of Park (ha)	25
Length of coastline (m)	2674
Exposure rating	Moderate
Wave Energy	Low
Influential currents	None
Tidal variation - springs (m)	0.8
Tidal variation - neaps (m)	0
Water temp - summer (°C)	17
Water temp - winter (°C)	13.5
0 - 10 m (ha)	25
Discharges	Merri River
Adjacent catchment	Urban, Agricultural.

3.1.2 MARINE HABITAT CLASSES

The Marine Sanctuary encompasses large areas of gradually sloping intertidal reef near the shore and also significant areas of subtidal soft sediment. Surrounding the offshore islands are areas of intertidal and subtidal reef with rocky overhangs and gutters with great habitat diversity (Figure A2.1a). No quantitative survey of either flora or fauna has been undertaken in the Merri Marine Sanctuary, however some information can be derived from surveys of nearby coastline or incidental reports. The Marine Research Group completed a limited survey of intertidal invertebrates on calcarenite reefs between Pickering and Thunder Points in the Marine Sanctuary (Handreck and O'Hara 1994b).

Table 3.1.2. Marine Habitat Classes for the Merri Marine Sanctuary.

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
	Platform
	Beach / Platform
	Cliff
Substratum relief	High profile reef
Substratum texture	Solid reef
Artificial structure	Nearby breakwater (not in Marine National Park)
Lithology	Sandstone
	Calcarenite
Subtidal reef biota	Kelp - mixed Phyllospora / Ecklonia
Subtidal reef understorey biota	Sessile invertebrates
Subtidal sediment biota	Amphibolis
Heavy reef Area (ha)	20
Total Reef Area (ha)	20
Undefined Area (ha)	4

3.1.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine Sanctuary, refer to Table 3.1.6.

Intertidal reef

No quantitative information on flora or fauna is available for the intertidal reef in the Marine Sanctuary.

Flora

There are no quantitative data from Merri Marine Sanctuary. Common intertidal macrophytes include *Ulva* sp., red coralline algae (Corallinaceae), *Caulerpa* sp., *Phyllospora comosa* and *Codium pomoides*. neptune's necklace (*Hormosira banksii*) is less common and seagrass (*Amphibolis antarctica* and *Zostera*/*Heterozostera* sp.) is sometimes present in rockpools. The bull kelp *Durvillaea potatorum* is present on the fringe of the intertidal reef (T. Matthews pers. comm.).

Invertebrate fauna

Common intertidal marine invertebrates in the Marine Sanctuary include gastropods (*Thais orbita*, *Cominella lineolata*, *Austrocochlea constricta*, *Turbo undulatus*), limpets (*Cellana tramoserica*, *Patelloida alticostata*, *Siphonaria* sp., *Patelloida latistrigata*), sea stars (*Patiriella calcar*, *Coscinasterias muricata*, *Allostichaster polyplax*), crabs (*Cyclograpsus granulosus*, *Paragrapsus quadridentatus*), anemones (*Actinia tenebrosa*) (T. Matthews pers comm.). Also present are the gastropods (*Littorina unifasciata*, *Bembicium nanum*, *Lepsiella vinosa*, *Pleuroploca australasia*), sea hare (*Aplysia* sp.), cone anemone shell (*Conus* sp.), air-breathing onchidellid gastropods (*Onchidella patelloides*), brittle stars (*Ophionereis* sp.), chitons, terebellid polychaetes and mussels (*Brachidontes rostratus*, *Xenostrobus pulex*) (T. Matthews pers. comm.).

An MRG survey of the intertidal reefs in the Marine Sanctuary found 86 species and the highest level of species richness in the Warrnambool region on calcarenite reefs. Gastropod snails were most common and comprised over half of the species found in the area, with crabs, seastars and anemones also of medium diversity (Handreck and O'Hara 1994b).

Fish

In larger rockpools, fish including sweep (*Scorpis aequipinnis*), Tasmanian blenny (*Parablennius tasmanianus*) and wrasse are sometimes found (T. Matthews pers. comm.)

Subtidal reef

No quantitative information on flora or fauna is available for the reef in the Marine Sanctuary.

Flora

The subtidal reef is dominated by the brown kelps *Phyllospora comosa* and *Ecklonia radiata*. Other species present include the green algae *Caulerpa* sp. and red algae (MCCN 2002).

Invertebrate fauna

Numerous sponges, brittle stars and soft corals are present and also southern rock lobster (*Jasus edwardsii*) is occasionally sighted (M. Koopman pers. comm.).

Fish

No quantitative surveys of subtidal fish were found. The dominant fish on the subtidal reefs in Merri Marine Sanctuary are sea sweep (*Scorpis aequipinnis*) and zebra fish (*Girella zebra*). Other species present in significant numbers include marble cod (*Aplodactylus arctidens*), wrasse (*Notolabrus tetricus*, *N. fucicola*), herring cale (*Odax cyanomelas*), salmon

(*Arripis trutta*), barracouta (*Thyrsites atun*), Port Jackson shark (*Heterodontus portusjacksoni*), eagle ray, leatherjackets and clinid weedfish (M. Koopman pers. comm.).

Subtidal soft sediment

No quantitative data are available on subtidal soft sediment in the Marine Sanctuary, however common fish include sea mullet (*Mugil cephalus*) and salmon (*Arripis trutta*) near the Merri River mouth (M. Koopman, pers. comm.). Cat shark (*Parascyllium* sp.), and draughtboard shark (*Cephaloscyllium laticeps*) are also present (Park Notes).

3.1.4 BIOLOGICAL PROCESSES

Biological processes occurring within the Marine Sanctuary are unknown.

3.1.5 SPECIES DISTRIBUTION INFORMATION

A list of algae species which have their distributional limits at or near the Merri Marine Sanctuary is presented in Table 3.1.3. No other algae or invertebrate species have their distributional limits near the area. The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

Table 3.1.3. Biota with distributional limits located at or near the Merri Marine Sanctuary. (PW – presumed to be at or near western limit in Sanctuary, PE – presumed to be at or near eastern limit in Sanctuary).

Phylum	Family	Species	Common name	Category
Phaeophyta	Dictyotaceae	*Padina fraseri*	Brown algae	PW
Rhodophyta	Ceramiaceae	*Antithamnion verticale*	Red algae	PE
Rhodophyta	Ceramiaceae	*Pterothamnion squarrulosum*	Red algae	PE
Rhodophyta	Ceramiaceae	*Ptilotia hannafordi*	Red algae	PE
Rhodophyta	Corallinaceae	*Lithophyllum johansenii*	Red algae	PE
Rhodophyta	Erythrotrichiaceae	*Erythrotrichia ligulata*	Red algae	PE
Rhodophyta	Halymeniaceae	*Grateloupia ovata*	Red algae	PE
Rhodophyta	Kallymeniaceae	*Callophyllis cervicornis*	Red algae	PE

3.1.6 SHOREBIRDS

Threatened shorebird species recorded within the boundaries of the Merri Marine Sanctuary and surrounding waters are listed in Table 3.1.4.

Within the Marine Sanctuary are two breeding colonies of Little Penguins. Merri Island holds a population of approximately 10 breeding pairs whilst Middle Island holds approximately 400 breeding pairs. These birds are present all year round with nesting occurring from May to January, peak laying from August to October and moulting occurring from February to March. They are a protected species under the 1975 Wildlife Act.

A Hooded Plover observation was recorded about 2km away from the Marine Sanctuary, along the coast between Rutledges Cutting and Leveys Point.

3.1.7 MARINE MAMMALS

Approximately 3 km east of the Marine Sanctuary lies Logan's Beach whale Marine Sanctuary, representing an important calving site for the southern Right Whale (Critically endangered, TWV). Calving occurs from May to October with up to 8 adult/calf pairs regularly recorded. Humpback Whales have also been recorded in the waters offshore from Merri Marine Sanctuary.

Other threatened marine mammals to have been sighted in the surrounding waters include the Subantarctic Fur Seal and Southern Elephant Seal (AVW).

Table 3.1.4. Threatened shorebird records from Merri Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		2000
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		2000
Blue Petrel	*Halobaena caerulea*		Vul			1990
Caspian Tern	*Sterna caspia*	L		Vul	CJ	1997
Crested Tern	*Sterna bergii*			LR		2000
Great Egret	*Ardea alba*	L		End	CJ	2000
Pacific Gull	*Larus pacificus*			LR		1999
Pied Cormorant	*Phalacrocorax varius*			LR		1998
Southern Giant-Petrel	*Macronectes giganteus*		End	End		1987

Table 3.1.5. Threatened marine mammal records from Merri Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Humpback Whale	*Megaptera novaeangliae*		Vul	End		1986
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1993
Subantarctic Fur Seal	*Arctocephalus tropicalis*		Vul			1997

Table 3.1.6. Selection of some animals and plants that may be found in the Merri Marine Sanctuary.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	**Scientific name**
Flora	brown algae	*Phyllospora comosa, Hormosira banksii, Ecklonia radiata*
	green algae	*Ulva* sp., *Caulerpa* sp., *Codium pomoides,*
	waratah anemone	*Actinia tenebrosa*
	red coralline algae	Corallinaceae
Invertebrates	gastropods	*Thais orbita*, *Cominella lineolata*, *Austrocochlea constricta*, *Turbo undulatus, Littorina unifasciata*, *Bembicium nanum*, *Lepsiella vinosa, Pleuroploca australasia*, *Onchidella patelloides*
	limpet gastropods	*Cellana tramoserica, Patelloida alticostata*, *Siphonaria* sp., *Patelloida latistrigata*
	sea stars	*Patiriella calcar, Coscinasterias muricata*, *Allostichaster polyplax*
	crabs	*Cyclograpsus granulosus*, *Paragrapsus quadridentatus*
	sea hare	*Aplysia* sp.
	cone anemone shell	*Conus* sp.
	brittle stars	*Ophionereis* sp.
	chitons	
	terebellid polychaetes	
	mussels	*Brachidontes rostratus*, *Xenostrobus pulex*
Fish	sea sweep	*Scorpis aequipinnis*
	zebra fish	*Girella zebra*
	marble cod	*Aplodactylus arctidens*
	wrasse	*Notolabrus tetricus*, *N. fucicola*
	herring cale	*Odax cyanomelas*
	salmon	*Arripis trutta*
	barracouta	*Thyrsites atun*
	Port Jackson shark	*Heterodontus portusjacksoni*
	eagle ray	
	leatherjackets and clinid weedfish	
	sea mullet	*Mugil cephalus*
	salmon	*Arripis trutta*
	cat shark	*Parascyllium* sp.
	draughtboard shark	*Cephaloscyllium laticeps*

3.1.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

There are no known sites of geological or geomorphological significance in the Marine Sanctuary.

3.1.9 KNOWLEDGE GAPS

No quantitative data are available for either subtidal or intertidal reef in the Merri Marine Sanctuary and all information presented has been derived from incidental reports or residents' local knowledge.

3.1.10 RESEARCH

Author	Project	Notes
Ovareem, R.	Little Penguin project at Merri Reserve	Ongoing PhD project

3.2 The Arches Marine Sanctuary

To the south of Port Campbell, the Arches Marine Sanctuary is situated over limestone seafloor with a series of ledges, deep cracks and vertical sinkholes and then a series of tunnels, arches and caverns that provide a shaded habitat for a wide diversity of invertebrate species. This is a popular dive site due to the spectacular physical and biological scenery provided by this offshore Marine Sanctuary.

3.2.1 PHYSICAL PARAMETERS

The Arches Marine Sanctuary is situated approximately one kilometre offshore from Port Campbell and is part of a very exposed section of coast.

Table 3.2.1. Physical parameters for the Arches Marine Sanctuary.

Park Name	**The Arches**
Conservation status	Marine Sanctuary
Biophysical Region	Otway
Size of Park (ha)	45
Length of coastline	0
Exposure rating	High
Wave Energy	High
Influential currents	None
Tidal variation - springs (m)	0.9
Tidal variation - neaps (m)	0.3
Water temp - summer (°C)	17
Water temp - winter (°C)	13.5
10 - 20 m (ha)	40
20 - 30 m (ha)	5
Discharges	None
Adjacent catchment	N/A

3.2.2 MARINE HABITAT CLASSES

The Marine Habitat Classes in the Arches Marine Sanctuary are high and low profile subtidal reef (Figure A2.2a). The subtidal reef habitat includes spectacular limestone formations such as canyons, tunnels, arches, caverns, ledges, cracks and vertical sinkholes.

Table 3.2.2. Marine Habitat Classes for the Arches Marine Sanctuary.

Marine Habitat Class	**Attributes**
Substratum relief	Low profile reef
	High profile reef
Substratum texture	Solid reef
	Broken reef
	Gutters
	Coarse sand
	Medium sand
	Fine sand
	Shell rubble / grit
Lithology	Calcarenite
Subtidal reef biota	Kelp - mixed Phyllospora / Ecklonia
Subtidal reef understorey biota	Mixed algae - brown dominated
	Cystophora
	Acrocarpia
	Sessile invertebrates
	Coralline algae
Low Profile Reef Area (ha)	45
Total Reef Area (ha)	45

3.2.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine Sanctuary, refer to Table 3.2.5.

Subtidal reef

No quantitative information on flora or fauna is available for the reef in the Marine Sanctuary.

Flora

Incidental observations indicate that the upper surfaces of The Arches are covered in *Ecklonia radiata* kelp with an understorey of red algae (O'Hara 2000). Other kelps (*Phyllospora comosa*) have also been reported from the shallower areas at this site (J. Rudge pers comm.) and stands of *Macrocystis angustifolia* are also present within the Sanctuary (O'Hara 2000). At a nearby site the algal understorey consisted of foliose reds (*e.g.,*. *Plocamium* spp, *Hymenena* spp, *Ballia callitricha*, *Nizymenia australis*, *Phacelocarpus peperocarpos*), coralline algae, the encrusting red *Sonderopelta coriacea* and tufty brown algae (*Zonaria* spp, *Halopteris* spp) (O'Hara 2000). Also recorded at a nearby site were at least four species of the genus Caulerpa (*C. brownii, C. obscura, C. flexilis, C. cactoides*) and both *Cystophora moniliformis* and *Cystophora grevillei* (J. Rudge, pers comm.). The floral assemblage within the Marine Sanctuary is likely to be similar.

Invertebrate fauna

The underneath of The Arches and on the sides of the canyons is dominated by a diverse sessile faunal assemblage usually characteristic of some deeper Bass Strait waters (O'Hara 2000). The large sessile animals observed included sponges, bryozoans, gorgonians and hydroids. The seastars *Petricia vernicina*, *Formia polypora*, *Nectria* spp, and *Plectaster decanus* were common (O'Hara 2000).

Other large invertebrates collected from a nearby site by O'Hara (2000), also considered typical of rocky habitats along the Victorian coast, include the black lip abalone *Haliotis rubra*, the large turbinate gastropod *Turbo undulatus* and the elephant snail (*Scutus antipodes*). Bonnet limpets (*Sabia australis*) were also found on those large gastropod species. Several chitons were collected including large specimens of *Ischnochiton elongatus*. southern rock lobsters, red bait crabs (*Plagusia chabrus*) and the white sea urchin *Heliocidaris erythrogramma* have also been observed within The Arches Marine Sanctuary as well as the occasional green lip abalone (*Haliotis laevigata*), the tiger cowrie *Cypraea comptoni* and the seastar *Pateriella exigua* (J. Rudge pers comm.).

Fish

The common fish species that have been reported from this Sanctuary include the sea sweep (*Scorpis aequipinnis*), zebra fish (*Girella zebra*), snapper (*Chrysophrys auratus*), marble fish (*Aplodactylus arctidens*), magpie perch (*Cheilodactylus nigripes*), Australian salmon (*Arripis truttacea*), scaly fin (*Parma victoriae*) and blue throat wrasse (*Notolabrus tetricus*) (J. Rudge pers comm.). The Port Jackson shark (*Heterodontus portusjacksoni*) is also commonly seen in the Arches Marine Sanctuary (MCCN 2002). Commercial and recreational fishers outside the Sanctuary also mention short-fin mako (*Isurus oxyrinchus*) taking baits (J. Rudge pers comm.).

3.2.4 BIOLOGICAL PROCESSES

Biological processes occurring within the Marine Sanctuary are unknown.

3.2.5 SPECIES DISTRIBUTION INFORMATION

No marine invertebrates, fish or algae are known to have their distributional limits near or within the Marine Sanctuary.

3.2.6 SHOREBIRDS

There are no recorded sightings of threatened bird species within the Arches Marine Sanctuary within the AVW. Species which have been recorded in the vicinity include the Australasian Gannet, Black-faced Cormorant, Crested Tern and Pied Cormorant and it is reasonable to assume that these species may also be sighted in the Marine Sanctuary (Table 3.2.3).

3.2.7 MARINE MAMMALS

Australian Fur Seals have been observed in the Arches Marine Sanctuary (Park Notes). In the surrounding waters, species such as the Humpback Whale, Southern Right Whale and Southern Elephant Seal have all been recorded (AVW). As water depths at this site are around 20m it is likely that such species may also be observed within the Marine Sanctuary at times.

Table 3.2.3. Threatened shorebird records from The Arches Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		1995
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		1997
Crested Tern	*Sterna bergii*			LR		1995
Pied Cormorant	*Phalacrocorax varius*			LR		1995

Table 3.2.4. Threatened marine mammal records from The Arches Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Humpback Whale	*Megaptera novaeangliae*		Vul	End		1997

Table 3.2.5. Selection of some animals and plants that may be found in the Arches Marine Sanctuary.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Ecklonia radiata, Phyllospora comosa, Cystophora moniliformis* and *Cystophora grevillei*
	red algae	*Plocamium* spp, *Hymenena* spp, *Ballia callitricha*, *Nizymenia australis*, *Phacelocarpus peperocarpos*
	green algae	*Caulerpa brownii, C. obscura, C. flexilis, C. cactoides*
Invertebrates	seastars	*Petricia vernicina*, *Formia polypora*, *Nectria* spp., and *Plectaster decanus*

	black lip abalone	*Haliotis rubra*
	gastropod	*Turbo undulatus*
	elephant snail	*Scutus antipodes*
	bonnet limpets	*Sabia australis*
	chitons	*Ischnochiton elongatus*
	red bait crabs	*Plagusia chabrus*
	sea urchin	*Heliocidaris erythrogramma*
Fish	sea sweep	*Scorpis aequipinnis*
	zebra fish	*Girella zebra*
	snapper	*Chrysophrys auratus*
	marble fish	*Aplodactylus arctidens*
	magpie perch	*Cheilodactylus nigripes*
	Australian salmon	*Arripis truttacea*
	scaly fin	*Parma victoriae*
	blue throat wrasse	*Notolabrus tetricus*
	Port Jackson shark	*Heterodontus portusjacksoni*

3.2.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

There are no known sites of geological or geomorphological significance in the Marine Sanctuary.

3.2.9 KNOWLEDGE GAPS

No quantitative data are available for the subtidal reefs in the Arches Marine Sanctuary and all information in this section has been derived from incidental reports or residents' local knowledge. No species are known to be restricted or have their distributional limits at the Arches Marine Sanctuary.

3.2.10 RESEARCH

Author	Project	Notes
(O'Hara 2000)	Faunal and floral assemblages associated with rocky reefs along the Victoria coast	

3.3 Marengo Reefs Marine Sanctuary

The Marengo Reefs support a high diversity of both intertidal and subtidal flora and fauna. The offshore nature of the Marine Sanctuary assists in maintaining the low level of human impact on the reef although the area is very popular as a snorkelling and diving location. Australian Fur-Seals occasionally haul out on the exposed section of the reef.

3.3.1 PHYSICAL PARAMETERS

The Marengo Marine Sanctuary is located less than two kilometres west of Apollo Bay, offshore from the small town of Marengo on the Great Ocean Road. Henty and Little Henty reefs, around which the Sanctuary is based, lie approximately 80 m offshore from Marengo and are exposed only at low tide when a channel of about 100m separates each island (Tsernjavski 1995). The reefs are composed of relatively smooth Cretaceous sandstone and are the only exposed offshore reefs between Cape Schanck and the Schomberg reef near Peterborough (Smith 1993) in (Tsernjavski 1995).

Table 3.3.1. Physical parameters for Marengo Marine Sanctuary.

Park Name	**Marengo Reefs**
Conservation status	Marine Sanctuary
Biophysical Region	Central Victoria
Size of Park (ha)	12
Length of coastline (m)	0
Exposure rating	High
Wave Energy	High
Influential currents	None
Tidal variation - springs (m)	1.7
Tidal variation - neaps (m)	0.9
Water temp - summer (°C)	17
Water temp - winter (°C)	13.5
0 - 10 m (ha)	6
10 - 20 m (ha)	6
Discharges	None
Adjacent catchment	N/A

3.3.2 MARINE HABITAT CLASSES

The major Marine Habitat Classes in the Marengo Reefs Marine Sanctuary are intertidal and subtidal reef and a small area of subtidal soft sediment between the two reefs (Figure A2.3a).

Table 3.3.2. Marine Habitat Classes for Marengo Marine Sanctuary.

Marine Habitat Class	Attributes
Shoreline category	Platform
Substratum relief	High profile reef
Substratum texture	Broken reef
	Gutters
	Medium sand
	Fine sand
Lithology	Basalt
	Limestone
Subtidal reef biota	Kelp - Phyllospora dominated
Subtidal reef understorey biota	Cystophora
	Sessile invertebrates
	Caulerpa
Intertidal reef biota	Durvillaea
	Coralline algae
	Pyura
	Mussels
	Barnacles
Heavy reef Area (ha)	10
Total Reef Area (ha)	10
Sediment Area (ha)	2

3.3.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine Sanctuary, refer to Tables 3.3.2., 3.3.3 and 3.3.8.

Intertidal rocky shore

Flora

Intertidal macrophytes recorded from Marengo Reef Marine Sanctuary include *Phyllospora comosa* and the Bull kelp *Durvillaea potatorum* (Tsernjavski 1995).

Invertebrate fauna

Intertidal marine invertebrates were surveyed by the Marine Research Group of Victoria and Table 3.3.3. presents a checklist of species that have been recorded from within the Marengo Reef Sanctuary (adapted from (Tsernjavski 1995))

Table 3.3.3. Intertidal marine invertebrates of the Marengo Marine Sanctuary.

Common Name	Scientific Name
White-stripped anemone	*Anthothoe albocincta*
Brittle star	*Ophioplocus bispinosus*
Feather star	*Antedon sp*
Sea cucumber	*Staurothyone inconspicua*
Sea urchin	*Heliocidaris erythrogramma*
Blacklip abalone	*Haliotis rubra*
Rugose slit limpet	*Clypidina rugosa*
Gastropod	*Cantharidus pulcherrimus*
Gastropod	*Macrozafra fulgida*
Gastropod	*Pseudamycla dermestoidea*
Southern crypt dweller (bivalve)	*Hiatella australis*
Bivalve	*Notomytilus ruber*
Bivalve	*Lissarca rhomboidalis*
Bivalve	*Musculus paulucciae*
Golf ball sponge	*Tethya sp.*
Bryozoan (Moss animal)	*Paracribricellina cribraria*
Bryozoan (Moss animal)	*Claviporella sp*
Bryozoan (Moss animal)	*Catenicella elegans*
Bryozoan (Moss animal)	*Crisia acropora*
Three pronged “sea spider” crab	*Halicarcinus ovatus*
Cleft fronted shore crab	*Plagusia chabrus*
Decorator crab	*Pilumnus sp*
Decorator crab	*Notomithrax sp*
Spiny porcelain crab	*Petrocheles australiensis*
Hairy stone crab	*Lomis hirta*
Hermit crab	*Pagurixus handrecki*
Stalked barnacle	*Ibla quadrivalvis*
Acorn barnacle	*Catomerus polymerus*
Acorn barnacle	*Chthamalus antennatus*
Acorn barnacle	*Epopella simplex*
Acorn barnacle	*Austromegabalanus nigrescens*
Biscuit star	*Tosia australis*
Eleven arm sea star	*Coscinasterias calamaria*
Diminutive sea star	*Patiriella exigua*
Sea star	*Patiriella calcar*
Sea star	*Allostichaster polyplax*

Sea star	*Ophiactis resiliens*
	Ophionereis schayeri
	Amphiura cf ptena
	Ophiothrix caespitosa
Ribbed top shell	*Austrocochlea constricta*
Chequered top shell	*Austrocochlea odontis*
Wavy clanculus	*Clanculus undatus (dead)*
Plebeian clanculus	*Clanculus plebejus*
Warrener	*Turbo undulatus*
Golden star	Astrea aurea
Banded periwinkle	*Littorina unifasciata*
Stripe-mouthed coniwink	*Bembicium nanum*
Conical horse hoof	*Hipponix conicus*
Foliaceous bonnet limpet	*Antisabia foliacea*
Ophione hidden bubble shell	*Lamellaria ophione*
Brown cowry	*Cypraea angustata*
Warted sand whelk	*Cymatiella verrucosa*
Wine mouthed lepsiella	*Lepsiella vinosa*
Dog whelk	*Thais orbita*
Lineated cominella	*Cominella lineolata*
Tulip shell	*Pleuroploca australasia (juvenile)*
Glabrous mitre	*Mitra carbonaria (dead)*
Magpie mitre	*Waimatea obscura*
Anemone cone shell	*Conus anemone*
Wilson’s coral shell	*Coralliophila wilsoni*
	Magilia caperata
	Patelloida insignis
Elongate Ischnochiton	*Ischnochiton elongatus*
Southern Ischnochiton	*Ischnochiton australis*
Hidden Acanthochiton	*Acanthochitona retrojecta*
White Plaxiphora	*Plaxiphora albida*
	Callochiton crocina
Variegated Ischnochiton	*Ischnochiton versicolor*
Corded heterozona	*Ischnochiton variegatus*
	Chiton calliozonas
Van Dieman’s land siphon shell	*Siphonaria diemenensis*
Corded siphon shell	*Siphonaria funiculata*
Sea hare	*Aplysia sp*

	Caldudia affinis
Hairy ark shell	*Barbatia pistachia*
Scaly ark shell	*Acar squamosa*
Beaked mussel	*Austromytilus rostratus*
Little black horse mussel	*Xenostrobus pulex*
Thick ribbed cardiata	*Cardita crassicosta*
Hairy three area mussel	*Gregariella barbatus*
Southern crypt dweller	*Hiatella australis*
Scallop	*Chlamys atkinos*

A very rich community of 96 species was identified at one reef in one visit (in Tsernjavski 1995) and 108 species are recorded from the area altogether (Handreck and O'Hara 1994b).

Fish

No data relating to intertidal fish from Marengo Reef Marine Sanctuary were found.

Subtidal reef

Flora

The nearest information on subtidal reef flora for the area was from at site 16 km away (Tsernjavski 1995) and Table 3.3.4. provides a checklist of algal species recorded from this nearby site.

Table 3.3.4. List of algae species on a sandstone reef sixteen kilometres east of Marengo Reef Marine Sanctuary between Cape Patton and Grey River (Tsernjavski 1995).

Common Name	Scientific Name
Phaeophyta (brown algae)	Sargassum sp.
	Sargassum globulariea
	Zonaria angustata
	Zonaria sp.
	Halopteris sp.
	Cystophora torlosa
	Cystophora subfarcinata
	Cystophora retorta
Chlorophyta (green algae)	Caulerpa longifolia
Rhodophyta (red algae)	Haliptilon sp.
	Liagora sp.
	Plocamium sp.
	Cheilosporum saggitatum

	Corallina officinalis
	Laurencia sp
	Lobospira sp
	Corallina sp.
	Jania sp.

Invertebrate fauna

A relatively recent subtidal survey of Little Henty Reef found the most numerically dominant subtidal invertebrate was the common sea-urchin (*Heliocidaris erythrogramma*) with green warreners (*Turbo undulatus*), sea tulips (*Pyura* sp.), elephant snails (*Scutus antipodes*) and blacklip abalone (*Haliotis rubra*) also common (Tsernjavski 1995). A single southern rock lobster (*Jasus novaehollandiae*) was also found. Interestingly the tulip shell (*Pleuroploca australasia*) was more abundant than on other reef areas in the region (Tsernjavski 1995),

Fish

Numerous subtidal reef fish were identified in a recent survey with the most numerically abundant species being the zebra fish (*Girella zebra*) (Tsernjavski 1995). Other common species included globe fish (*Diodon nicthemerus*), herring cale (*Odax cyanomelas*), purple wrasse (*Pseudolabrus fucicola*), horseshoe leatherjacket (*Meuschenia hippocrepis*), scaly fin (*Parma victoriae*), blue throat wrasse (*Pseudolabrus tetricus*), magpie morwong (*Cheilodactylus vestitus*) and old wife (*Enoplosus armatus*), (Tsernjavski 1995). The survey also found smaller numbers of senator wrasse (*Pictilabrus laticlavius*), bullseye (*Pempheris multiradiata*), toothbrush leatherjacket (*Penicipelta vittiger*), southern sea carp (*Aplodactylus arctidens*), sea sweep (*Scorpis aequipinnis*), bastard trumpeter (*Latridopsis forsteri*) and silver sweep (*Scorpis lineolatus*) (Tsernjavski 1995).

3.3.4 BIOLOGICAL PROCESSES

Biological processes occurring within the Marine Sanctuary are unknown.

3.3.5 SPECIES DISTRIBUTION INFORMATION

A list of algae, mollusc and echinoderm species which have their distributional limits at or near the Marengo Marine Sanctuary is presented in Table 3.3.5. The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

Table 3.3.5. Biota with distributional limits located at or near the Marengo Marine Sanctuary. (PW – presumed to be at or near western limit in Sanctuary, PE – presumed to be at or near eastern limit in Sanctuary, RW – record from in Sanctuary is western limit, RE – record from in Sanctuary is eastern limit).

Phylum	Family	Species	Common name	Category
Echinodermata	Cucumariidae	*Apsolidium densum*	Sea Cucumber	PW
Mollusca	Volutidae	*Notovoluta kreuslerae*	Marine snail	PE
Mollusca	Acanthochitonidae	*Acanthochitona retrojectus*	Chiton	PW
Phaeophyta	Scytothemnaceae	*Scytothamnus australis*	Brown algae	RW
Phaeophyta	Cystoseiraceae	*Cystophora torulosa*	Brown algae	PW
Rhodophyta	Ceramiaceae	*Ceramium lenticulare*	Red algae	RE
Rhodophyta	Ceramiaceae	*Trithamnion aculeatum*	Red algae	RE
Rhodophyta	Corallinaceae	*Spongites tunicatus*	Red algae	PW
Rhodophyta	Hildenbrandiaceae	*Hildenbrandia expansa*	Red algae	RW

3.3.6 SHOREBIRDS

Threatened species of shorebirds recorded within the Marengo Reefs Marine Sanctuary have included the Crested Tern, Black-faced cormorant and Pacific Gull (AVW). Other species have been recorded in the vicinity of the Marine Sanctuary and are listed in Table 3.3.6.

Although not directly within the Marine Sanctuary, the nearby Hayley Point has been identified as a nesting site for Hooded Plovers. Also, within a kilometre of the Marine Sanctuary is the Mounts Bay nesting and winter flocking site for Hooded Plovers (M. Weston pers. comm.).

A breeding colony of 20 pairs of Little Penguins is present at the Apollo Bay breakwater and it is probable that this species would occur in the Marine Sanctuary. Along the coast of the nearby Otway National Park there have also been incidental sightings of the Fiordland Penguin (Department of Conservation and Natural Resources 1994). Other species of birds to use the breakwater as a minor roost site include the Hooded Plover, Arctic Jaeger, Australasian Gannet, Crested Tern, Pacific Gull, Sanderling and Shy Albatross.

The nearby Barham River Estuary is a regionally significant salt marsh and estuary system, providing nesting, roosting and feeding habitat for many species of bird.

3.3.7 MARINE MAMMALS

Species of marine mammals to have been recorded in the close vicinity of the Marine Sanctuary include the Australian Fur Seal, Southern Elephant Seal, Subantarctic Fur Seal, Humpback Whale and Southern Right Whale (the Southern Right Whale sightings were just on the border of the Marine Sanctuary) (AVW). Leopard Seal sightings have also been recorded along the coast of the nearby Otway National Park (DCNR 1994).

A non-breeding haul out site for Australian Fur Seals is present at Hayley Point, with the seals inhabiting a small group of near shore rocks. Fur seals also use Henty Island (within the reserve) as a haul out (Park Notes).

Table 3.3.6. Threatened shorebird records from Marengo Reefs Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		2000
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		2000
Crested Tern	*Sterna bergii*			LR		1999
Fairy Tern	*Sterna nereis*	L		Vul		2001
Great Egret	*Ardea alba*	L		End	CJ	1999
Hooded Plover	*Thinornis rubricollis*	L		End		1991
Pacific Gull	*Larus pacificus*			LR		1999
Pied Cormorant	*Phalacrocorax varius*			LR		1999
Shy Albatross	*Diomedea cauta*		Vul			1983

Table 3.3.7. Threatened marine mammal records from Marengo Reefs Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australian Fur Seal	*Arctocephalus pusillus*			Vul		1995
Humpback Whale	*Megaptera novaeangliae*		Vul	End		1993
Southern Elephant Seal	*Mirounga leonina*		Vul			1994
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1992
Subantarctic Fur Seal	*Arctocephalus tropicalis*		Vul			1995

Table 3.3.8. Selection of some animals and plants that may be found in the Marengo Reefs Marine Sanctuary.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common names	Scientific name
Flora	brown algae	*Phyllospora comosa*, *Durvillaea potatorum*
Invertebrates	common sea-urchin	*Heliocidaris erythrogramma*
	green warreners	*Turbo undulatus*,

	sea tulips	*Pyura* sp.
	elephant snails	*Scutus antipodes*
	blacklip abalone	*Haliotis rubra*
Fish	zebra fish	*Girella zebra*
	globe fish	*Diodon nicthemerus*
	herring cale	*Odax cyanomelas*
	purple wrasse	*Pseudolabrus fucicola*
	horseshoe leatherjacket	*Meuschenia hippocrepis*
	scaly fin	*Parma victoriae*
	blue throat wrasse	*Pseudolabrus tetricus*
	magpie morwong	*Cheilodactylus vestitus*
	old wife	*Enoplosus armatus*

3.3.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

There are no known sites of geological or geomorphological significance in the Marine Sanctuary.

3.3.9 KNOWLEDGE GAPS

Very little quantitative data are available for the Marengo Marine Sanctuary and all information on intertidal and subtidal reef in this section has been derived from qualitative surveys, incidental reports or residents' local knowledge. The small areas of subtidal soft sediment included in the Marine Sanctuary are unstudied.

3.3.10 RESEARCH

Author	Project	Notes
(Porter 1997)	Subtidal reef areas in Victoria's central marine biophysical region: identification, assessment and documentation of significant sites for nomination to the Register of the National Estate	Subtidal invertebrates and macroalgae
(Tsernjavski 1995)	Marine and coastal sites of significance in Victoria. Nomination form and guidelines for listing marine and coastal areas to the National Estate Register	Subtidal invertebrates, macroalgae and fish

3.4 Eagle Rock Marine Sanctuary

This Sanctuary consists of extensive intertidal platforms that support a high diversity of invertebrates, plus a range of other habitats such as rock pools and large bommies that vary in height and that are honeycombed with ledges and caves. The Sanctuary is named after a tall volcanic stack that is capped by limestone and is visible from several kilometres away. This Sanctuary is a popular dive and snorkelling site.

3.4.1 PHYSICAL PARAMETERS

Eagle Rock Marine Sanctuary is located less than one kilometre south of Aireys Inlet and surrounds the large rock stack known as Eagle Rock. The basalt and calcarenite reefs are highly exposed.

Table 3.4.1. Physical parameters for Eagle Rock Marine Sanctuary.

Park Name	Eagle Rock
Conservation status	Marine Sanctuary
Biophysical Region	Central Victoria
Size of Park (ha)	17
Length of coastline (m)	709
Exposure rating	High
Wave Energy	High
Influential currents	None
Tidal variation - springs (m)	1.7
Tidal variation - neaps (m)	0.9
Water temp - summer (°C)	17.5
Water temp - winter (°C)	13.5
0 - 10 m (ha)	17
Discharges	Painkalac Creek discharges 100 metres west of Marine National Park
Adjacent catchment	Urban, Agricultural

3.4.2 MARINE HABITAT CLASSES

A number of different habitats are present in the Eagle Rock Marine Sanctuary (Figure A2.4a). The most notable ones are the intertidal and subtidal reefs, and the large boulders that are present both intertidally and subtidally and that have, in places, scoured potholes and gulches in the shore platform (Bird 1993). Subtidally the bommies range in size and the larger ones are honeycombed with ledges and caves (Stone 1999). The reefs are a mixture of basalt and sandstone and much of the rock is capped with yellow limestone. Rock pools are also common and there is a small area of sandy beach within the Marine Sanctuary and soft sediment habitat is interspersed between the subtidal reef habitat. Steep rocky limestone cliffs back the Sanctuary.

Table 3.4.2. Marine Habitat Classes for Eagle Rock Marine Sanctuary.

Marine Habitat Class	Attributes
Shoreline category	Platform
	Cliff
Substratum relief	High profile reef
Substratum texture	Solid reef
	Gutters
	Outcrops
	Fine sand
Lithology	Basalt
	Calcarenite
Subtidal reef biota	Kelp - Phyllospora dominated
Subtidal reef understorey biota	Sessile invertebrates
Intertidal reef biota	Durvillaea
	Coralline algae
Heavy reef Area (ha)	15
Total Reef Area (ha)	15
Sediment Area (ha)	2
Undefined Area (ha)	0.0003

3.4.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine Sanctuary, refer to Table 3.4.6.

Intertidal Reef

Flora

A survey of the intertidal reef undertaken in 1989 by Braley *et al.*.(1991) found that the floral assemblage was dominated by *Hormosira banksii* (neptune's necklace), *Ulva australis* (sea lettuce) and red coralline algae. The ephemeral species *Enteromorpha intestinalis* and *Scytosiphon lomentaria* were the dominant re-colonising algae during the experimental procedures of this study (Braley *et al*. 1991).

Invertebrate fauna

The most dominant organisms present in a survey undertaken in 1989 (Braley *et al.*.1991) were the gastropod *Bembicium nanum*, the pulmonate *Siphonaria diemenensis* and, another very common species in Victoria, *Austrocochlea constricta*.

Fish

No information was found on the fish that use the intertidal reef at Eagle Rock Marine Sanctuary

Subtidal Reef

Flora

The floral assemblage at Eagle Rock Marine Sanctuary is dominated by *Phyllospora comosa* although *Ecklonia radiata* and fleshy red algae are also relatively abundant. The bull kelp *Durvillaea* is found in the shallow subtidal zone and other brown algal species are also present, but in low abundance and the same applies to the erect coralline algae (Roob *et al*. 2000).

Invertebrate fauna

There is very little information available regarding the invertebrate fauna of the Eagle Rock Marine Sanctuary, however a colourful array of sponges, ascidians, bryozoans, gorgonians and the starfish (*Tosia australis*) have been recorded from the Sanctuary (MCCN 2002). Abalone and rock lobster can also be found on the subtidal reef (ECC 1999).

Fish

Fish species recorded from the Eagle Rock Marine Sanctuary (MCCN 2002) include the scaly *fin (Parma victoriae*), the magpie perch (*Cheilodactylus nigripes*). Other common reef fish are also likely to be seen in this Sanctuary including the blue throat wrasse (*Notolabrus tetricus*), the rosy wrasse, and sweep (*Scorpis aequipinnis*). Snapper (*Pagrus auratus*) are also reported to use the reef systems in this area (Classon and Wilson 2002).

Unvegetated Soft Sediments

Invertebrate fauna

The nearest information about the invertebrate fauna of the soft sediment environment comes from a site at 10 m depth to the west of Eagle Rock. A mean of 158 individuals were recorded from this site and a mean of 16 species were recorded from three replicate grab samples (Coleman *et al*. 2002).

Fish

A number of fish species are likely to use the soft sediment environment at the Eagle Rock Marine Sanctuary including the Port Jackson shark (*Heterodontus portusjacksoni*) and cat shark (*Parascyllium* sp.), as well as stingarees, skates and rays, which can often be seen in aggregations in the sand areas that intersperse the reef (Park Notes). Yellow-eye mullet (*Aldrichetta forsteri*), Australian salmon (*Arripis trutta*) and gummy sharks (*Mustelus antarcticus*) may also use the shallow soft sediment areas to feed (Classon and Wilson 2002).

3.4.4 BIOLOGICAL PROCESSES

Biological processes occurring within the Marine Sanctuary are unknown.

3.4.5 SPECIES DISTRIBUTION INFORMATION

A list of algae, mollusc and crustacean species which have their distributional limits at or near the Eagle Rock Marine Sanctuary is presented in Table 3.4.3. The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

Table 3.4.3. Biota with distributional limits located at or near the Eagle Rock Marine Sanctuary. Table of biota with distributional limits located at or near the Eagle Rock Marine Sanctuary. (PW – presumed to be at or near western limit in Sanctuary, PE – presumed to be at or near eastern limit in Sanctuary).

Phylum	Family	Species	Common name	Category
Crustacea	Hymenosomatidae	*Amarinus paralacustris*	Crab	PW
Mollusca	Olividae	*Belloliva leucozona*	Marine snail	PW
Rhodophyta	Ceramiaceae	*Muellerana wattsii*	Red algae	PE
Rhodophyta	Ceramiaceae	*Psilothallia siliculosa*	Red algae	PE
Rhodophyta	Corallinaceae	*Lesueuria mindeniana*	Red algae	PE
Rhodophyta	Phyllophoraceae	*Ahnfeltiopsis humilis*	Red algae	PE
Rhodophyta	Polyidaceae	*Rhodopeltis australis*	Red algae	PE

3.4.6 SHOREBIRDS

A list of threatened shorebird species recorded around the Eagle Rock Marine Sanctuary is given in Table 3.4.4. Hooded Plovers have been recorded as using this stretch of coast.

The stretch of coastline from Split Point to Urquharts Bluff is of national importance as a wildlife habitat, although it appears to be as a result of its small mammal richness and presence of Swamp Antechinus and Rufous Bristlebird (Yugovic *et al*. 1993).

Just to the west of the Marine Sanctuary, at Aireys Inlet, lies the regionally significant Painkalac Creek Estuary. The estuary supports remnant salt marsh, which is rare in the area, as well as grassland and floodplain habitats. The estuary is significant for its diversity of water birds and small numbers of migratory waders.

3.4.7 MARINE MAMMALS

Southern Right Whales have been recorded in the waters around Eagle Rock Marine Sanctuary. Australian Fur Seals have been observed along the coastline of the Angahook-Lorne State Park (Parks Victoria 1998) so it is probable that they may appear in the Marine Sanctuary at times.

Table 3.4.4. Threatened shorebird records from Eagle Rock Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		1999
Caspian Tern	*Sterna caspia*	L		Vul	CJ	2000
Crested Tern	*Sterna bergii*			LR		1999
Great Egret	*Ardea alba*	L		End	CJ	2000
Nankeen Night Heron	*Nycticorax caledonicus*			Vul		2000
Pacific Gull	*Larus pacificus*			LR		1999
Pied Cormorant	*Phalacrocorax varius*			LR		2001
Shy Albatross	*Diomedea cauta*		Vul			2000

Table 3.4.5. Threatened marine mammal records from Eagle Rock Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1982

Table 3.4.6. Selection of some animals and plants that may be found in the Eagle Rock Marine Sanctuary.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Hormosira banksii*, *Scytosiphon lomentaria, Phyllospora comosa*, *Ecklonia radiata, Durvillaea potatorum*
	green algae	*Ulva australis, Enteromorpha intestinalis*
	red coralline algae	Corallinaceae
Invertebrates	gastropod	*Bembicium nanum*, *Siphonaria diemenensis*, *Austrocochlea constricta*
	seastar	*Tosia australis*
Fish	scaly fin	*Parma victoriae*
	magpie perch	*Cheilodactylus nigripes*
	wrasse	*Notolabrus tetricus*
	sweep	*Scorpis aequipinnis*
	snapper	*Pagrus auratus*
	Port Jackson shark	*Heterodontus portusjacksoni*
	cat shark	*Parascyllium* sp.
	stingarees, skates and rays	Elasmobranchs
	yellow-eye mullet	*Aldrichetta forsteri*
	Australian salmon	*Arripis trutta*
	gummy sharks	*Mustelus antarcticus*

3.4.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Eagle Rock Marine Sanctuary are listed below (MPV database and (Buckley 1993):

- Aireys Inlet, (State significance): Cliffs at Aireys Inlet show a lower Oligocene volcanic structure consisting of larvals, agglomerates and vesicular basalt with large columnar join. This is overlain by Upper Oligocene Point Addis Limestone which penetrates joints in the basalt
- Split Point, (State significance): Oligocene basalt together with pyroclastic and associated terrigenous sediments of the Angahook Member. Older Oligocene Volcanic basalt overlain by Point Addis limestone. This sequence can be observed in the cliff face. Here the basalt is vesicular with large columnar jointing.

3.4.9 KNOWLEDGE GAPS

Some data on the intertidal reef flora and fauna exists in the form of site descriptions for an experimental study (Braley *et al*. 1991), but information on subtidal reefs and unvegetated soft sediment in the Eagle Rock Marine Sanctuary is derived from incidental reports or residents' local knowledge. No quantitative survey of fish, algae or invertebrates has been conducted in the Sanctuary.

3.4.10 RESEARCH

Author	**Project**	**Notes**
Porter, C.	Ecology and the management of intertidal areas of the Surf Coast Shire	Deakin and ARC ongoing project
(O'Hara 2000)	Faunal and floral assemblages associated with rocky reefs along the Victoria coast	
(Braley *et al*.. 1991)	The effect of the grazing gastropod Bembicium nanum on recolonization of algae on an intertidal rock platform.	

3.5 Point Danger Marine Sanctuary

Point Danger Marine Sanctuary separates the front and back surfing beaches at Torquay and contains a large sandy limestone rock platform. The Marine Sanctuary also has a highly diverse sea slug (opisthobranch) invertebrate fauna, and is likely to contain a high diversity of many other invertebrate species.

3.5.1 PHYSICAL PARAMETERS

The Point Danger Marine Sanctuary is based around a high energy limestone rock platform below limestone cliffs (Bird 1993).

Table 3.5.1. Physical parameters for the Point Danger Marine Sanctuary.

Park Name	**Point Danger**
Conservation status	Marine Sanctuary
Biophysical Region	Central Victoria
Size of Park (ha)	25
Length of coastline (m)	139
Exposure rating	High
Wave Energy	High
Influential currents	None
Tidal variation – springs (m)	2.1
Tidal variation – neaps (m)	0.7
Water temp – summer (°C)	17.5
Water temp – winter (°C)	13.5
0 - 10 m (ha)	25
Discharges	None
Adjacent catchment	Urban, Agricultural

3.5.2 MARINE HABITAT CLASSES

The major Marine Habitat Classes in Point Danger Marine Sanctuary are subtidal and intertidal reef and small areas of subtidal sand sediment, some of which supports seagrass (Figure A2.5a). The intertidal reef is covered with a network of small boulders, crevices and pools (Park Notes).

Table 3.5.2. Marine Habitat Classes for the Point Danger Marine Sanctuary.

Marine Habitat Class	Attributes
Shoreline category	Beach
	Platform
	Beach / Platform
	Cliff
Substratum relief	High profile reef
Substratum texture	Medium sand
	Fine sand
Lithology	Calcarenite
Subtidal reef biota	Kelp - mixed Phyllospora / Ecklonia
	Sessile invertebrates
	Caulerpa
Subtidal soft sediment biota	Amphibolis
Intertidal reef biota	Fleshy algae - mixed greens
	Fleshy algae - mixed browns
	Durvillaea
	Hormosira
	Turf algae
	Coralline algae
	Pyura
	Mussels
	Barnacles
Heavy reef Area (ha)	20
Total Reef Area (ha)	20
Sediment Area (ha)	2
Undefined Area (ha)	3

3.5.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine Sanctuary, refer to Table 3.5.3, Table 3.5.4 and Table 3.5.7.

Intertidal reef

Flora

Table 3.5.3 outline the various forms of algae found intertidally at the reef at Point Danger Marine Sanctuary. The dominant intertidal algae is neptune's necklace (*Hormosira banksii*), whilst blue-green algae (Cyanophyta) *Rivularia* sp. and the seagrass (*Amphibolis antarctica*) are also present (Tsernjavski 1995).

Table 3.5.3. Marine Algae on the intertidal reef platform at Point Danger, adapted from (Tsernjavski 1995).

Class	Scientific Name
Phaeophyta (Brown Algae)	*Cystophora retorta*
	Cystophora sp.
	Cystophora subfarcinata
	Sargassum sp.
	Durvillaea sp.
	Hormosira banksii
	Notheia sp.
	Caulocystis uvifera
	Zonaria sp.
Chlorophyta (Green Algae)	*Codium fragile*
	Caulerpa brownii
	Caulerpa geminata
	Ulva sp.
Rhodophyta (Red Algae)	*Laurencia sp.*
	Liagora sp.

Invertebrate fauna

The Point Danger Marine Sanctuary contains an unusually high diversity of intertidal invertebrates for a limestone substrate (Handreck and O'Hara 1994b) and 96 species of opisthobranchs have been recorded from the area, 20% of which are undescribed (Park Notes).

Table 3.5.4 Intertidal invertebrates in Point Danger Marine Sanctuary (Tsernjavski 1995)

Common Name	Scientific name
Three Pronged “Sea Spider” crab	*Halicarcinus ovatus*
	Nectocarcinus tuberculosus
Smooth Shore crab	*Cyclograpsus granulosus*
	Paragrapsus quadridentatus
Burrowing shore crab	*Leptograpsodes octodentatus*
Cleft-fronted shore crab	*Plagusia chabrus*
Decorator crab	*Notomithrax ursus*
	Aplysia parvula
	Berthella medietas

	Spurilla macleayi
	Marinula xanthostoma
Van Dieman's Land siphon shell	*Siphonaria diemenensis*
	Siphonaria tasmanica
Corded siphon shell	*Siphonaria funiculata*
	Onchidella patelloides
Elongate Ischnochiton	*Ischnochiton elongatus*
Southern Ischnochiton	*Ischnochiton australis*
White Plaxiphora	*Plaxiphora albida*
Yellow Chiton	*Callochiton crocina*
Blue ringed octopus	*Hapalochlaena maculosa*
Hairy ark shell	*Barbatia pistachia*
Beaked mussel	*Austromytilus rostratus*
Little black mussel	*Xenostrobus pulex*
Southern Lasaea	*Lasaea australis*
	Venerupis carditoides
Tangled tube worm	*Galeolaria caespitosa*
Common feather star	*Comanthus trichoptera*
Feather star	*Antedon loveni*
Biscuit sea star	*Tosia australis*
	Paranepanthia grandis
	Patiriella exigua
	Patiriella calcar
	Patiriella gunnii
Eleven armed sea star	*Coscinasterias calamaria*
	Allostichaster polyplax
	Smilasterias irregularis
	Amphipholis squamata
	Ophiothrix caespitosa
	Ophiobrus canaliculata
	Ophionereis schayeri
	Ophiopbrus bispinosus
	Ophiactis resiliens

Fish

No information was found that related to the intertidal fish in Point Danger Marine Sanctuary.

Subtidal reef

Flora

There are no records for subtidal reef macrophytes, although it is likely that the area would have similar algae composition to nearby shallow habitat in Point Addis Marine National Park, where the kelp (*Phyllospora comosa*) dominates with some other brown (*Acrocarpia paniculata*, *Ecklonia radiata*, *Cystophora moniliformis* and *Seirococcus axillaris*), green (*Caulerpa flexilis*) and red algae (*Melanthalia obtusa*, *Plocamium preissianum* and red turf species) also present (O'Hara 2000) .

Invertebrate fauna

There are no specific records for subtidal marine invertebrates for Point Danger Marine Sanctuary, although both black lip abalone (*Haliotis rubra*) and southern rock lobster (*Jasus edwardsii*) are known to be present (J. Giddins, pers comm.).

Fish

The dominant subtidal reef fish is blue throat wrasse (*Notolabrus tetricus*) and kingfish (*Seriola lalandi*), while salmon (*Arripis* sp.), barracouta (*Thyrsites atun*) and snapper (*Chrysophrys auratus*) are also present (J. Giddins, pers comm.). Eagle rays are known to occur in deeper subtidal reef (Park Notes).

Seagrass

Flora

The seagrass *Amphibolis antarcticus* is known to grow on subtidal soft sediment offshore of the reef in the Marine Sanctuary (Park Notes)

Invertebrate fauna

No records of invertebrates associated with seagrass in the Marine Sanctuary are available.

Fish

No records of fish associated with seagrass in the Marine Sanctuary are available.

3.5.4 BIOLOGICAL PROCESSES

Biological processes occurring within the Marine Sanctuary are unknown.

3.5.5 SPECIES DISTRIBUTION INFORMATION

The crab *Hexapus granuliferus* and the cerith gastropod *Tubercliopsis septapila* are thought to have their western distributional limit at or near the Point Danger Marine Sanctuary (Macpherson & Gabriel 1962, MoV database). The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

3.5.6 SHOREBIRDS

A list of threatened shorebird species recorded in and around the Point Danger Marine Sanctuary is shown in Table 3.5.5. Hooded Plovers have also been observed along this stretch of coast.

To the west of the Marine Sanctuary is the regionally significant Spring Creek Estuary, Torquay. The estuary is characterised by degraded riparian vegetation, shallow stream and mud flats. It provides a feeding habitat for waterbirds and limited numbers of waders. Threatened species recorded at the estuary include the Dusky Moorhen and Great Egret.

3.5.7 MARINE MAMMALS

Marine mammals recorded in the vicinity of the Marine Sanctuary are listed in Table 3.5.6.

Table 3.5.5. Threatened shorebird records from Point Danger Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		1999
Nankeen Night Heron	*Nycticorax caledonicus*			Vul		1999
Pacific Gull	*Larus pacificus*			LR		1999

Table 3.5.6. Threatened marine mammal records from Point Danger Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australian Fur Seal	*Arctocephalus pusillus*			Vul		1997
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1985

Table 3.5.7. Selection of some animals and plants that may be found in the Point Danger Marine Sanctuary.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	**Scientific name**
Flora	brown algae	*Phyllospora comosa*, *Acrocarpia paniculata*, *Ecklonia radiata*, *Cystophora moniliformis, Seirococcus axillaris, Hormosira banksii*
	red algae	*Melanthalia obtusa*, *Plocamium preissianum* and red turf species
	green	*Caulerpa flexilis*
	seagrass	*Amphibolis antarctica*
	blue-green algae	*Rivularia* sp.
Invertebrates	black lip abalone	*Haliotis rubra*
	southern rock lobster	*Jasus edwardsii*
Fish	blue throat wrasse	*Notolabrus tetricus*
	kingfish	*Seriola lalandi*
	salmon	*Arripis* sp.
	barracouta	*Thyrsites atun*
	snapper	*Chrysophrys auratus*

3.5.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

There are no known sites of geological or geomorphological significance in the Marine Sanctuary.

3.5.9 KNOWLEDGE GAPS

Point Danger Marine Sanctuary is very poorly known with no quantitative data available on any of the Marine Ecological Community in the Sanctuary. All information in this section has been derived from reports on nearby coastline or incidental reports from qualitative sources.

3.5.10 RESEARCH

Author	**Project**	**Notes**
Porter, C.	Ecology and the management of intertidal areas of the Surf Coast Shire	Deakin and ARC ongoing project

3.6 Barwon Bluff Marine Sanctuary

3.6.1 PHYSICAL PARAMETERS

The Barwon Bluff Sanctuary extends southeast off a large rocky headland less than two kilometres south of the Barwon Heads township. The geology of Barwon Bluff is complex with the eastern side of the Sanctuary dominated by basalt reef and boulders formed from a Mt Duneed lava flow (Bird 1993). The western side of the Sanctuary has a large intertidal sandstone platform that slopes gradually to 10 m depth subtidally. The Barwon River is the major discharge into the Marine Sanctuary.

Table 3.6.1. Physical parameters for Barwon Bluff Marine Sanctuary.

Park Name	**Barwon Bluff**
Conservation status	Marine Sanctuary
Biophysical Region	Central Victoria
Size of Park (ha)	17
Length of coastline (m)	614
Exposure rating	High
Wave Energy	High
Influential currents	None
Tidal variation - springs (m)	2.1
Tidal variation - neaps (m)	0.7
Water temp - summer (°C)	17.5
Water temp - winter (°C)	13.5
0 – 10 m (ha)	17
Discharges	Barwon River mouth is 600 metres from Marine
Adjacent catchment	Agricultural, Urban

3.6.2 MARINE HABITAT CLASSES

The major Marine Habitat Classes in Barwon Bluff Marine Sanctuary are subtidal soft sediment and subtidal and intertidal reef (Figure A2.6a).

Table 3.6.2. Marine Habitat Classes for Barwon Bluff Marine Sanctuary.

Marine Habitat Class	**Attributes**
Shoreline category	Beach
	Platform
	Beach / Platform
	Cliff
Substratum relief	Low profile reef
	High profile reef
Substratum texture	Solid reef

	Gutters
	Outcrops
	Medium sand
	Fine sand
	Shell rubble / grit
Lithology	Sandstone
	Basalt
Subtidal reef biota	Kelp - Phyllospora dominated
	Kelp - Ecklonia dominated
	Kelp - mixed Phyllospora / Ecklonia
Dominant understorey reef biota	Cystophora
	Acrocarpia
	Sessile invertebrates
	Caulerpa
Intertidal reef biota	Fleshy algae -mixed greens
	Fleshy algae -mixed browns
	Durvillaea
	Hormosira
	Turf algae
	Coralline algae
	Pyura
	Mussels
	Barnacles
Heavy reef Area (ha)	13
Total Reef Area (ha)	13
Undefined Area (ha)	4

3.6.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine Sanctuary, refer to Table 3.6.5.

Intertidal reef

Flora

In the mid tide level, the turf red algae (*Gelidium pusillum*) and neptune's necklace (*Hormosira banksii*) are very common often comprising almost 100% cover of the substratum in some places. Other algae include some greens such as (*Ulva* spp.) and occasional patches of coralline algae in areas not dominated by *H. banksii* (Marine Discovery Centre 2002).

Invertebrate fauna

The most common invertebrates at the high tide mark are the periwinkle (*Nodilittorina unifasciata*), the mussel (*Xenostrobus pulex*) and barnacles including (*Tetraclitella purpurascens* and *Chthamalus antennatus*). The striped coniwink (*Bembicium nanum*) and the ribbed top shell (*Austrocochlea constricta*) are also present. Closer to the mid-tide level the tube worm (*Galeolaria caespitosa*), the smooth limpet (*Cellana tramoserica*), striped limpet (*Siphonaria diemenensis*) and scaly limpet (*Patelloida latistrigata*) are also common with the occasional air breathing gastropod (*Onchidella patelloides*) also found. In rock pools which retain some water during low tide, small numbers of anemones including the waratah anemone (*Actinia tenebrosa*) and other anemones (including *Oulactis* spp., *Aulactinia veratra*) are found whilst the limpets already mentioned are still common along with the gastropods, including the chequerboard snail (*Cominella lineolata*), warrener (*Turbo undulatus*) and dog whelk (*Cominella lineolata*). Two seastars of the genus *Patiriella* are common (*P. calcar* and *P. exigua*) and shore crabs including *Cyclograpsus* spp., *Paragrapsus* spp. are often found under rocks and in rock pools towards the low tide mark. At very low tide a rim of cunjevoi (*Pyura stolonifera*) are uncovered on the perimeter of the reef (Marine Discovery Centre 2002).

Fish

The most common fish on the Barwon Heads intertidal platform are the Tasmanian blenny (*Parablennius tasmanianus*) and the southern crested weedfish (*Cristiceps australis*) (S. Swearer pers. comm.)

Subtidal Reef

Flora

The marine algae community in deeper waters is dominated by giant kelp (*Macrocystis angustifolia*) forests whilst a fringe of bull kelp (*Durvillaea potatorum*) exists on the platform edge on the intertidal mark (Porter 1997). In shallow subtidal reef habitat common kelp (*Ecklonia radiata*) is present with other brown algae including *Cladophora* spp. and with *Cystophora* spp. forming a smaller component (R. Watson, pers comm.). Green algae, including sea lettuce (*Ulva* sp.) in shallow water and *Caulerpa brownii* and *C. cactoides* in slightly deeper habitat (R. Watson, pers comm.), are common. Red algae species including *Delisea pulchra*, *Corallina officinalis*, *Plocamium* sp. and encrusting corallines are also present (R. Watson, pers comm.).

Invertebrate fauna

Common molluscan species include the black lip abalone (*Haliotis rubra*), warrener (*Turbo undulatus*), elephant snail (*Scutus antipodes*) and dogwhelk (*Thais orbita*) (R. Watson, pers comm.). The echinoderm fauna is diverse and includes eleven-armed sea stars (*Coscinasterias calamaria*), biscuit stars (*Tosia australis*), *Uniophora granifera*, *Nectria* sp. *Patiriella brevispina* and *Echinaster varicolour* (R. Watson, pers comm.). Also present are sea tulip (*Pyura gibbosa*) and red bait crab (R. Watson, pers comm.). The area off Barwon Bluff is also thought to be a brooding area for female rock lobster females (Steve Frlan, in Porter, 1997).

The eastern tip of the Marine Sanctuary supports many filter-feeding invertebrates such as feather-stars which rely on fast currents to bring food. Sponges are common beneath small bommies and ledges and opisthobranchs can be found on the reef sides (Park Notes).

Fish

A scuba survey of the subtidal reef fish near the edge of the rock platform found the blue throat wrasse (*Notolabrus tetricus*) dominant with (*N. fucicola*) present, but much less common (R. Watson, pers comm.). At least three species of leatherjackets are commonly encountered including (*Meuschenia hippocrepis*, *M. galii* and *M. freycineti*) (R. Watson, pers comm.). Other species present include scaly fin (*Parma victoriae*), mado (*Atypichthys strigatus*) and sea sweep (*Scorpis aequipinnis*) and on one occasion a large school of juvenile zebra fish (*Girella zebra*) (R. Watson, pers comm.). A scuba survey on the reef off Barwon Bluff recorded twenty species of fish (Porter 1997). Eagle rays are sometimes sighted in the deeper sections of the Marine Sanctuary (S. Blake pers comm).

3.6.4 BIOLOGICAL PROCESSES

Biological processes occurring within the Marine Sanctuary are unknown.

3.6.5 SPECIES DISTRIBUTION INFORMATION

No marine invertebrates, fish or algae are known to have their distributional limits near or within the Marine Sanctuary.

3.6.6 SHOREBIRDS

The list of threatened shorebird species recorded in and around the Barwon Bluff Marine Sanctuary is shown in Table 3.6.3. A Hooded Plover nesting site is located less than 300m to the west of the Marine Sanctuary boundary (near the 29W beach emergency sign). The shoreline within the Marine Sanctuary is primarily a mix of sand and rock platform so it is probable these birds may also forage along the shoreline within the Marine Sanctuary itself.

In close proximity to the Marine Sanctuary is the internationally significant Barwon River Estuary and Lake Connewarre. This area is also a Ramsar site providing nesting, roosting and feeding habitat for large numbers of waders and waterbirds (approximately 85 species recorded).

3.6.7 MARINE MAMMALS

Threatened marine mammals recorded in and around the Barwon Bluff Marine Sanctuary are listed in Table 3.6.4.

Table 3.6.3. Threatened shorebird records from Barwon Bluff Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		1999
Blue Petrel	*Halobaena caerulea*		Vul			1999
Caspian Tern	*Sterna caspia*	L		Vul	CJ	1998
Common Diving-Petrel	*Pelecanoides urinatrix*			LR		2001
Crested Tern	*Sterna bergii*			LR		1998
Fairy Prion	*Pachyptila turtur*		Vul	LR		2001
Great Egret	*Ardea alba*	L		End	CJ	1988
Gull-billed Tern	*Sterna nilotica*	L		End		1997
Hooded Plover	*Thinornis rubricollis*	L		End		2000
Pacific Gull	*Larus pacificus*			LR		1999
Southern Giant-Petrel	*Macronectes giganteus*		End	End		1984
Whiskered Tern	*Chlidonias hybridus*			LR		1997
White-faced Storm-Petrel	*Pelagodroma marina*			Vul		2000

Table 3.6.4. Threatened marine mammal records from Barwon Bluff Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australian Fur Seal	*Arctocephalus pusillus*			Vul		1988
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1989

Table 3.6.5. Selection of some animals and plants that may be found in the Barwon Bluff Marine Sanctuary.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Macrocystis angustifolia*, *Durvillaea potatorum*, *Ecklonia radiata*, *Cladophora* spp., *Cystophora* spp., *Hormosira banksii*
	green algae	*Ulva* spp., *Caulerpa brownii, C. cactoides*
	turf red algae	*Gelidium pusillum*
	red algae	*Delisea pulchra*, *Corallina officinalis*, *Plocamium* sp. and encrusting corallines
Invertebrates	mussel	*Xenostrobus pulex*
	barnacles	*Tetraclitella purpurascens* and *Chthamalus antennatus*.
	gastropods	*Bembicium nanum*, *Austrocochlea constricta, Onchidella patelloides, Cominella lineolata*, *Turbo undulatus*, *Cominella lineolata, Nodilittorina unifasciata*
	tube worm	*Galeolaria caespitosa*,
	limpet gastropods	*Cellana tramoserica*, *Siphonaria diemenensis*, *Patelloida latistrigata*
	anemones	*Actinia tenebrosa*, *Oulactis* spp., *Aulactinia veratra*
	seastars	*Patiriella calcar* and *P. exigua*
	crabs	*Cyclograpsus* spp., *Paragrapsus* spp.
	ascidians	*Pyura stolonifera*
	black lip abalone	*Haliotis rubra*,
	elephant snail	*Scutus antipodes*
	seastars	*Coscinasterias calamaria*, *Tosia australis*, *Uniophora granifera*, *Nectria* sp. *Patiriella brevispina* and *Echinaster varicolour*
Fish	wrasse	*Notolabrus tetricus*, *N. fucicola*
	leatherjackets	*Meuschenia hippocrepis*, *M. galii* and *M. freycineti*
	scaly fin	*Parma victoriae*,

3.6.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Barwon Bluff Marine Sanctuary are listed below (MPV database and Buckley 1993):

Barwon Heads (Regional/Local Significance): Calcarenite coastal bluff rising south of Barwon Heads township. Bluff shows sections in Pleistocene dune calcarenite with interbedded palaeosols resting upon basalt which outcrops on the shore and forms reefs off the mouth of the Barwon River

3.6.9 KNOWLEDGE GAPS

Very little quantitative data are available for any areas within the Barwon Bluff Marine Sanctuary. Student surveys of the intertidal reef and a single survey involving five diver transects on the subtidal reefs in the Sanctuary are the only information available. No species are known to be restricted or have their distributional limits at the Barwon Bluff Marine Sanctuary.

3.6.10 RESEARCH

Author	Project	Notes
(Marshall 2002)	In-situ measures of spawning synchrony and fertilisation success in an intertidal free spawning invertebrate	
Marine Discovery Centre Queenscliff	Long history of leading students and members of the public on rockpool rambles in the area	

3.7 Point Cooke Marine Sanctuary

Point Cooke Marine Sanctuary is situated close to Melbourne and incorporates a number of low basalt reefs that are the remains of lava flow across the plains of northern Port Phillip Bay. Saltmarsh, dunes and wetlands back on to the Marine Sanctuary and, along with the Point Cook Coastal Park, the Sanctuary forms part of a Ramsar site. The saltmarsh provides an important feeding ground for the endangered orange-bellied parrot.

3.7.1 PHYSICAL PARAMETERS

The Point Cooke Marine Sanctuary is situated approximately twenty kilometres to the west of Melbourne and is easily accessible. The Point Cooke coastal park backs the Marine Sanctuary and there are large areas of wetland within the coastal park. There are no significant freshwater discharges into the Marine Sanctuary, although the Yarra River discharges into northern Port Phillip Bay at Melbourne and further to the west the Western Treatment Plant discharges into the bay and there are two rivers (Werribee River and Little River) also in this area.

Table 3.7.1. Physical parameters for Point Cooke Marine Sanctuary.

Park Name	Point Cooke
Conservation status	Marine Sanctuary
Biophysical Region	Victorian embayments
Size of Park (ha)	290
Length of coastline (m)	3390
Exposure rating	Low
Wave Energy	Low
Influential currents	None
Tidal variation - springs (m)	0.80
Tidal variation - neaps (m)	0.20
Water temp - summer (°C)	20.40
Water temp - winter (°C)	11.40
Intertidal (ha)	25
0 - 2 m (ha)	95
2 - 5 m (ha)	110
5 - 10 m (ha)	60
Discharges	None
Adjacent catchment	Urban

3.7.2 MARINE HABITAT CLASSES

The Marine Sanctuary at Point Cooke encompasses a number of habitats including sandy beaches, subtidal soft sediment, intertidal and subtidal reef, beds of the cunjevoi *Pyura Stolonifera* and small patches of seagrass (Figure A2.7a). Some saltmarsh is present within the Sanctuary boundaries but the majority is protected within the Point Cook Coastal Park along with the associated wetlands and coastal dunes.

Table 3.7.2. Marine Habitat Classes in the Point Cooke Marine Sanctuary.

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
Substratum relief	Low profile reef
Substratum texture	Broken reef
	Artificial structure
	Coarse sand
	Fine sand
Lithology	Basalt
	Granite
	Calcarenite
Subtidal reef biota	Kelp - Durvillaea dominated
	Kelp - Ecklonia dominated
	Kelp - mixed Phyllospora / Ecklonia
Subtidal reef understorey biota	Mixed algae - brown dominated
	Cystophora
	Sessile invertebrates
	Red algae dominated
Subtidal soft sediment biota	Zostera
	Heterozostera
	Caulerpa
Intertidal reef biota	Saltmarsh
	Seagrass
	Durvillaea
	Coralline algae
	Pyura
	Mussels
Low Profile Reef Area (ha)	1
Macroalgae on Reef Area ha)	160
Total Reef Area (ha)	160

Macroalgae Area (ha)	20
Pyura & Macroalgae Area (ha)	15
Sediment Area (ha)	90
Salt Marsh Area (ha)	0.5
Undefined Area (ha)	4

3.7.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine Sanctuary, refer to Table 3.7.6.

Saltmarsh

Flora

A number of species have been recorded from the saltmarsh at the adjacent Cheetham Wetlands and are likely to be present within the Point Cooke Marine Sanctuary as well as the Point Cook coastal park. These species include the beaded glasswort *Sarcocornia quinqueflora*, the southern sea heath *Frankenia pauciflora*, the austral seablite *Suaeda australis*, the shrubby glasswort *Sclerostegia arbuscula* and the grey glasswort *Halosarcia halocnemoides* (Melbourne Parks and Waterways 1996). In a separate study 36 species were recorded from the Point Cook Coastal Park saltmarsh habitat and a similar species composition can be expected within the Point Cooke Marine Sanctuary (Cantrill and Lunt 1984). These species are the main food plant for the orange-bellied parrot (Melbourne Parks and Waterways 1996).

Invertebrate fauna

No information on the invertebrate fauna of the saltmarsh was uncovered by the literature search

Fish

No information on the fish species that use the saltmarsh habitat at Point Cooke Marine Sanctuary was uncovered during the literature search.

Intertidal reef

Flora

The rubbly reef and rock pool flora at Point Cooke is very much dominated by the green sea lettuce *Ulva* sp. *Enteromorpha* sp., filamentous red algal species as well as *Corallina* sp. and *Gracilaria* sp.

Invertebrate fauna

The invertebrate fauna of the intertidal reef is dominated by the mussel *Mytilus edulis*, the tube worm *Galeolaria caespitosa* and the grazing snail *Austrocochlea* spp. Other common snails include *Turbo undulatus* and the whelk *Lepsiella vinosa*. Also reported from Point Cooke Marine Sanctuary intertidal reef are several species of anemone, several species of crab including spider crabs and hermit crabs, sea urchins, chitons, limpets, amphipods and isopods (L.Henderson pers. comm.)

Fish

Fish commonly found in the intertidal pools at Point Cooke include the Tasmanian blenny *Parablennius tasmanianus*, and the weedfish (Clinidae) (L.Henderson pers. comm.).

Subtidal reef

Flora

Algal species that have been recorded on the subtidal reef at Point Cooke include *Ecklonia radiata*, *Cystophora* sp. and *Sargassum* sp. (MAFRI unpublished). Other species also recorded from Point Cooke include *Caulerpa* spp. *Enteromorpha linza*, *Cystoseira* spp. and during the summer months a thick mat of drift red algae that was mostly *Jeannerettia pedicellata* (Officer *et al*. 2001a).

Invertebrate fauna

Invertebrate species reported from the subtidal reef at Point Cooke include abalone, sea urchins, sea stars, sponges (such as the golf ball sponge *Tethya* sp.), octopus species including the blue-ringed octopus *Hapalochlaena maculosa*, anemones, bryozoans and sea squirts (Stone 1999, L. Henderson pers comm.). Abalone are also common on the subtidal reef areas (Officer *et al*. 2001a; Officer *et al*. 2001b).

Fish

Surveys of a nearby reef at Altona (Jenkins *et al*. 1996) recorded large numbers of hardy heads (Atherinidae), abundant weed fish (Clinidae, *Heteroclinus adelaide*, *Heteroclinus perpicillatus*) and gobies (Gobiidae). These species are common to reefs in northern Port Phillip Bay and are likely to be important components of the subtidal reef at the Point Cooke Marine Sanctuary as well. Leatherjackets, snapper and silver trevally are also associated with reefs in the general area of Point Cooke Marine Sanctuary (Classon and Wilson 2002).

Unvegetated soft sediments

Invertebrate fauna

A fairly large proportion of the soft sediment habitat supports *Pyura* (cunjevoi) beds in the Point Cooke Marine Sanctuary. This sea squirt species can anchor to soft sediments by root-like stolons and can clump together to form beds that then provide a substrate for a range of algae and other invertebrates to attach to (Parks Victoria and GHD-MacKnight Pty Ltd 1997).

Fish

The unvegetated soft sediment provides good habitat for flathead, mullet and King George whiting and these species can be abundant in the Point Cooke area (Classon and Wilson 2002).

Seagrass

Flora

Heterozostera tasmanica occurs in some areas of the Point Cooke Marine Sanctuary (Park Notes).

Invertebrate fauna

There was no data available on the invertebrate fauna of seagrass areas in the Point Cooke Marine Sanctuary or nearby areas. During summer swarms of jellyfish may occur in the Sanctuary (Park Notes).

Fish

Seagrass beds in the nearby Altona region are important habitat for juvenile whiting and are sampled on a monthly basis as part of an ongoing baywide project undertaken by MAFRI. Small sharks and skates are present in seagrass and surrounding areas (Park Notes).

3.7.4 BIOLOGICAL PROCESSES

Biological processes occurring within the Marine Sanctuary are unknown.

3.7.5 SPECIES DISTRIBUTION INFORMATION

A list of crustacean, echinoderm, molluscan and seagrass species which have their distributional limits at or near the Point Cooke Marine Sanctuary is presented in Table 3.7.3. The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

Table 3.7.3. Biota with distributional limits located at or near the Point Cooke Marine Sanctuary. (PW – presumed to be at or near western limit in Sanctuary, PE – presumed to be at or near eastern limit in Sanctuary).

Phylum	Family	Species	Common name	Category
Crustacea	Mictyridae	*Mictyris platycheles*	Crab	PW
Crustacea	Alpheidae	*Athanopsis australis*	Shrimp	PE
Crustacea	Axiidae	*Axiopsis werribee*	Ghost shrimp	PW
Echinodermata	Chiridotidae	*Scoliorhapis sp. MoV 1643*	Sea Cucumber	PE
Magnoliophyta	Zannichelliaceae	*Lepilaena marina*	Seagrass	PE
Mollusca	Acanthochitonidae	*Acanthochitona gatliffi*	Chiton	PE

3.7.6 SHOREBIRDS

Approximately 50 species of shorebirds have been recorded around the Point Cooke Marine Sanctuary (Arthur Rylah Institute 1999). This diversity is due primarily to the proximity of the Port Phillip Bay (Western Shoreline) Ramsar area which incorporates areas of mudflat, sandy beach and rocky coastline, as well as adjacent salt marsh, coastal dune vegetation, open saline lake and reed bed/sedgeland (Schulz *et al*. 1991). The site is of international significance as an area for nesting, feeding and roosting and includes the Cheetham Wetlands.

Table 3.7.4 lists threatened species recorded in this area thought likely to be found along the shoreline and within the boundaries of the MS itself.

3.7.7 MARINE MAMMALS

A Humpback Whale was sighted to the northeast of the Marine Sanctuary in 2001 (AVW). Dolphins are rarely sighted in the northern half of Port Phillip Bay, preferring instead to remain just inside the entrance to the bay (Hale 2002).

Table 3.7.4. Threatened shorebird records from Point Cooke Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Caspian Tern	*Sterna caspia*	L		Vul	CJ	1988
Common Diving-Petrel	*Pelecanoides urinatrix*			LR		1999
Crested Tern	*Sterna bergii*			LR		1990
Fairy Tern	*Sterna nereis*	L		Vul		1988
Great Egret	*Ardea alba*	L		End	CJ	1988

Little Egret	*Egretta garzetta*	L		CEn		1990
Pacific Gull	*Larus pacificus*			LR		1990
Pied Cormorant	*Phalacrocorax varius*			LR		1988
Royal Spoonbill	*Platalea regia*			Vul		1990

Table 3.7.5. Threatened marine mammal records from Point Cooke Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Humpback Whale	*Megaptera novaeangliae*		Vul	End		2001

Table 3.7.6. Selection of some animals and plants that may be found in the Point Cooke Marine Sanctuary.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Ecklonia radiata*, *Cystophora* sp. and *Sargassum* sp.
	green algae	*Caulerpa* spp. *Enteromorpha linza*, *Cystoseira* spp., *Ulva*
	red algae	*Jeannerettia pedicellata*, *Corallina* sp. and *Gracilaria* sp.
	saltmarsh	*Sarcocornia quinqueflora*, *Frankenia pauciflora*, *Suaeda*
Invertebrates	mussel	*Mytilus edulis*
	tube worm	*Galeolaria caespitosa*
	gastropods	*Austrocochlea* spp, *Turbo undulatus*, *Lepsiella vinosa*
	anemones	
	crabs	
	sea urchins	
	chitons	
	sponges	*Tethya* sp.
	blue-ringed octopus	*Hapalochlaena maculosa*
Fish	Tasmanian blenny	*Parablennius tasmanianus*
	weedfish	Clinidae
	hardy heads	Atherinidae
	weed fish	Clinidae, *Heteroclinus adelaide*, *Heteroclinus perpicillatus*
	gobies	Gobiidae
	Leatherjackets	Monacanthidae
	snapper	*Chrysophrys auratus*
	silver trevally	*Pseudocaranx dentex*

3.7.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Point Cooke Marine Sanctuary are listed below (MPV database and Buckley 1993):

- Point Cook Parallel Sand Ridges, (Regional/Local Significance): Sand ridges that relate to sedimentary history of the area.
- Point Cook Relict Spits, (Regional/Local Significance): The point is an outcrop of Quaternary basalt buried by sand, shell and gravel. Sand ridges that relate to sedimentary history of the area.

3.7.9 KNOWLEDGE GAPS

No quantitative data are available for any of the Marine Ecological Communities in the Point Cooke Marine Sanctuary and all information is derived from incidental reports from other studies or residents' local knowledge.

3.7.10 RESEARCH

Author	Project	Notes
(Lindsay)	Reef fish recruitment inside and outside of marine parks	Upcoming Honours project
(Officer *et al*. 2001a)	Movement and re-aggregation of the blacklip abalone, *Haliotis rubra* Leach, after fishing	
(Officer *et al*. 2001b)	Distance-based abundance estimation for abalone	
(Huang *et al*. 2000)	Analysis of genetic structure of blacklip abalone (*Haliotis rubra*) populations using RAPD, minisatellite and microsatellite markers.	
(Troynikov *et al*. 1998)	Estimation of seasonal growth parameters using a stochastic Gompertz model for tagging data.	

3.8 Jawbone Marine Sanctuary

The Jawbone area consists of sandy beach flanked by basalt rock outcrops that are the seaward end of flows of basalt larvae that characterise Melbourne's western plains. The Marine Sanctuary includes one of the few mangrove stands within Port Phillip Bay as well as saltmarsh, seagrass beds, reefs and sandy beaches. The basalt platform is a roosting site for migratory waders.

3.8.1 PHYSICAL PARAMETERS

Table 3.8.1. Physical parameters of the Jawbone Marine Sanctuary.

Park Name	Jawbone
Conservation status	Marine Sanctuary
Biophysical Region	Victorian embayments
Size of park (ha)	30
Length of coastline (m)	1908
Exposure rating	Low
Wave Energy	Low
Influential currents	None
Tidal variation - springs (m)	0.8
Tidal variation - neaps (m)	0.2
Water temp - summer (°C)	20.4
Water temp - winter (°C)	11.6
Intertidal (ha)	10
Discharges	Rifle Range outfall east drain
Adjacent catchment	Urban

3.8.2 MARINE HABITAT CLASSES

The major Marine Habitat Classes in the Jawbone Marine Sanctuary are saltmarsh, mangrove, seagrass and intertidal and subtidal reef and soft sediment (Figure A2.8a).

Table 3.8.2. Marine Habitat Classes for the Jawbone Marine Sanctuary.

Marine Habitat Class	Attributes
Shoreline category	Beach
	Platform
	Beach / Platform
Substratum relief	Low profile reef
Substratum texture	Solid reef
Lithology	Basalt

	Granite
	Calcarenite
Subtidal reef biota	Kelp - Phyllospora dominated
	Kelp - Ecklonia dominated
	Kelp - mixed Phyllospora / Ecklonia
Subtidal reef understorey biota	Mixed algae - brown dominated
	Cystophora
	Sessile invertebrates
	Red algae dominated
Subtidal soft sediment biota	Zostera
	Heterozostera
	Mixed seagrass/algae
	Caulerpa
Intertidal soft sediment biota	Mangrove
	Saltmarsh
	Seagrass
Low Profile Reef Area	10.7
Macroalgae on Reef Area (ha)	5.1
Total Reef Area (ha)	15.8
Zostera/Heterozostera Dominant Seagrass (ha)	1.8
Sediment Area (ha)	6.9
Salt Marsh Area (ha)	0.9
Undefined Area (ha)	4.5

3.8.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine Sanctuary, refer to Table 3.8.5.

Saltmarsh

Flora

The higher saltmarsh zone is characterised by the glasswort (*Halosarcia pergranulata*). This species is confined to the western shores of Port Phillip Bay, the Bellarine Peninsula and the Barwon River estuary (Urban Land Authority 1987). The mid to lower saltmarsh zone is dominated by the beaded glasswort *Sarcocornia quinqueflora* with *Sclerostegia arbuscula* and *Suaeda australis* also occurring (Urban Land Authority 1987).

Invertebrate fauna

No information on the invertebrate fauna of the saltmarsh has been uncovered during the literature search.

Fish

No information on the fish fauna of the saltmarsh area of the Jawbone Marine Sanctuary has been uncovered by the literature search.

Mangrove

Flora

The *Avicennia marina* mangrove community at Jawbone Marine Sanctuary is very unusual because it occurs amongst massive basalt boulders rather than on intertidal mudflats which is unique for Victoria and combined with the associated saltmarsh vegetation is considered significant at the state level (O'Byrne 1989; Urban Land Authority 1987).

Invertebrate fauna

The literature search uncovered no information on the invertebrate fauna of the mangrove areas.

Fish

The literature search uncovered no information on the fish fauna of the mangrove areas.

Intertidal reef

Flora

Macroalgae are generally absent from the intertidal zone although articulated coralline algae are dominant in the very low intertidal zone (Sharpe and Keough 1998).

Invertebrate fauna

A survey undertaken by the Marine Research Group in 1987 recorded large numbers of mussels (*Mytilus edulis*), the turbo (*Turbo undulatus*) and the limpet (*Cellana tramoserica*). A total of 65 species were recorded on a single visit (Urban Land Authority 1987). Other studies have found the herbivorous gastropods to be the most conspicuous animals, in particular *Cellana tramoserica*, *Austrocochlea constricta, Bembicium nanum*, *Nerita atramentosa*, with scattered *Siphonaria diemenensis*, the scavenger *Cominella eburnea* and the predatory snail *Lepsiella vinosa* (Sharpe and Keough 1998). The tube building polychaete *Galeolaria caespitosa* and *Turbo undulatus* were also found to be common lower on the shore, with the only other common species being the small omnivorous seastar *Pateriella exigua* (Sharpe and Keough 1998).

A survey of marine molluscs (excluding chitons and cephalopods) washed up on the shoreline of the nearby Altona Coastal Park found common shells in addition to those mentioned including the gastropods *B. melanostomum*, *Austrocochlea odontis*, *Phasianella australis*, *Polinices conicus*, *P. sordidus*, *P. aulacoglossa*, the limpet *Patelloida alticostata* and bivalves *Soletellina biradiata*, *S. donacioides* (Schulz 1991).

Fish

No details about the fish fauna of the intertidal reef was uncovered by the literature search.

Subtidal reef

Flora

Surveys of the adjacent Gloucester Reef recorded the following species: the green algae *Ulva australis*, *Caulerpa* spp. the brown algae *Sargassum* and the red algal species *Corallina officinalis*, *Gracilaria* spp. and *Polysiphonia* sp. in the very shallow sublittoral zone. The lower sublittoral zone was characterised by a very high cover of *Ecklonia radiata* and *Sargassum bracteolosum* (O'Brien 1975). A later survey of the same reef (Gloucester Reef) described three main algal communities (O'Brien 1981). The first of these was characterised by dominance of *Caulerpa* spp., *Corallina officinalis* and *Acrosorium uncinatum* and was restricted to the shallower areas of the basalt reef. The second community was dominated by *Ecklonia radiata* and *Sargassum bracteolosum* and the understorey red algae *Gelidium pusillum*, *Phycodrys australasica* and encrusting corallines. The third community described by O'Brien (1981) occurred in the sandy depressions that occur randomly in the basalt reef and only *Caulerpa remotifolia* was dominant throughout the year on this habitat type. Other species did occur though and they included *Acrosorium uncinatum*, *Bropsis plumosa*, *Caulerpa brownii*, *C. longifolia*, *Enteromorpha compressa*, *Sargassum bracteolosum and Ulva lactuca* (O'Brien 1981).

Invertebrate fauna

No quantitative information on the invertebrate fauna of the subtidal reef at The Jawbone Marine Sanctuary was uncovered by the literature search. However, the following species have been reported as being common in the Marine Sanctuary; the black lipped abalone *Haliotis rubra*, the urchin *Heliocidaris erythrogramma*, the warrener *Turbo undulatus* and the seastar *Uniophora granifera* (P. Marshall pers. comm.). Less common is the elephant snail *Scutus antipodes* (P. Marshall pers. comm.).

Fish

Surveys of a nearby reef at Altona (Jenkins *et al*. 1996) recorded large numbers of hardy heads (Atherinidae), abundant weed fish (Clinidae, *Heteroclinus adelaide*, *Heteroclinus perpicillatus*) and gobies (Gobiidae). These species are all common to reefs in northern Port Phillip Bay and are likely to be important components of the subtidal reef at the Jawbone Marine Sanctuary as well. Casual observations report that the zebra fish *Girella zebra* is frequently observed within the Marine Sanctuary as are juvenile scaly fins (*Parma* spp.) (P. Marshall pers. comm.).

Seagrass

Flora

There are some areas of *Heterozostera tasmanica* seagrass beds in the Jawbone Marine Sanctuary (Park Notes).

Invertebrate fauna

No information was uncovered regarding the invertebrate fauna of the seagrass beds at the Jawbone Marine Sanctuary

Fish

There was no information available describing the fish assemblages associated with the Jawbone Marine Sanctuary seagrass beds.

Unvegetated soft sediment

Invertebrate fauna

Infaunal samples were taken as part of an environmental effects statement in the nearby Altona Bay in 1986 (Urban Land Authority 1987). The macroinvertebrate fauna was numerically dominated by the polychaete worm *Ceratonereis pseudoerythraeensis*, the bivalves *Mysella donaciformis* and Galeommatidae and the amphipod *Corophium* spp. (Urban Land Authority 1987).

Fish

The Marine and Freshwater Resources Institute has undertaken repeated trawl surveys in Port Phillip Bay on soft sediments, which include a station at 7 m depth off Williamstown. This is the nearest relevant information that was available on the fish fauna of soft sediments for the Jawbone Marine Sanctuary. This site was characterised by abundant stingarees, globefish, yank flathead, long snouted and greenback flounder (Parry *et al*. 1995).

3.8.4 BIOLOGICAL PROCESSES

Biological processes occurring within the Marine Sanctuary are unknown.

3.8.5 SPECIES DISTRIBUTION INFORMATION

A list of crustacean, fish, algae and seagrass species which have their distributional limits at or near the Jawbone Marine Sanctuary is presented in Table 3.8.3. The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

Table 3.8.3. Biota with distributional limits located at or near the Jawbone Marine Sanctuary. (PW – presumed to be at or near western limit in Sanctuary, PE – presumed to be at or near eastern limit in Sanctuary).

Phylum	Family	Species	Common name	Category
Chordata	Syngnathidae	*Leptoichthys fistularius*	Brushtail pipefish	PE
Crustacea	Penaeidae	*Penaeus plebejus*	Prawn	PW
Magnoliophyta	Zannichelliaceae	*Lepilaena cylindracarpa*	Seagrass	PE
Rhodophyta	Ceramiaceae	*Bornetia tenuis*	Red algae	PE
Rhodophyta	Ceramiaceae	*Rhipidothamnion secundum*	Red algae	PW

3.8.6 SHOREBIRDS

The Jawbone Marine Sanctuary encompasses the eastern end of an area extending from Altona to Williamstown that is a nationally significant shorebird feeding area. The marine and intertidal areas are diverse, including habitats such as salt marsh, rocky reef, seagrass beds, intertidal flats, sandy beaches and mangroves. The region is primarily a feeding area for birds although some roosting occurs. The threatened species list is shown in Table 3.8.4 and includes the Orange-bellied Parrot. Other threatened species to have been recorded in the Marine Sanctuary include the Little Tern, Fairy Tern and Eastern Curlew (Schulz 1991).

Small numbers of waterbirds roost on the shore platforms of the Marine Sanctuary but it is the shallow offshore waters that provide important feeding areas for species such as cormorants, grebes and terns.

3.8.7 MARINE MAMMALS

No recorded sightings of threatened marine mammals were found for the Jawbone Marine Sanctuary.

Table 3.8.4. Threatened shorebird records from Jawbone Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		1991
Caspian Tern	*Sterna caspia*	L		Vul	CJ	1997
Crested Tern	*Sterna bergii*			LR		1991
Fairy Prion	*Pachyptila turtur*		Vul	LR		2000
Glossy Ibis	*Plegadis falcinellus*			Vul	C	1987
Great Egret	*Ardea alba*	L		End	CJ	2001
Intermediate Egret	*Ardea intermedia*	L		CEn		2001
Little Egret	*Egretta garzetta*	L		CEn		1988
Orange-bellied Parrot	*Neophema chrysogaster*	L	End	CEn		1988
Pacific Gull	*Larus pacificus*			LR		1991
Pied Cormorant	*Phalacrocorax varius*			LR		1991
Whiskered Tern	*Chlidonias hybridus*			LR		2000

Table 3.8.5. Selection of some animals and plants that may be found in the Jawbone Marine Sanctuary.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Sargassum bracteolosum, Ecklonia radiata*
	green algae	*Ulva* spp., *Ulva australis*, *Ulva lactuca, Caulerpa* spp.,
	red algae	*Corallina officinalis*, *Gracilaria* spp. and *Polysiphonia* sp.
	saltmarsh	*Halosarcia pergranulata, Sarcocornia quinqueflora Suaeda*
	mangrove	*Avicennia marina*
	seagrass	*Heterozostera tasmanica*
Invertebrates	polychaete	*Ceratonereis pseudoerythraeensis, Galeolaria caespitosa*
	bivalves	*Mysella donaciformis, Mytilus edulis* and Galeommatidae
	amphipod	*Corophium* spp.
	gastropods	*Turbo undulatus, Cellana tramoserica, Austrocochlea*
	seastar	*Pateriella exigua*, *Uniophora granifera*
	black lipped abalone	*Haliotis rubra*
	urchin	*Heliocidaris erythrogramma*
Fish	hardy heads	Atherinidae
	weed fish	*Heteroclinus adelaide, Heteroclinus perpicillatus*
	gobies	Gobiidae
	zebra fish	*Girella zebra*
	juvenile scaly fin	*Parma* spp.

3.8.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Jawbone Marine Sanctuary are listed below (MPV database and Buckley 1993):

Merrett Rifle Range Shore Platform, (Regional/Local Significance): Four features, intertidal area, shore platform of Quaternary Volcanics, white mangrove, shell deposits. Shore platform and shell deposits with mangrove.

Altona East Sand Bars, (Regional/Local Significance): The site includes the intertidal and submarine topography of part of northern Port Phillip Bay. Major sand bars/spit/ridge system.

3.8.9 KNOWLEDGE GAPS

Despite the proximity of the Jawbone Marine Sanctuary to Melbourne there was surprisingly little information uncovered by the literature search. Descriptions of the intertidal reef invertebrates are available as site descriptions for experimental research at this site. Detailed information is available relating to the flora of an adjacent subtidal reef but no surveys, to our knowledge, have been undertaken on the subtidal reef within the Marine Sanctuary. No information was available for intertidal reef fish and all other Marine Ecological Communities in the Jawbone Marine Sanctuary are unstudied.

3.8.10 RESEARCH

Author	Project	Notes
(Lindsay)	Reef fish recruitment inside and outside of marine parks	Upcoming Honours project
(Sharpe and Keough 1998)	An investigation of the indirect effects of intertidal shellfish collection	
(Keough *et al*. 1997)	Geographic variation in interactions between size classes of the limpet *Cellana tramoserica*	
(Marshall and Keough 1994)	Asymmetry in intraspecific competition in the limpet *Cellana tramoserica* (Sowerby).	
(Keough *et al*. 1993)	Correlations between human collecting and intertidal mollusc populations on rocky shores	
(O'Brien 1981)	The subtidal algal ecology of the Gloucester reserve reef, northern Port Phillip Bay	
(O'Brien 1975)	Standing crop, community composition and seasonal variations in two contrasting benthic algal communities of the Hobsons Bay area	

3.9 Ricketts Point Marine Sanctuary

Ricketts Point Marine Sanctuary encompasses a diversity of habitats and an associated diversity of flora and fauna within a relatively small area. It is an outstanding example of a sandstone reef habitat that occurs in northern Port Phillip Bay and is also an important site for migratory and resident bird species. It is easily accessible from Melbourne and is a popular site for snorkelling, diving and education.

3.9.1 PHYSICAL PARAMETERS

The Ricketts Point Marine Sanctuary at Beaumaris in northern Port Phillip Bay is approximately twenty kilometres from the centre of Melbourne. The Sanctuary includes nearly three kilometres of coast line and the majority of the Sanctuary is in shallow waters (< 5 m depth).

Table 3.9.1. Physical parameters of the Ricketts Point Marine Sanctuary.

Park Name	Ricketts Point
Conservation status	Marine Sanctuary
Biophysical Region	Victorian Embayments
Size of park (ha)	115
Length of coastline (m)	2928
Exposure rating	Low
Wave Energy	Low
Influential currents	None
Tidal variation - springs (m)	0.80
Tidal variation - neaps (m)	0.20
Water temp - summer (°C)	20.30
Water temp - winter (°C)	11.60
Intertidal (ha)	20
0 - 2 m (ha)	45
2 - 5 m (ha)	50
5 - 10 m (ha)	0.3
Discharges	6 drains incl. Ebden Park and Nautilus St drains
Adjacent catchment	Urban

3.9.2 MARINE HABITAT CLASSES

Despite the small size of the Ricketts Point Sanctuary there is a considerable diversity of habitats. The most notable is the extensive intertidal and subtidal sandstone reef that incorporates a variety of microhabitats (Figure A2.9a). These include rockpools, numerous holes and gullies, boulders and crags. The basic structure of headlands and reefs in interspersed with sandy beaches and subtidal soft-sediment environments with healthy intertidal and subtidal seagrass meadows (B. Whiteway pers. comm.). While not within the Sanctuary boundaries, sand dunes and cliffs back the area in places.

Table 3.9.2. Marine Habitat Classes of the Ricketts Point Marine Sanctuary.

Marine Habitat Class	**Attributes**
Shoreline category	Dune*
	Beach
	Platform
	Beach / Platform
	Cliff
	Artificial seawall*
Substratum relief	Low profile reef
Substratum texture	Solid reef
	Broken reef
	Gutters
	Outcrops
	Artificial structure
	Coarse sand
	Medium sand
Lithology	Sandstone
Subtidal reef biota	Kelp - Ecklonia dominated
	Cystophora
	Sessile invertebrates
Subtidal soft sediment biota	Zostera
	Heterozostera
	Seagrass
Intertidal reef biota	Hormosira
	Coralline algae
	Pyura
	Mussels
Low Profile Reef Area (ha)	50
Macroalgae on Reef Area (ha)	40
Total Reef Area (ha)	90
Zostera/Heterozostera Dominant	1
Sediment Area (ha)	10
Undefined Area (ha)	15

3.9.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine Sanctuary, refer to Table 3.9.5.

Intertidal Reef

Flora

The brown alga *Hormosira banksii* (neptune's necklace) occurs in dense mats on the lower intertidal reefs at Ricketts Point, although in other area its cover is patchy (MSE 1999). The green sea lettuce *Ulva* spp. also occurs at high densities. Rock pools contain a range of species including *Ulva*, *Corallina*, *Chaetomorpha*, Ectocarpaceae and *Polysiphonia* (King *et al.*.1971 in MSE 1999).

Invertebrate fauna

The intertidal reef habitat between Brighton and Beaumaris was found to be comparatively diverse by the Marine Research Group and of the 138 species recorded from this segment, the majority were recorded from Ricketts Point (Parks Victoria and GHD-MacKnight Pty Ltd 1997). A more recent survey found the majority of the animal species on the intertidal reef to be herbivorous molluscs that graze on algae (MSE 1999). The most abundant molluscs were the gastropods *Austrocochlea constricta* and *Turbo undulatus*, and other common species included the gastropods *Bembicium nanum*, *Nerita atramentosa*, *Cominella lineolata*, *Lepsiella vinosa* the limpets *Cellana tramoserica*, *Patelloida alticostata*, *Notoacmea flammea* and the mussels *Mytilus edulis* (MSE 1999). There were a number of other common organisms on the intertidal reefs at Ricketts Point including the polychaete worm *Galeolaria caespitosa*, the anemone *Actinia tenebrosa*, crabs including the introduced European green crab *Carcinus maenas* as well as *Cyclograpsus granulosus* and *Pilumnus serratifrons* and the sea stars *Patiriella calcar* and *Coscinasterias muricata*. The dog winkle *Thais orbita* was also recorded intertidally but was more common in the shallow subtidal (MSE 1999).

Fish

Observations of the intertidal and shallow subtidal reef fish in Port Phillip Bay undertaken by Coleman (Coleman 1972) found no fish that were restricted to the intertidal. At Ricketts Point or the nearby Sandringham Reef the Tasmanian blenny (*Parablennius tasmanianus*), the common weedfish (*Heteroclinus perpicillatus*) and the dragonet (*Bovichtus angustifrons*) were all common in rockpools while the shore eel *Alabes dorsalis* appeared less common, although as Edgar (2000) points out it can be hard to see because of its small size.

Subtidal Reef

Flora

There are no quantitative surveys of the subtidal reef floral assemblage that were uncovered in the literature searches. The seaweeds that have been recorded from the subtidal reef at Ricketts Point include the green algae *Ulva* sp., *Codium fragile* and *Caulerpa* sp. the red alga *Corallina officinalis* (MSE 1999; Watson and McInnes 1999) in the shallow subtidal areas and the kelps *Ecklonia radiata*, and *Cystophora* sp. have also been recorded (Watson and McInnes 1999). Further offshore, rock bommies have been described as being covered in the green alga *Caulerpa* sp. and the brown alga *Sargassum* sp. is also present (Park notes). The introduced species *Undaria pinnatifida* occupies deeper water towards the seaward boundary of the Sanctuary and (B. Whiteway pers. comm.).

Invertebrate fauna

No formal surveys of the subtidal reef at Ricketts Point were found. Observations on the reef however, have reported sponges e.g. *Tethya* sp. *Dendrilla rosea*, ascidians (e.g. *Clavelina moluccensis*), anemones, mussels, abalone (*Haliotis rubra*), sea urchins (*Heliocidaris erythrogramma*), crabs and seastars (*Coscinasterias muricata*, *Pateriella calcar*, *Tosia australis*) (MSE 1999, Whiteway pers. comm.). Octopus, including the venomous blue ringed octopus (*Hapalochlaena maculosa*), squid and cuttlefish including the giant cuttlefish (*Sepia apama*) have also been observed on the reef (Park notes). Two introduced species have also been observed within the Sanctuary, the fanworm *Sabella spallanzani* and the North Pacific seastar *Asterias amurensis* although only in very small numbers to date (B. Whiteway pers. comm.). A brief survey in the shallow subtidal of the habitat under boulders revealed 13 species of bryozoans suggesting that there is a diverse bryozoan fauna at Ricketts Point (MSE 1999).

Fish

Observations of fish species associated with the subtidal reef at Ricketts Point include the greenback flounder *Rhombosolea tapirina*, Tasmanian blenny *Parablennius tasmanianus* and common weedfish *Heteroclinus perpicillatus* (Coleman 1972). Other species reported from the reef include old wives (*Enoplosus armatus*), toadfish (Aracanidae), leather jackets (Monacanthidae), porcupine fish (Diodontidae), zebra fish (*Girella zebra*), blennies (Blennidae) and seahorses (*Hippocampus* sp.) (B. Whiteway pers comm.). A number of commercial species have also been associated with the subtidal reef of Ricketts Point including King George whiting, snapper and Australian salmon (B. Whiteway pers comm.)

Fish surveys from the nearby Black Rock found the hardyheads (Atherinidae), southern hulafish (*Trachinops caudimaculatus*), the weedfish (*Heteroclinus adelaide* and *H. perpicillatus*), and little rock whiting (*Neodax balteatus*) to be abundant (Jenkins *et al*. 1996). In this study (Jenkins *et al.*.1996) the only commercial species observed at Black Rock were grass flathead (*Platycephalus laevigatus*), red mullet (*Upeneichthys vlamingii*) and the rough leatherjacket *Scobinichthys granulatus*).

Seagrass

Invertebrate fauna

The gastropods *Zeacumantus diemenensis*, *Velacmantus australis* and *Nassarius* sp. have been recorded from the seagrass patches at Ricketts Point (MSE 1999).

Fish

Seagrass beds often provide nursery areas for a number of species and juvenile King George whiting and flounder have been recorded from the seagrass at Ricketts Point. Pipe fish (Syngnathidae) and hardyheads (Atherinidae) are also commonly found in this habitat (G. Jenkins pers. comm.).

Unvegetated soft sediments

Invertebrate fauna

Dense cunjevoi (*Pyura stolonifera*) beds are known to exist in the 4 – 8 m depth range on the northeast coast of Port Phillip Bay (Parks Victoria and GHD-MacKnight Pty Ltd 1997) and so are likely to be either in, or immediately adjacent to, the Ricketts Point Sanctuary. The bivalve *Paphies angusta* was found to be dominant in the sandy beaches in the vicinity of Ricketts Point. A number of invertebrate macrofauna was also collected in trawl surveys from a nearby site at 7 m depth. These species included spider crabs, Balmain bugs, the smooth skinned and the rough octopus and southern calamari (Parry *et al*. 1995).

Fish

Data from trawl surveys on unvegetated soft sediment is available from a 7 m depth station south of Ricketts Point which was considered to have a high diversity of fish fauna (Parry *et al.*.1995). Common species at this station included the sparsely spotted stingaree the eastern shovelnose stingaree (Urolophidae), globe fish (*Diodon nicthemerus*), eagle rays (*Myliobatis australis*), banjo rays (*Trygonorrhina fasciata*), yank flathead (*Platycephalus speculator*), red mullet (*Upeneichthys vlamingii*), long snouted flounder (*Ammotretis rostratus*), prickly toadfish (*Contusus brevicaudus*), Port Jackson shark (*Heterodontus* *portusjacksoni*), angel shark (*Squatina australis*) and rock ling (*Genypterus tigerinus*). These species are all likely to occur in the deeper sections of the Ricketts Point Sanctuary as well.

A survey at the nearby Black Rock (Jenkins *et al*. 1996) recorded low numbers of sand flathead (*Platycephalus bassensis*), the long snouted flounder (*Ammotretis rostratus*), the red mullet (*Upeneichthys vlamingii*), toadfish (*Tetractenos glaber*), gobies (Gobiidae), and skates (Rajidae) on unvegetated soft sediment.

3.9.4 BIOLOGICAL PROCESSES

Biological processes occurring within the Marine Sanctuary are unknown.

3.9.5 SPECIES DISTRIBUTION INFORMATION

A survey of the epiphytic hydroid fauna undertaken during the 1980's at Ricketts Point (Watson and McInnes 1999) revealed two species that had not been recorded before in Australia (*Clava* sp. and *Coryne* sp.). Another species, *Halecium fragile*, had not been previously recorded from Port Phillip Bay and the record of *Dicoryne annulata* was the first since its original description in 1884. Another species found, *Halecium* sp., may be a previously undescribed species although more material is needed in order to verify this (Watson and McInnes 1999). The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

Distributional limits

The swimming crab *Ovalipes catharus* and the red algae *Bonnemaisonia australis* are thought to have their western distributional limit in the Ricketts Point Marine Sanctuary (MoV database, Womersley 1996).

3.9.6 SHOREBIRDS

A small area within the Ricketts Point Marine Sanctuary is recognised as an area of regional significance for roosting and feeding shorebirds. Threatened species of bird recorded in and around the Marine Sanctuary are shown in Table 13. Other species of bird to have been recorded include the Masked Lapwing and Silver Gull.

3.9.7 MARINE MAMMALS

Mammal species to be recorded in and around the Ricketts Point Marine Sanctuary are the Australian Fur Seal and Humpback Whale (AVW). Dolphins are rarely sighted in the northern half of Port Phillip Bay, preferring instead to remain just inside the entrance to the bay (Hale 2002).

Table 3.9.3. Threatened shorebird records from Ricketts Point Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		1986
Crested Tern	*Sterna bergii*			LR		1999
Eastern Curlew	*Numenius madagascariensis*			LR	CJ	2001
Glossy Ibis	*Plegadis falcinellus*			Vul	C	1994
Pacific Gull	*Larus pacificus*			LR		1999
Pied Cormorant	*Phalacrocorax varius*			LR		1988

Table 3.9.4. Threatened marine mammal records from Ricketts Point Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australian Fur Seal	*Arctocephalus pusillus*			Vul		1994
Humpback Whale	*Megaptera novaeangliae*		Vul	End		1980

Table 3.9.5. Selection of some animals and plants that may be found in the Ricketts Point Marine Sanctuary.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Hormosira banksii*, Ectocarpaceae, *Sargassum* sp., *Ecklonia radiata*, and *Cystophora* sp.
	green algae	*Ulva* spp., *Chaetomorpha* sp., *Codium fragile* and *Caulerpa* sp.
	red algae	*Corallina officinalis*, *Polysiphonia* sp.
Invertebrates	gastropods	*Austrocochlea constricta*, *Turbo undulatus*, *Bembicium nanum*, *Nerita atramentosa*, *Cominella lineolata*, *Lepsiella vinosa*, *Thais orbita*
	limpet gastropods	*Cellana tramoserica*, *Patelloida alticostata*, *Notoacmea flammea*
	mussels	*Mytilus edulis*
	polychaete	*Galeolaria caespitosa*

	anemone	*Actinia tenebrosa*
	sponges	*Tethya* sp., *Dendrilla rosea*
	ascidians	*Clavelina moluccensis*
	sea urchins	*Heliocidaris erythrogramma*
	abalone	*Haliotis rubra*
	seastars	*Coscinasterias muricata*, *Pateriella calcar*, *Tosia australis*
	cunjevoi	*Pyura stolonifera*
	blue ringed octopus	*Hapalochlaena maculosa*
	giant cuttlefish	*Sepia apama*
	crabs	*Cyclograpsus granulosus*, *Pilumnus serratifrons*
	sea stars	*Patiriella calcar*, *Coscinasterias muricata*
Fish	Tasmanian blenny	*Parablennius tasmanianus*
	common weedfish	*Heteroclinus perpicillatus*
	dragonet	*Bovichtus angustifrons*
	shore eel	*Alabes dorsalis*
	greenback flounder	*Rhombosolea tapirina*
	Tasmanian blenny	*Parablennius tasmanianus*
	old wives	*Enoplosus armatus*
	leatherjackets	Monacanthidae
	porcupine fish	Diodontidae
	zebra fish	*Girella zebra*
	blennies	Blennidae
	seahorses	*Hippocampus* sp.
	King George whiting	*Sillaginodes punctata*
	snapper	*Chrysophrys auratus*
	Australian salmon	*Arripis trutta*
	stingarees	Urolophidae
	globe fish	*Diodon nicthemerus*
	yank flathead	*Platycephalus speculator*
	red mullet	*Upeneichthys vlamingii*
	Port Jackson shark	*Heterodontus portusjacksoni*
	angel shark	*Squatina australis*
	skates	Rajidae
	eagle rays	*Myliobatis australis*
	banjo rays	*Trygonorrhina fasciata*
	rock ling	*Genypterus tigerinus*.
	sand flathead	*Platycephalus bassensis*
	long snouted	*Ammotretis rostratus*

	flounder	
	red mullet	*Upeneichthys vlamingii*
	toadfish	*Tetractenos glaber*
	prickly toadfish	*Contusus brevicaudus*
	gobies	Gobiidae

3.9.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

Sites of geological and/or geomorphological significance within or adjacent to Ricketts Point Marine Sanctuary are listed below (MPV database and Buckley 1993):

- Ricketts Point (Regional/Local Significance): Structural, palaeontological & geomorphological significance widest shore platform in area Tertiary Black Rock sandstone. Displays relationship between rock structure and landforms.
- Table Rock Point (Regional/Local Significance): Tertiary Black Rock Sandstone. Beaumaris monocline. Undermining of cliffs has produced sea caves. Extensive development of cliffs in Black Rock Sandstone.

3.9.9 KNOWLEDGE GAPS

There are no quantitative studies on unvegetated soft sediment within the Ricketts Point Marine Sanctuary, all information is derived from nearby areas. The majority of the other information is also derived from informal surveys or observations by local residents.

3.9.10 RESEARCH

Author	Project	Notes
(Lindsay)	Reef fish recruitment inside and outside of marine parks	Upcoming Honours project
(Watson and McInnes 1999)	Hydroids from Ricketts Point and Black Rock, Victoria	
(Jenkins *et al*. 1996)	Importance of shallow water, reef-algal habitats as nursery areas for commercial fish from southeastern Australia	
(Parry *et al*. 1995)	The distribution, abundance and diets of demersal fish in Port Phillip Bay	
(Coleman 1972)	Observations on shallow water, rocky reef fishes of Port Phillip Bay, Victoria	

3.10 Mushroom Reef Marine Sanctuary

Mushroom Reef Marine Sanctuary is situated at the southwest corner of Western Port and consists of ancient basalt that has been strongly weathered to provide a range of microhabitats that allow an extremely high diversity of flora and fauna to exist.

3.10.1 PHYSICAL PARAMETERS

Mushroom Reef Marine Sanctuary is situated on the western entrance to Western Port less than one kilometre from Flinders. It is a moderately exposed reef with no major discharges in the vicinity of the Sanctuary that covers 702m of coastline.

Table 3.10.1 Physical parameters of the Mushroom Reef Marine Sanctuary.

Park Name	**Mushroom Reef**
Conservation status	Marine Sanctuary
Biophysical Region	Central Victoria
Size of Park (ha)	56
Length of coastline (m)	702
Exposure rating	moderate
Wave Energy	high
Tidal variation - springs (m)	2.1
Tidal variation - neaps (m)	0.7
Water temp - summer (°C)	17.5
Water temp - winter (°C)	13
0 - 10 m (ha)	56
Discharges	None
Adjacent catchment	Agricultural/urban

3.10.2 MARINE HABITAT CLASSES

The Mushroom Reef Marine Sanctuary is, as its name suggests, predominantly a reef habitat. The intertidal and subtidal reefs include a number of microhabitats such as rock pools, overhanging ledges, boulders, bommies and gutters. A cobble strip separates the reef from the shore. While not within the boundary, the Sanctuary is backed by steep rocky cliffs and embankments and a sandy beach (Figure A2.10a).

Table 3.10.2. Marine Habitat Classes of the Mushroom Reef Marine Sanctuary.

Marine Habitat Class	Attributes
Shoreline category	Dune
	Beach
	Platform
	Beach / Platform
Substratum relief	High profile reef
Substratum texture	Broken reef
	Gutters
Lithology	Basalt
	Granite
	Calcarenite
Subtidal reef biota	Kelp - Phyllospora dominated
	Kelp - Macrocystis dominated
	Kelp - Durvillaea dominated
	Kelp - Ecklonia dominated
	Kelp - mixed Phyllospora / Ecklonia
Understorey reef biota	Mixed algae - brown dominated
	Mixed algae - green
	Cystophora
	Sessile invertebrates
	Red algae dominated
Intertidal reef biota	Caulerpa
	Fleshy algae -mixed greens
	Fleshy algae -mixed browns
	Durvillaea
	Hormosira
	Coralline algae
	Barnacles
Heavy reef Area (ha)	5
Total Reef Area (ha)	5
Undefined Area (ha)	52

3.10.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine Sanctuary, refer to Table 3.10.6.

Intertidal Reef

Flora

The most conspicuous algal species on the intertidal reef is the brown neptune's necklace (*Hormosira banksii*), with mats of coralline algae (e.g. *Jania* sp.) also common. Lower on the shore several species of the brown alga *Cystophora* have been reported as well as the green alga *Caulerpa brownii* (Synnot and Wescott 1976).

Invertebrate fauna

Synnot and Wescott (1976) described the zonation pattern at Flinders Reef. They considered the main rock platform separately to the cobble strip and describe the most common species of the supralittoral fringe as the small blue periwinkle *Littorina unifasciata* and a closely related species *L. praetermissa* was also recorded in that area. Further down the shore, the barnacles *Chthamalus antennatus*, *Tetraclitella purpurascens* and *Chamaesipho columna* are common. They described the most conspicuous animals in the midlittoral zone as the molluscs' *Austrocochlea constricta*, *Bembicium nanum*, *Nerita atramentosa*, *Lepsiella vinosa*, *Cellana tramoserica*, *Siphonaria diemenensis*, *Patelloida alticostata* and the tubeworm *Galeolaria caespitosa*. The tubeworm forms encrusting masses of calcareous tubes that provide many microhabitats for a variety of crabs, worms and amphipods. Common invertebrate species at the lower section of the shore include the dogwhelk *Thais orbita*, the wavy turbo *Subninella undulata* and the chitons *Poneroplax albida* and *P. costata*.

The cobble strip or rock rubble areas at Mushroom Reef were also considered to be zoned by Synnot and Wescott (1976) although not as strongly as the main platform. They recorded several species of grapsid crab (*Paragrapsus quadridentatus*, *Cyclograpsus granulosus*, *C. audouini*, *Brachynotus spinosus* and *Leptograpsodes octodentatus*) as being common in the mid-littoral area. The introduced green grab *Carcinus maenas* was also recorded from the upper mid-littoral area. The green sea star *Pateriella exigua* and the gastropods *Nerita atramentosa*, *Austrocochlea constricta* and *Lepsiella vinosa* were also recorded from the rubble / cobble areas by Synnot and Wescott (1976).

Fish

No information regarding the fish species that use the intertidal reef environment in this Marine Sanctuary was uncovered during the literature search.

Subtidal Reef

Flora

Seafloor areas at approximately 2-3 m depth are protected by a shallow reef on the ocean side and are covered in a diverse carpet of algae and seagrasses. The larger rocks are covered in kelps, and smaller brown and red algae. The sandy bottom supports large beds of *Amphibolis* seagrass and patches of green algae (*Caulerpa brownii*) (O'Hara pers comm.). *Ecklonia radiata* and *Phyllospora comosa* dominate the subtidal reef. Other abundant brown algae include *Carpoglossum confluens*, *Seirococcus axillaris* and *Sargassum* sp. Fleshy red algal species have also been described as abundant (Roob *et al*. 2000)

Invertebrate fauna

No information about the invertebrate fauna of the subtidal reef at Mushroom Reef Marine Sanctuary was uncovered during the literature search however a popular dive site nearby has been described as supporting ascidians including the sea tulip (*Pyura gibbosa*), sponges, soft corals and gorgonian fans (Alcyonacea) (Stone 1999). Separate experimental research on abalone (Officer *et al*. 2001a) and the bryozoan *Mucropetraliella elleri* (Klemke 1993) confirm that these species are also present.

Fish

A large variety of the weed fish (Clinidae) have been reported from this area along with clingfishes (Gobiesocidae) and *Siphonognathus attenuatus* the weed whiting (R. Kuiter pers. comm.). Common species from nearby sites include blue throated wrasse *Notolabrus tetricus*, morwongs (Cheilodactylidae), sweep (Scorpididae) and leatherjackets (Monacanthidae) (Stone 1999).

3.10.4 BIOLOGICAL PROCESSES

Biological processes occurring within the Marine Sanctuary are unknown.

3.10.5 SPECIES DISTRIBUTION INFORMATION

Distributional Limits

A list of algae, mollusc and echinoderm and crustacean species which have their distributional limits at or near the Mushroom Reef Marine Sanctuary is presented in Table 3.10.3. The distributional limits of the biota listed here may reflect collection effort in this area rather than actual Victorian distributions. Many areas of the Victorian coast have never been sampled and therefore biota ranges may be much greater than those suggested.

Table 3.10.3. Biota with distributional limits located at or near the Mushroom Reef Marine Sanctuary. (PW – presumed to be at or near western limit in Sanctuary, PE – presumed to be at or near eastern limit in Sanctuary, RW – record from in Sanctuary is western limit, RE – record from in Sanctuary is eastern limit)

Phylum	Family	Species	Common name	Category
Crustacea	Grapsidae	*Pachygrapsus transversus*	Crab	PW
Crustacea	Majidae	*Huenia australis*	Crab	PE
Crustacea	Majidae	*Pseudomicippe maccullochi*	Crab	PW
Crustacea	Hippolytidae	*Tozeuma kimberi*	Shrimp	RE
Crustacea	Strahlaxiidae	*Strahlaxius plectrorhynchus*		PE
Echinodermata	Cucumariidae	*Apsolidium densum*	Sea Cucumber	RE
Echinodermata	Cucumariidae	*Apsolidium handrecki*	Sea Cucumber	PE
Mollusca	Anabathridae	Pisinna olivacea olivacea	Marine snail	RW
Mollusca	Triphoridae	*Cheirodonta labiata*	Marine snail	PW
Mollusca	Ischnochitonidae	*Ischnochiton virgatus*	Chiton	PE
Phaeophyta	Dictyotaceae	*Dictyopteris nigricans*	Brown algae	RE
Rhodophyta	Ceramiaceae	*Ceramium tasmanicum*	Red algae	PE
Rhodophyta	Ceramiaceae	*Heterothamnion episiliquosum*	Red algae	PE
Rhodophyta	Ceramiaceae	*Lamathamnion epicodii*	Red algae	PE
Rhodophyta	Ceramiaceae	*Radiathamnion speleiotis*	Red algae	RE
Rhodophyta	Ceramiaceae	*Spermothamnion pinnatum*	Red algae	PE
Rhodophyta	Ceramiaceae	*Spongoclonium brownianum*	Red algae	RE
Rhodophyta	Ceramiaceae	*Wrangelia abietina*	Red algae	PE
Rhodophyta	Ceramiaceae	*Wrangelia velutina*	Red algae	PE
Rhodophyta	Dasyaceae	*Dasya clavigera*	Red algae	PE
Rhodophyta	Corallinaceae	*Austrolithon intumescens*	Red algae	PE
Rhodophyta	Corallinaceae	*Mesophyllum printzianum*	Red algae	PE
Rhodophyta	Corallinaceae	*Pneophyllum submersiporum*	Red algae	PE
Rhodophyta	Areschougiaceae	*Rhabdonia clavigera*	Red algae	PE
Rhodophyta	Cystocloniaceae	*Craspedocarpus blepharicarpus*	Red algae	PE
Rhodophyta	Dumontiaceae	*Dudresnaya australis*	Red algae	PE
Rhodophyta	Halymeniaceae	*Carpopeltis phyllophora*	Red algae	PE
Rhodophyta	Halymeniaceae	*Zymurgia chondriopsidea*	Red algae	RE
Rhodophyta	Kallymeniaceae	*Kallymenia cribosa*	Red algae	RE
Rhodophyta	Kallymeniaceae	*Polycoelia laciniata*	Red algae	PE
Rhodophyta	Mychodeaceae	*Mychodea gracilaria*	Red algae	PE
Rhodophyta	Nemastomataceae	*Platoma foliosa*	Red algae	PE
Rhodophyta	Nemastomataceae	*Tsengia comosa*	Red algae	PE
Rhodophyta	Peyssonneliaceae	*Peyssonnelia splendens*	Red algae	RE

Rhodophyta	Hildenbrandiaceae	*Hildenbrandia expansa*	Red algae	PE
Rhodophyta	Lomentariaceae	*Lomentaria pyramidalis*	Red algae	RE
Rhodophyta	Rhodymeniaceae	*Leptosomia rosea*	Red algae	RE
Rhodophyta	Rhodymeniaceae	*Rhodymenia stenoglossa*	Red algae	PE

3.10.6 SHOREBIRDS

The list of threatened bird species recorded within and around the Mushroom Reef Marine Sanctuary is shown in table 3.10.4.

3.10.7 MARINE MAMMALS

Both Australian Fur Seals and Southern Right Whales have been recorded in the waters around Mushroom Reef Marine Sanctuary although it is probably too shallow for whales to enter the site itself.

Table 3.10.4. Threatened shorebird records from Mushroom Rock Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		2001
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		2001
Crested Tern	*Sterna bergii*			LR		2000
Kelp Gull	*Larus dominicanus*			CEn		1983
Pacific Gull	*Larus pacificus*			LR		2001
Pied Cormorant	*Phalacrocorax varius*			LR		1999

Table 3.10.5. Threatened marine mammal records from Mushroom Rock Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australian Fur Seal	*Arctocephalus pusillus*			Vul		1987
Southern Right Whale	*Eubalaena australis*	L	End	CEn		1989

Table 3.10.6. Selection of some animals and plants that may be found in the Mushroom Reef Marine Sanctuary.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Hormosira banksii, Ecklonia radiata* and *Phyllospora comosa*, *Carpoglossum confluens*, *Seirococcus axillaris* and *Sargassum* sp.
	coralline algae	*Jania* sp.
	green alga	*Caulerpa brownii*
	seagrass	*Amphibolis*
Invertebrates	gastropod	*Littorina unifasciata*, *L. praetermissa*, *Austrocochlea constricta*, *Bembicium nanum*, *Nerita atramentosa*, *Lepsiella vinosa*, *Thais orbita*, *Subninella undulata*
	barnacles	*Chthamalus antennatus*, *Tetraclitella purpurascens* and *Chamaesipho columna*
	limpet gastropods	*Cellana tramoserica*, *Siphonaria diemenensis*, *Patelloida alticostata*
	tubeworm	*Galeolaria caespitosa*
	chitons	*Poneroplax albida* and *P. costata*
	crab	*Paragrapsus quadridentatus*, *Cyclograpsus granulosus*, *C. audouini*, *Brachynotus spinosus* and *Leptograpsodes octodentatus*
	sea star	*Pateriella exigua*

3.10.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

There are no known sites of geological or geomorphological significance in the Marine Sanctuary.

3.10.9 KNOWLEDGE GAPS

No quantitative data are available on fish in both intertidal and subtidal reef in the Mushroom Marine Sanctuary, all information is derived from incidental sightings. The most recent descriptive information of the intertidal reef was from 1976. No more recent published or unpublished information was found.

3.10.10 RESEARCH

Author	Project	Notes
(Officer *et al*. 2001a)	Movement and re-aggregation of the blacklip abalone, *Haliotis rubra* Leach, after fishing	
(Klemke 1993)	Life history variation in the bryozoan *Mucropetraliella elleri* (MacGillivray)	PhD thesis
(Synnot and Wescott 1976)	Zonation at Flinders Reef, Westernport Bay. An introduction to Victorian intertidal ecology with specific reference to the Flinders Reef, Westernport Bay	

3.11 Beware Reef Marine Sanctuary

Beware reef is an isolated reef rising from sand substrate offshore from Cape Conran which supports a diverse assemblage of invertebrates, algae and fish. Australian Fur Seals regularly “haul-out” on the reef.

3.11.1 PHYSICAL PARAMETERS

Beware Reef is approximately six kilometres southeast of Cape Conran and approximately thirty kilometres southeast of Orbost. The Beware Reef complex consists of high profile permanently exposed reefs rising from subtidal sandy substrate in water between 20 m and 30 m depth. On the west side the reef drops steeply to the seabed, whilst on the northwestern edge a ridge occurs between 6-8 m. The reef is bisected by numerous subtidal gutters and three shipwrecks surround the reef.

Table 3.11.1. Physical parameters of the Beware Reef Marine Sanctuary.

Park Name	**Beware Reef**
Conservation status	Marine Sanctuary
Biophysical Region	Twofold Shelf
Size of Park (ha)	220
Length of coastline	0
Exposure rating	High
Wave Energy	High
Influential currents	None
Tidal variation - springs (m)	0.9
Tidal variation - neaps (m)	0.6
Water temp - summer (°C)	18.5
Water temp - winter (°C)	13.5
0 - 20 m (ha)	25
20 - 30 m (ha)	115
30 - 40 m (ha)	80
Adjacent catchment	N/A

3.11.2 MARINE HABITAT CLASSES

The major Marine Habitat Classes in the Beware Reef Marine Sanctuary are subtidal and intertidal reef and subtidal soft sediment (Figure A2.11a).

Table 3.11.2. Marine Habitat Classes of the Beware Reef Marine Sanctuary.

Marine Habitat Class	Attributes
Substratum relief	High profile reef
Substratum texture	Broken reef
	Gutters
	Outcrops
	Coarse sand
	Medium sand
	Shell rubble / grit
Lithology	Basalt
	Granite
	Calcarenite
Subtidal reef biota	Kelp - Phyllospora dominated
	Kelp - Macrocystis dominated
	Kelp - Durvillaea dominated
	Kelp - Ecklonia dominated
Subtidal understorey reef biota	Mixed algae - brown dominated
	Mixed algae - other
	Cystophora
	Sessile invertebrates
	Red algae dominated
	Urchin barrens
Intertidal reef biota	Durvillaea
	Coralline algae
	Fleshy algae -mixed greens
	Fleshy algae -mixed browns
	Pyura
	Mussels
	Barnacles
Sediment Area (ha)	35
Undefined Area (ha)	185

3.11.3 MARINE ECOLOGICAL COMMUNITIES

For a general outline of some of the animals and plants that may be found in this Marine Sanctuary, refer to Table 3.11.3 and Table 3.11.7.

Intertidal reef

Flora

The dominant intertidal algae in the lower intertidal is the bull kelp *Durvillaea potatorum* which grows in thick stands. Coralline algae and fleshy greens and brown algae have also been observed on the intertidal reef (J. Ariens, pers. comm.).

Invertebrate fauna

The dominant intertidal invertebrate in the lower intertidal is the ascidian *Pyura stolonifera* (J. Ariens, pers comm.)

Fish

No information was found that related to intertidal fish from Beware Reef.

Subtidal reef

Flora

Near the surface, in the sublittoral fringe, a layer of *Durvillaea potatorum* is common, whilst in shallow water on a ridge of the reef, a thick understorey of red coralline turf algae is cropped by *C. rodgersii*. A mixed cover of *Phyllospora comosa* and *Ecklonia radiata* and *Cystophora* spp is common in water less than ten metres and at deeper sites on the reef (13-20 m) long stiped *Ecklonia* dominate.

Invertebrate fauna

An abundant and diverse assemblage of invertebrates is present on Beware Reef. The black sea-urchin *Centrostephanus rodgersii* forms small barrens devoid of macroalgae on the coralline algae-covered shallow surfaces of the reef. The large Maori octopus (*Octopus maorum*) is also occasionally sighted at night amongst the *Ecklonia radiata* stipes and encrusting sponges infest the *E. radiata* holdfasts, along with numerous worms and the brittle stars (*Ophiothrix spongicola* and *O. caespitosa*) (O'Hara 2000).

Anemones (including *Anthothoe albocincta* and *Balanophyllia bairdiana*), encrusting sponges and large finger sponges, colonial (*Botrylloides* sp.) and stalked ascidians are abundant on deeper vertical faces and in shaded gutters on the reef where limited light penetration reduces algae cover (O'Hara 2000). Crinoids (*Cenolia trichoptera* and *C. tasmaniae*) of green, orange and white colour morphs are common in cracks, along with the urchin *Heliocidaris erythrogramma*, blacklip abalone (*Haliotis rubra*) and red bait crab (*Plagusia chabrus*) (O'Hara 2000). Hydroids, gorgonians (*Mopsella* sp. and *Capnella* sp.) and sea-whips (*Primnoella australasiae*) are common towards the base of the reef and the common brittle-star (*Ophionereis schayeri*) and a commensal scale worm (*Polynoid* sp.) were observed under loose rocks (O'Hara, 2002). Photographs from a recent survey on Beware Reef revealed the pink jewel anemone (*Corynactis australis*) and the nudibranch (*Hypselodoris bennetti*) to also be present on the reef (Ariens and May 2002).

Fish

Fish species were identified from a series of photographs taken on Beware Reef and common species are summarised in Table 3.11.3.

Table 3.11.3. Common fish on subtidal reef identified from a recent photographic survey (Ariens and May 2002).

Common name	Scientific name
Port Jackson shark	*Heterodontus portusjacksoni*
Wobbegong	*Orectolobus sp.*
Wrasse	
Long-snouted boarfish	*Pentaceropsis recurvirostris*
Weedy seadragon	*Phyllopteryx taeniolatus*
Draughtboard shark	*Cephaloscyllium laticeps*
Bullseye	*Pempheris sp.*
Butterfly perch	*Caesioperca lepidoptera*
Sea sweep	*Scorpis aequipinnis*

Subtidal soft sediment

Invertebrate fauna

No surveys of invertebrates on the subtidal soft sediments of Beware Reef are available. However, gut contents analysis of fish from trawl samples nearby indicates that numerous polychaetes, isopods, gastropods, euphasids, ophiuroids, bivalves, amphipods, cumaceans and cephalopods formed the diet of the fish collected (Bird and Watson 1993). Due to the nature of gut contents analysis, only some species were identifiable including the polychaete *Travisia* spp., the cumacean *Pomacuma australiae*, the pagurid *Paguristes brevirostris*, and the amphipods *Cheiriphotis* sp. and *Ampelisea* sp. nov. amphipod (Bird and Watson 1993).

Fish

A trawl survey was conducted near the Beware Reef Marine Sanctuary and the most common species collected are summarised in Table 3.11.4 which illustrates that the presence of some species is highly seasonal. Gut contents of the fish were analysed and two additional species were identified; the ophichthid *Muraenichthys australis* and the common bullseye *Pempheris multiradiatus* (Bird and Watson 1993).

Table 3.11.4. Numbers of fish species collected in February and June during three trawls covering 1700-1800 m at between 20 and 48 m depth approximately ten kilometres West of the Beware Reef Marine Sanctuary (Bird and Watson 1993). Fish species are arranged in decreasing average abundance.

Common name	Scientific name	Feb	June
Sparsely spotted stingaree	*Urolophus paucimaculatus*	16	20
Gurnard	*Lepidotrigla spp.*	16	19
Flathead	*Platycephalus spp.*	21	8
Common gurnard perch	*Neosebastes scorpaenoides*	19	6
Banded stingaree	*Urolophus cruciatus*	12	10
School whiting	*Sillago bassiensis*	5	15
Spiky globefish	*Diodon nicthemerus*	7	10
Swell shark	*Cephaloscyllium laticeps*	8	9
Barred toadfish	*Contusus richei*	6	10
Angel shark	*Squatina australis*	10	6
Long-snouted flounder	*Ammotretis rostratus*	11	5
Morwong	*Nemadactylus macropterus*	10	5
Jack mackerel juvenile	*Trachaurus declivis*	0	15
Spotted cat shark	*Asymbolus analis*	0	14
Nannygai	*Centroberyx affinis*	0	11
Southern saw shark	*Pristiophorus nudipinnis*	0	11
Warehou	*Seriolella brama*	0	11
Red mullet	*Upenichtys sp.*	5	5
Red gurnard	*Cheliodonichthys kumu*	6	4
Tasmanian numbfish	*Narcine tasmaniensis*	8	2
Velvet leatherjacket	*Parika scaber*	8	0
Peacock skate	*Pavoraja nitida*	0	6
Elephant shark	*Callorhynchus milii*	3	3
Silver trevally juvenile	*Pseudocaranx dentex*	6	0
Porcupinefish	*Allomycterus pilatus*	0	5
Silverbelly	*Paraquula melbournensis*	0	5
Snapper juvenile	*Chrysophrys auratus*	5	0
Gummy shark	*Mustelus antarcticus*	0	4
Eagle ray	*Myliobatis australis*	2	2
Robust boxfish	*Anoplocapros inermis*	4	0
Port Jackson shark	*Heterodontus portusjacksoni*	0	2
Barred grubfish	*Parapercis allporti*	0	1

3.11.4 BIOLOGICAL PROCESSES

Biological processes occurring within the Marine Sanctuary are unknown.

3.11.5 SPECIES DISTRIBUTION INFORMATION

No marine species are known to have their distributional limits within or near the Marine Sanctuary.

3.11.6 SHOREBIRDS

No records of threatened species available within the boundaries of the Beware Reef Marine Sanctuary. Table 3.11.5 lists threatened species of shorebirds recorded in the surrounding areas.

3.11.7 MARINE MAMMALS

Both Australian Fur Seals and Humpback Whales have been recorded in the waters close to the Beware Reef Marine Sanctuary. Australian Fur Seals use the exposed areas of the reef as a haul out site (Park Notes).

Table 3.11.5. Threatened shorebird records from Beware Reef Marine Sanctuary surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australasian Gannet	*Morus serrator*			Vul		1994
Black-faced Cormorant	*Phalacrocorax fuscescens*			Vul		1990
Crested Tern	*Sterna bergii*			LR		1986
Fairy Prion	*Pachyptila turtur*		Vul	LR		1992
Pacific Gull	*Larus pacificus*			LR		1986
Pied Cormorant	*Phalacrocorax varius*			LR		2000
Shy Albatross	*Diomedea cauta*		Vul			1993
Southern Giant-Petrel	*Macronectes giganteus*		End	End		1992
Wandering Albatross	*Diomedea exulans*		Vul	CEn	J	1986
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	L		End	C	1994

Table 3.11.6. Threatened marine mammal records from Beware Reef Marine Sanctuary and surrounds (AVW).

Common Name	Scientific Name	FFG	National (EPBC)	State (TWV)	Treaties	Year TWV
Australian Fur Seal	*Arctocephalus pusillus*			Vul		1990
Humpback Whale	*Megaptera novaeangliae*		Vul	End		1992

Table 3.11.7. Selection of some animals and plants that may be found in the Beware Reef Marine Sanctuary.

The table below is not an exhaustive species list, nor does it identify only common organisms, but is provided as an outline of some of the biota that may be seen in this park.

	Common name	Scientific name
Flora	brown algae	*Durvillaea potatorum*, *Phyllospora comosa*, *Ecklonia radiata*, *Cystophora* spp.
	red coralline turf algae	Corallinacea
Invertebrates	ascidian	*Pyura stolonifera*, *Botrylloides* sp.
	sea-urchin	*Centrostephanus rodgersii, Heliocidaris erythrogramma*
	brittle stars	*Ophiothrix spongicola* and *O. caespitosa*
	anemones	*Anthothoe albocincta, Balanophyllia bairdiana*
	large finger sponges	
	feather stars	*Cenolia trichoptera* and *C. tasmaniae*
	blacklip abalone	*Haliotis rubra*
	red bait crab	*Plagusia chabrus*
	hydroids	
	gorgonians	*Mopsella* sp. and *Capnella* sp.
	sea-whips	*Primnoella australasiae*
	brittle-star	*Ophionereis schayeri*
	polychaetes	*Polynoid* sp.

3.11.8 SITES OF GEOLOGICAL AND GEOMORPHOLOGICAL SIGNIFICANCE

There are no known sites of geological or geomorphological significance in the Marine Sanctuary.

3.11.9 KNOWLEDGE GAPS

No quantitative data are available for any Marine Ecological Community of the Beware Reef Marine Sanctuary and all information in this report is derived from incidental reports, qualitative descriptions and photographic evidence. The intertidal areas of the reef are particularly poorly known. No species are known to be restricted or have their distributional limits at the Beware Reef Marine Sanctuary.

3.11.10 RESEARCH

Author	Project	Notes
(O'Hara 2000)	Faunal and floral assemblages associated with rocky reefs along the Victoria coast	

Glossary and Acronyms

algae	any chlorophyll containing plant belonging to the subphylum Algae, such as seaweed of red, brown or green variety. Does not include seagrass.
AME	Australian Marine Ecology Pty. Ltd.
anemone	predominantly solitary polyps of the class Anthozoa, phylum Cnidaria. Lacks a skeleton and possesses stinging cells used for feeding or defence.
ascidian	sessile chordate animals of the class Ascidiacea, may be solitary or colonial and there is usually a free-swimming larva.
AVW	Atlas of Victorian Wildlife, database managed by the Department of Sustainability and Environment.
benthic	the flora and fauna of the bottom of the sea.
biodiversity	the variety of all life forms: the different plants, animals and micro-organisms, the genes they contain and the ecosystems they form.
biogenic	materials produced by the actions of living organisms.
biota	collectively, the plants, micro-organisms and animals of a region.
bivalve	an animal of the class Bivalvia and the phylum Mollusca characterised a shell composed of two halves joined by a hinge.
brachiopod	an animal of the phylum Brachiopoda with a bivalve mollusc-like external appearance, having a dorsal and ventral shell.
brittle star	see “ophiuroid”.
broken reef	patches of usually low profile (<1 m high) reef interspersed with sand. Broken reef can be worm bed-rock or calcified sediments and /or hard coral growths.
bryozoan	sessile colonial animals of the invertebrate phylum Bryozoa, sometimes known as “moss animals” which form tuft-like or moss-like aggregate masses.
CAMBA	China Australia Migratory Birds Agreement.
Cen.	Critically Endangered: A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
cephalopod	group of highly organised molluscs characterised by a distinct head with arms or tentacles attached (includes cuttlefish, squid, octopus etc.,).
cnidarians	animals of the invertebrate phylum Cnidaria, possessing nematocysts or stinging cells, and including hydroids, corals, sea anemones and sea-jellies.
community	an assemblage of plant or animals species living together in a particular place.
crustacean	arthropod animals, mostly aquatic, characterised by a hard close fitting shell which is shed periodically (includes crabs, lobsters, shrimps etc.,).
DNRE	See NRE
echinoderm	bottom-dwelling animal of the phylum Echinodermata, possessing pentamerous radial symmetry and external skeleton of calcareous plates just beneath the skin.
elasmobranch	fishes of the subclass Elasmobranchii, comprising the sharks, the rays, and the Chimaera. The skeleton is mainly cartilaginous.
End.	Endangered: A taxon is Endangered when it is facing a very high risk of extinction in the wild in the near future.
endemic	“native” species confined to a given region and not found elsewhere in the world.
EPA	Environmental Protection Authority
EPBC	Environment Protection and Biodiversity Act.

epibenthic	benthic organisms living on (not within) the sea bottom.
epifauna	an animal or group of animals living on (not within) the sea bottom.
epiflora	an alga or plant living on (not within) the sea bottom.
epiphyte	an animal or plant growing attached to the surface of another marine plant or alga rather than the substrate.
epizoic	an animal or plant growing attached to the surface of another marine animal rather than the substrate.
Ext.	Extinct: A taxon is Extinct when there is no reasonable doubt that the last individual has died.
feather star	an animal belonging to the phylum Echinomdermata and the class Crinoidea. Juveniles are attached to the sea bottom by a stalk with root-like branches; the mouth side faces upward and tentacles transport food to the mouth. In the adult stage they break away from the stalk and move about freely. They look like upturned feather-dusters.
FFG	Flora and Fauna Guarantee Act 1988.
flatworm	any worm of the phylum Platyhelminthes, having bilateral symmetry and a soft, solid, usually flattened body.
foraminiferan	type of protozoan which has a calcareous shell, often large enough to be seen by the naked eye. There are both bottom-dwelling and planktonic species.
gastropod	any mollusc of the class Gastropoda, comprising the snails, whelks, slugs, etc.
GIS	Geographic Information System.
gorgonian	An animal belonging to the invertebrate phylum Cnidaria including sea-whips and soft corals.
habitat	a geographic area that can provide for the key activities of life.
habitat	The place or site where an organism occurs.
heavy reef	continuous unbroken reef, usually protruding from bed-rock, often deeply dissected and featuring a relatively steeply changing gradient or areas of high relief. Also called “high profile reef”.
high energy coastline	areas of coast subject to the effects of storms and large waves.
holothurian	any echinoderm of the class Holothuroidea, comprising the sea cucumbers.
hydroid	an animal of the invertebrate phylum Cnidaria, possessing stinging cells and often occurring as sessile colonies or polyps.
IMCRA	Interim Marine and Coastal Regionalisation for Australia.
infauna	animals living in rather than on the sea floor.
Ins.	Data Deficient: A taxon is Data Deficient when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution or population status. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future investigation will show that a threatened classification is appropriate.
intertidal	an area between high and low tide subject to daily changes in physical and biological conditions from tide movement.
invertebrates	animals without an internal skeletal structure or backbone.
IUCN	World Conservation Union (formerly known as the International Union for the Conservation of Nature.
JAMBA	Japan Australia Migratory Birds Agreement.

kelp	large brown seaweed.
larva	a pre-adult developmental stage of many invertebrates which hatches from the egg or is born live and often leads a different life from that of the adult.
littoral	of or pertaining to a shore, especially a seashore. The specific zone of the sea floor lying between high and low tide.
low profile reef	relatively flat reef (<1 m high) which does not rise at a steep gradient.
LR	Lower Risk - near threatened: A taxon is Lower Risk - near threatened when it has been evaluated, does not satisfy the criteria for any of the threatened categories, but which is close to qualifying for Vulnerable. In practice, these species are most likely to move into a threatened category should current declines continue or catastrophes befall the species.
macroalgae	large algae (*e.g.,*., kelp).
macrobenthos	organisms living in or on aquatic substrates and large enough to be seen with the naked eye.
macrophytes	relatively large marine plants, visible to the naked eye.
MAFRI	Marine and Freshwater Resources Institute.
MRG	?
microbenthos	organisms (for example, protozoa, bacteria, nematodes) living on or in aquatic substrates and too small to be seen with the naked eye.
molluscs	group of soft bodied marine animals which usually have a hard shell (includes snails, bivalves, tooth shells and cephalopods).
MPV	Minerals and Petroleum Victoria.
MRG	Marine Research Group
neap tides	tides of small range which occur near the time of the first and last quarter phases of the moon, between spring tides.
NRE	Department of Natural Resources and Environment (now split into the Department of Sustainability and Environment and Department of Primary Industries).(Also written as DNRE).
ophiuroid	a group of animals of the class Ophiuroidea, commonly known as brittle stars, characterised by long slender arms with spines, extending from a circular, pentagonal or star-shaped body disk.
ostracod	an animal of the order Ostracoidea and the phylum Crusteacea, possessing hard bivalve shells. They are of small size, and are free swimming.
pelagic	living in the water column as distinct from living on the seabed.
phylum	high level of taxonomic division containing plants or animals of the same general form and preferably reflecting a common ancestry.
phytoplankton	planktonic plant organisms collectively.
planktonic	animals or plants occurring in the water column which float or drift passively subject to currents and tides.
polychaetes	class of segmented worms belonging to the phylum Annelida, characterised by numerous bristles on the foot stumps.
Ramsar site	A site listed under the Convention on Wetlands of International Importance (the “Ramsar Convention”). The convention on Wetlands was signed in Ramsar, Iran in 1971.
R/R	rare.
sea tulip	see ascidian.

seagrass	flowering plants adapted to a marine existence.
seapen	colonial animal belonging to the phylum Cnidaria and the order Pennatulacea, with an internal body cavity having the shape of a fleshy feather.
sessile	attached to the substrate, immobile.
sipunculid	an animal belonging to the sipunculacea suborder of Annelida marine worms, in which the body is imperfectly, or not at all, externally annulated, and is mostly without hairs. Sometimes called “peanut worms”.
species	populations of animals or plants that are to interbreed and produce fertile offspring.
sponge	aquatic animal belonging to the phylum Porifera with pores in the body wall and a tough elastic skeleton.
spring tides	tides of increased range which occur twice a month at the time when the moon is new or full.
subtidal	below the low-water mark.
tellin	animals closely related to members of the genus *Tellina* of marine bivalve molluscs having thin, delicate, and often colourful shells.
TWV	Threatened Wildlife of Victoria.
urchin	spherical-shaped animal of the phylum Echinodermata with movable spines covering the firm, globose shell of the body.
Vul.	Vulnerable: A Taxon is Vulnerable when it is not Endangered but is facing a high risk of extinction in the wild in the medium-term future.

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Feedback sheet for Natural Values Report

Victorian Marine National Parks and Sanctuaries

Have we missed anything?

Do you know of any research or monitoring, published or not, that is relevant for a Marine National Park or Sanctuary that may have been missed by this report?

If you do, can you let us know?

Just copy or print off this page and send it by mail, fax or email to:

Mail: Dr Anthony Boxshall
Manager, Marine National Parks Research Programs
Parks Victoria
Lvl 9, 535 Bourke St
Melbourne 3000

Email: aboxshall@parks.vic.gov.au
Fax: (03) 9619 0990 *Use this sheet for Faxing.*

To: Anthony Boxshall ***Parks Victoria***	*FAX to: 03 9619 0990*	
From: ____________________ ____________________	Return Fax:	No. Pages incl. this:

Research or Monitoring Feedback

Type of Research or Monitoring	*Location (Please include nearest park)*	*Who did/does it? (Please include any contact details).*	*When did/does it happen? How long?*	*Other Comments or Information*

Please use an extra sheet if you need it.

Parks Victoria is responsible for managing the Victorian protected area network, which ranges from wilderness areas to metropolitan parks and includes both marine and terrestrial components.

Our role is to protect the natural and cultural values of the parks and other assets we manage, while providing a great range of outdoor opportunities for all Victorians and visitors.

A broad range of environmental research and monitoring activities supported by Parks Victoria provides information to enhance park management decisions. This Technical Series highlights some of the environmental research and monitoring activities done within Victoria's protected area network.

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APPENDIX 1

MARINE NATIONAL PARK MAPS

LEGEND 1: Marine and Coastal Habitats and Monitoring Sites

- DNRE/Parks Victoria Marine Monitoring Sites
- AME Sampling Sites (data not available for this study)
- DNRE Stage 3 Study Sampling Sites
- DNRE Stage 3 Sediment Sampling Sites
- MAFRI Abalone Reef Assessment Sites
- EPA Fixed Site Monitoring Points
- EPA Beach E. Coli Monitoring Sites
- Piers
- Roads

Marine Protected Areas

- Marine National Parks
- Marine Sanctuaries
- Special Management Areas

Marine Habitats

- Amphibolis Dominant Seagrass
- Amphibolis Dominant Seagrass & Macroalgae
- Halophila Dominant Seagrass & Macroalgae
- Rocky Reef
- Macroalgae
- Macroalgae on Reef
- Posidonia Dominant Seagrass
- Pyura & Macroalgae
- Sediment
- Zostera/Heterozostera & Halophila Dominant Seagrass & Macroalgae
- Zostera/Heterozostera Dominant Seagrass
- Zostera/Heterozostera Dominant Seagrass & Macroalgae
- Undefined

Shore Types

- Cobble/Shingle Beach
- Intertidal Mud-Sand Flat
- Intertidal Shore Platform
- Mangroves
- Salt Marsh
- Sand Beach
- Sand Dunes
- Steep Shoreline (rocky cliffs/embankments)
- Land

Note: Maps are compiled from data layers at various scales and depicted boundaries are for illustrative purposes only.

LEGEND 2: Shorebirds and Other Fauna Values

- Shorebird Roosts
- Threatened Shorebird Sightings (AVW)
- Hooded Plover Nesting Sites
- Little Penguin Colonies
- Seal Colonies
- Threatened Marine Mammal Sightings (AVW)
- Sites of Geological Significance
- Boat Ramps
- Ramsar Sites
- Significant Shorebird Habitats

Marine Protected Areas

- Marine National Parks
- Marine Sanctuaries
- Special Management Areas
- Piers and Jetties
- Roads

Land

Depth Contours

- Low Water Mark
- 5 m
- 10 m
- 20 m
- 30 m
- 50 m
- 70 m
- 100 m

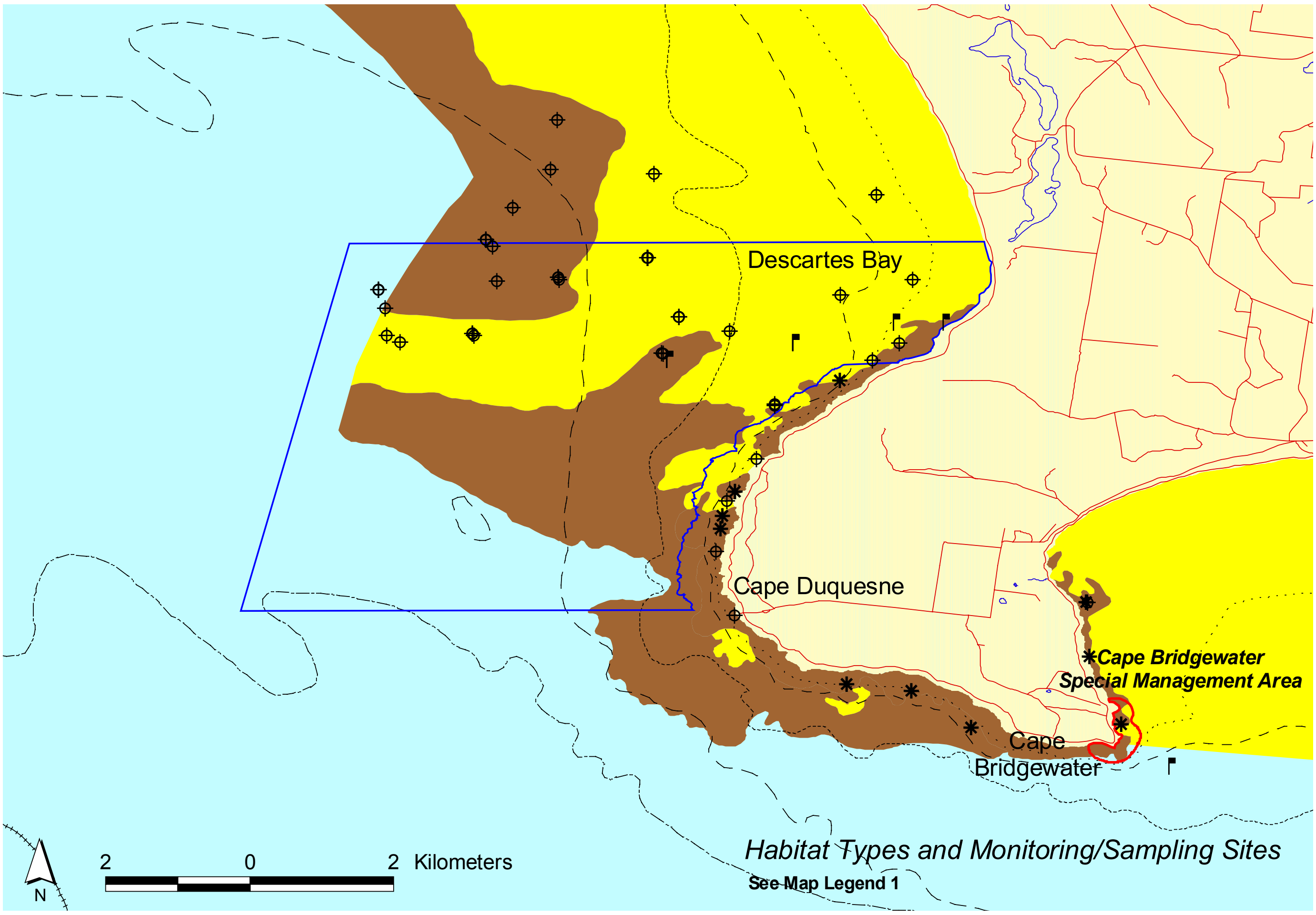

Figure A1.1a: Discovery Bay MNP marine habitats and monitoring/sampling sites.

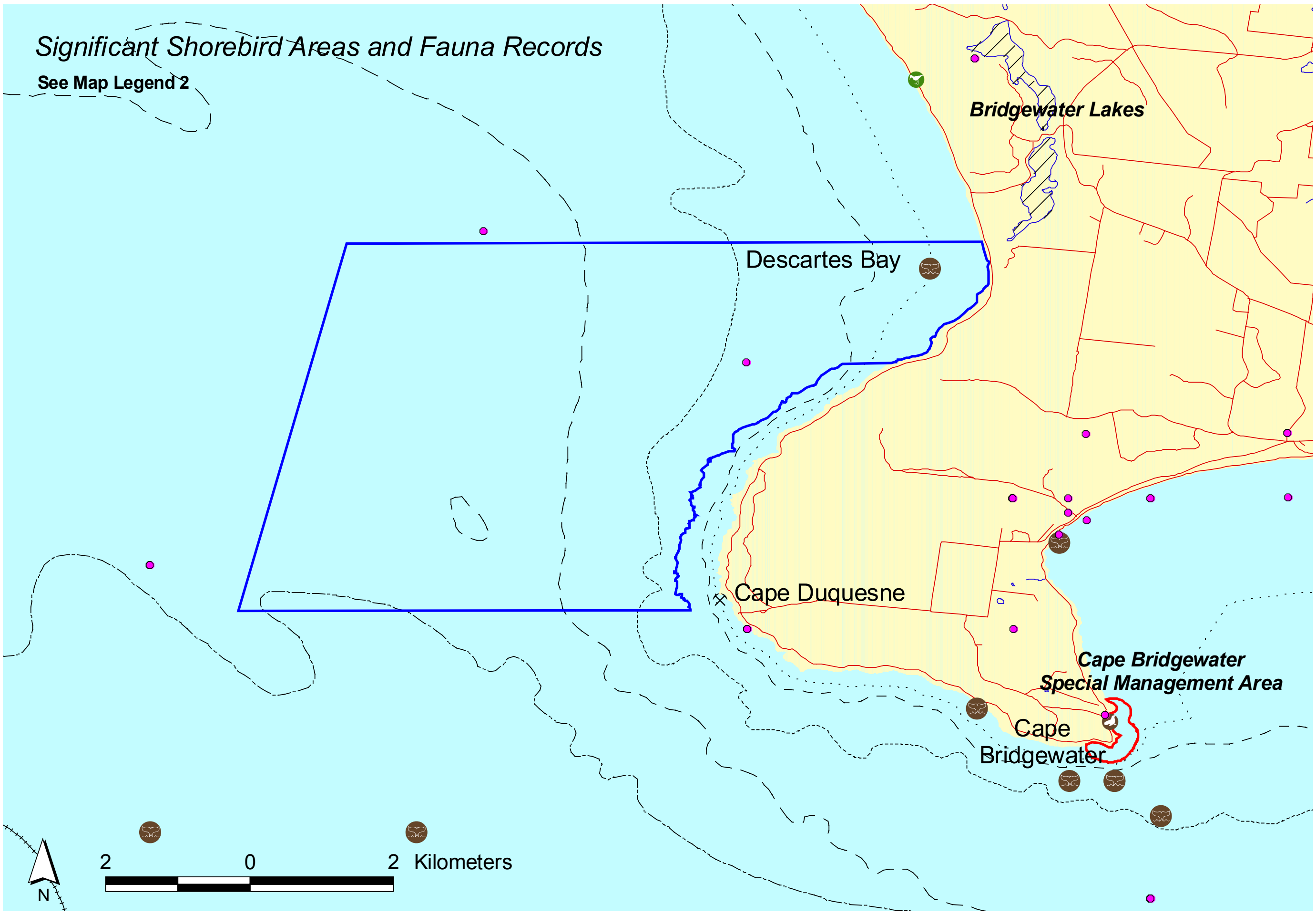

Figure A1.1b: Discovery Bay MNP shorebird and fauna values (see Tables 2.1.5 & 2.1.6 for threatened species lists).

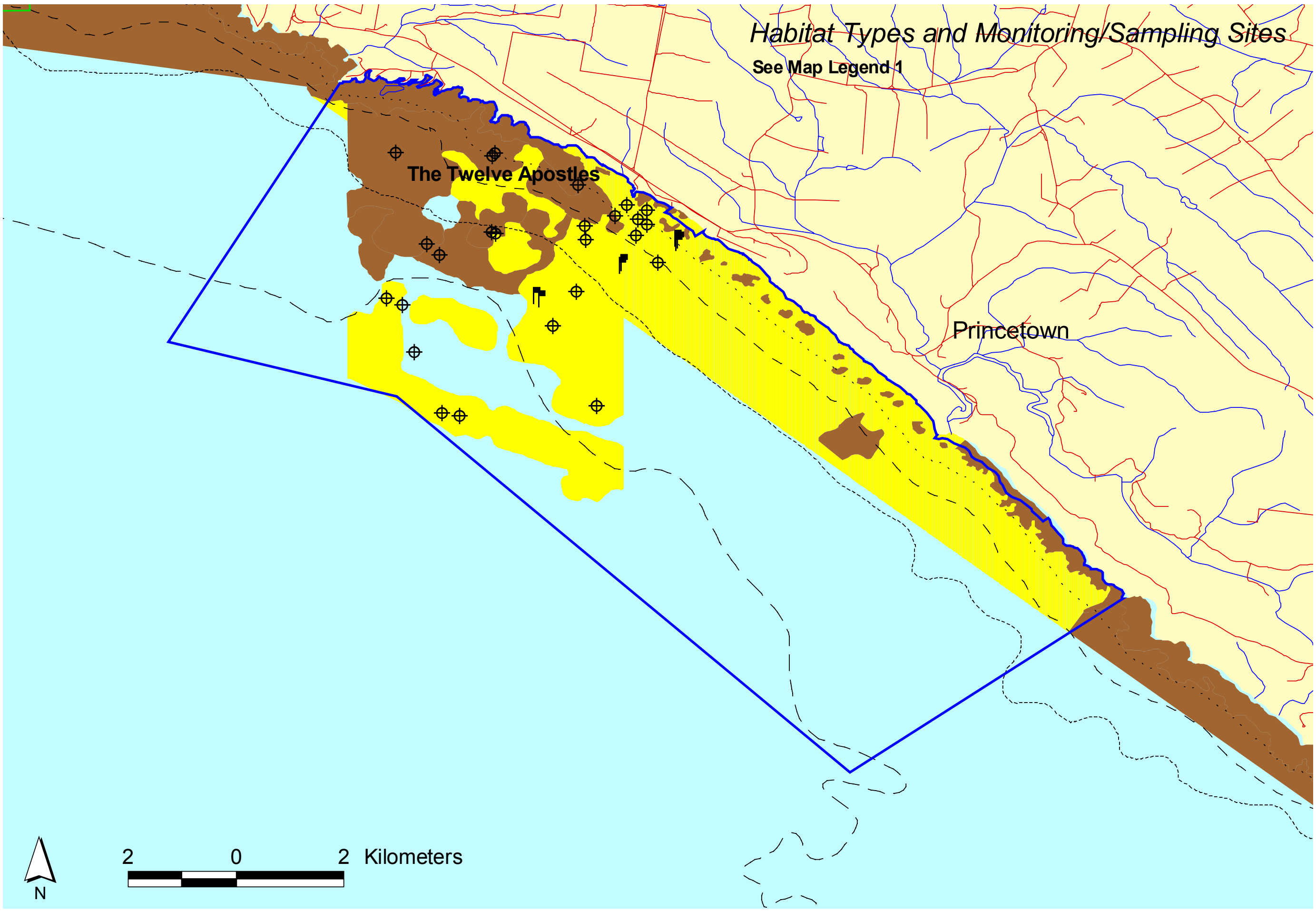

Figure A1.2a: Twelve Apostles MNP marine habitats and monitoring/sampling sites.

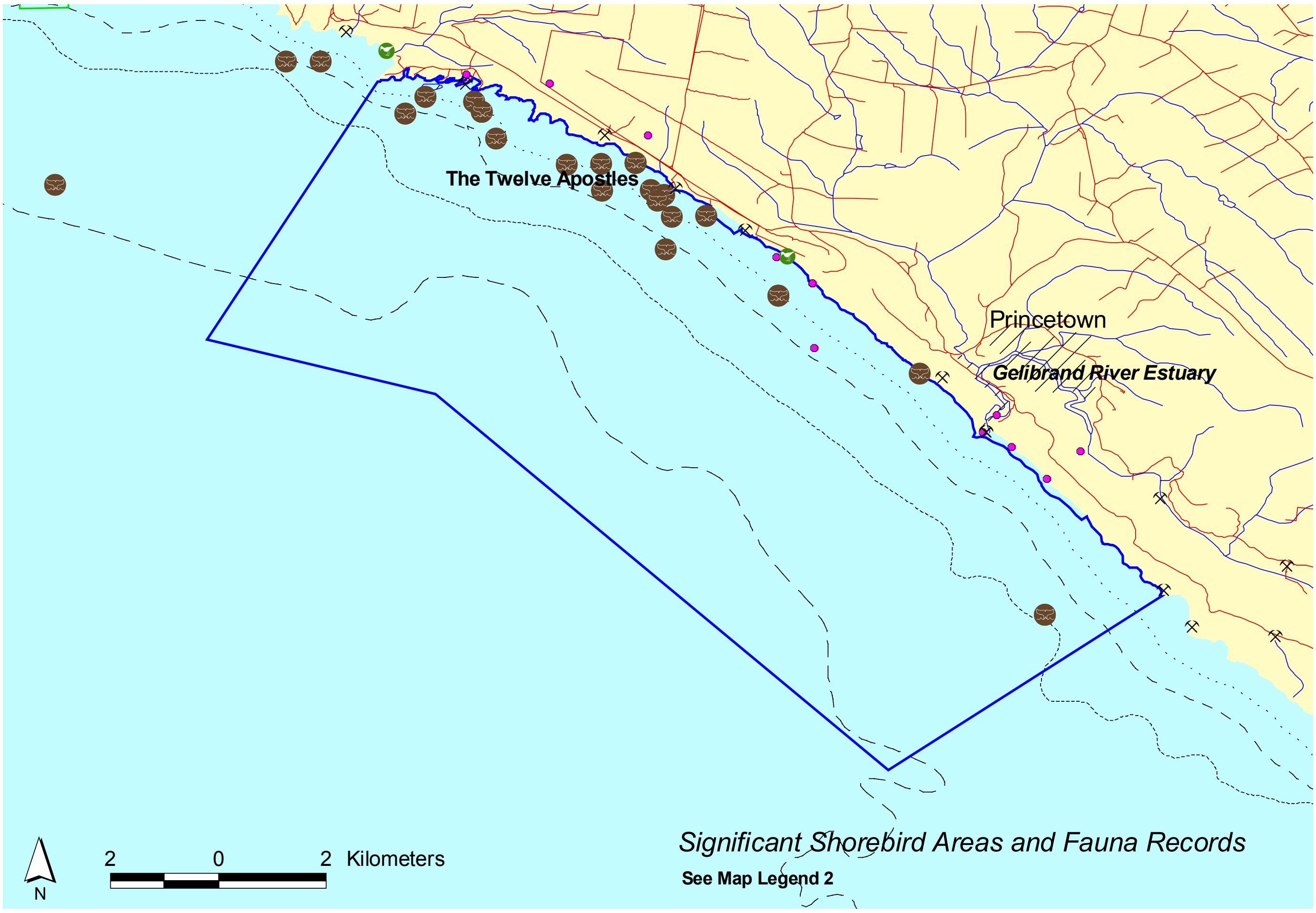

Figure A1.2b: Twelve Apostles MNP shorebird and fauna values (see Tables 2.2.3 & 2.2.4 for threatened species lists).

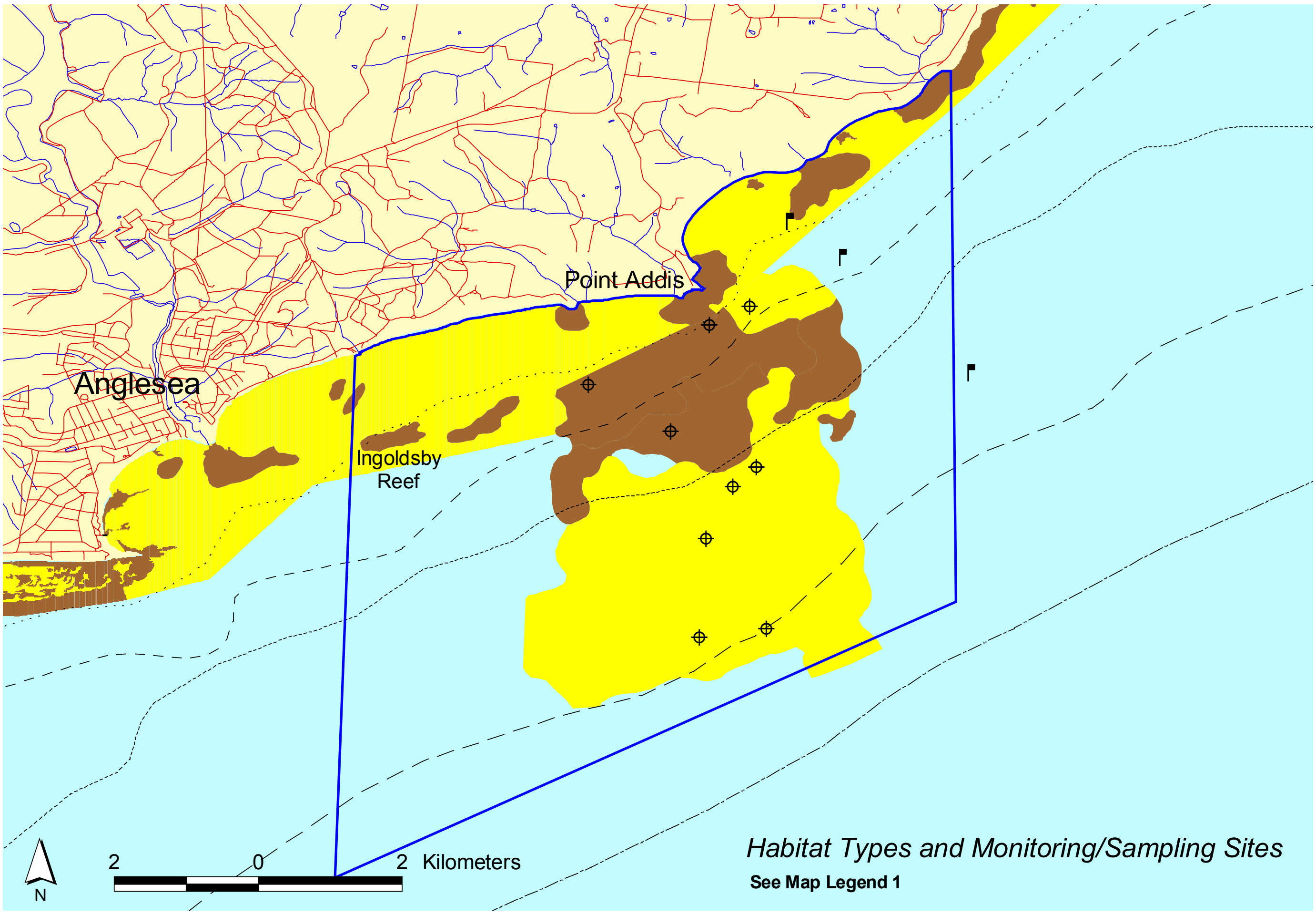

Figure A1.3a: Point Addis MNP marine habitats and monitoring/sampling sites.

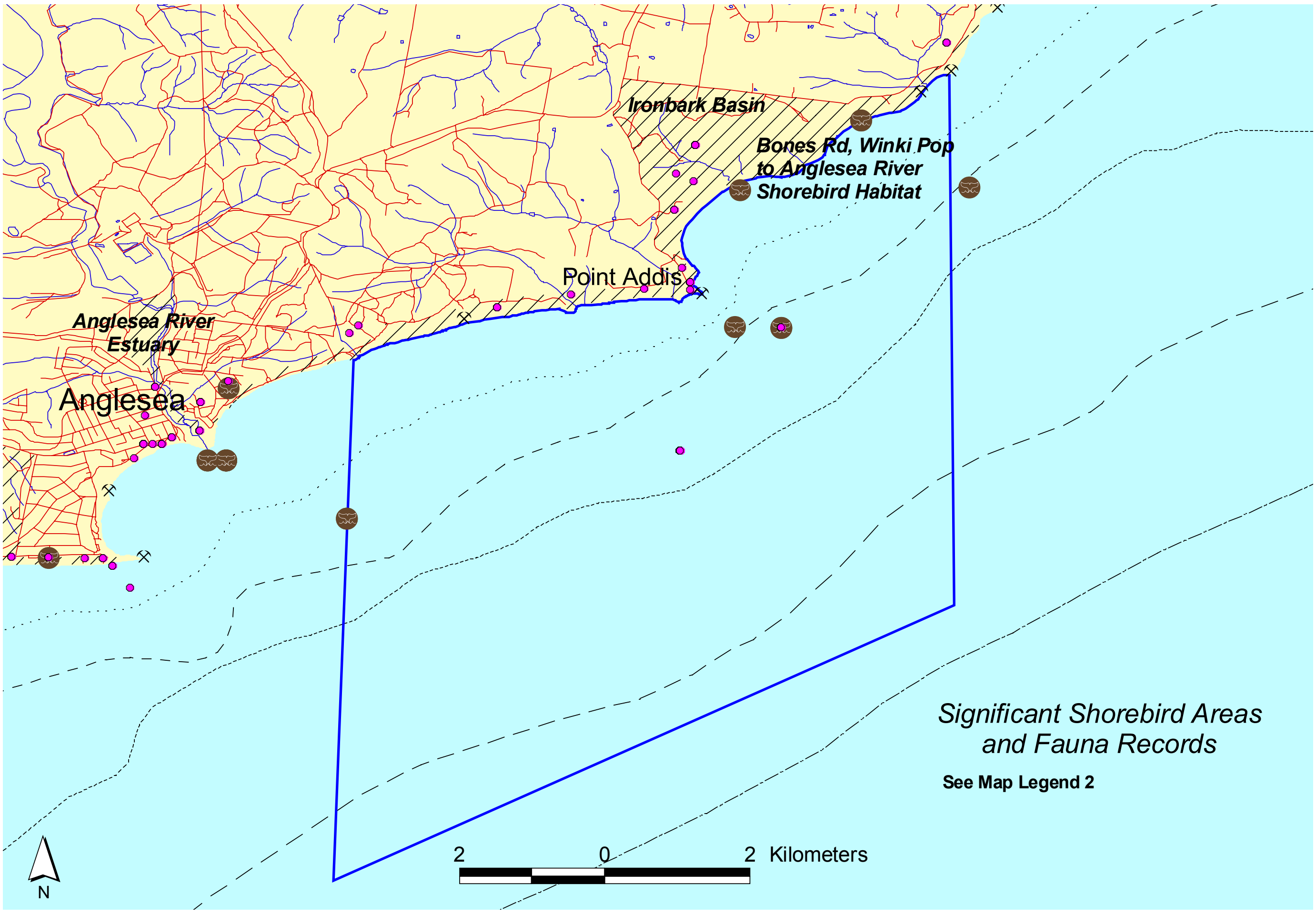

Figure A1.3b: Point Addis MNP shorebird and fauna values (see Tables 2.3.3 & 2.3.4 for threatened species lists).

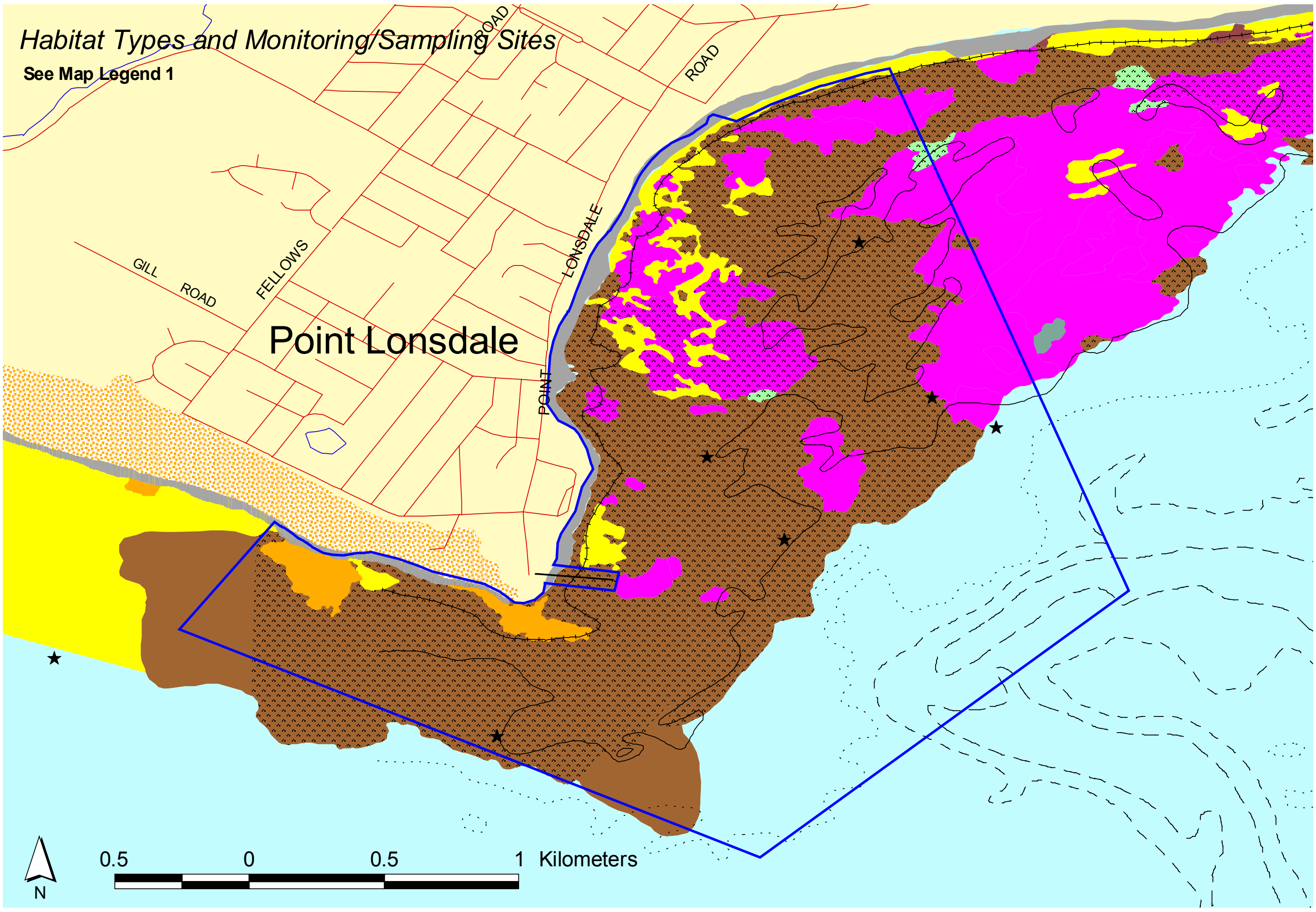

Figure A1.4a: Port Phillip Heads MNP – Point Lonsdale marine habitats and monitoring/sampling sites.

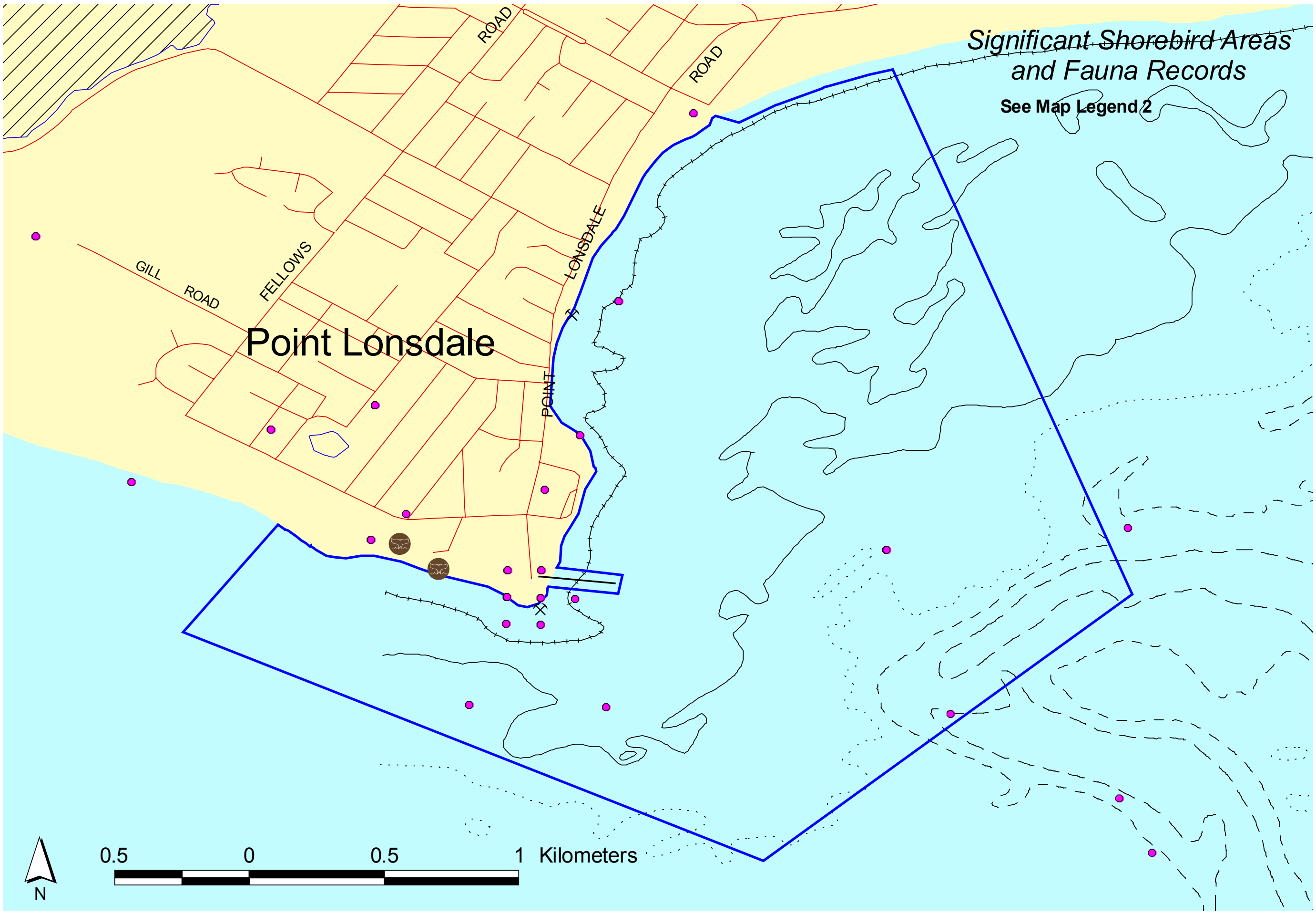

Figure A1.4b: Port Phillip Heads MNP – Point Lonsdale shorebird and fauna values (see Tables 2.4.5 & 2.4.6 for threatened species lists).

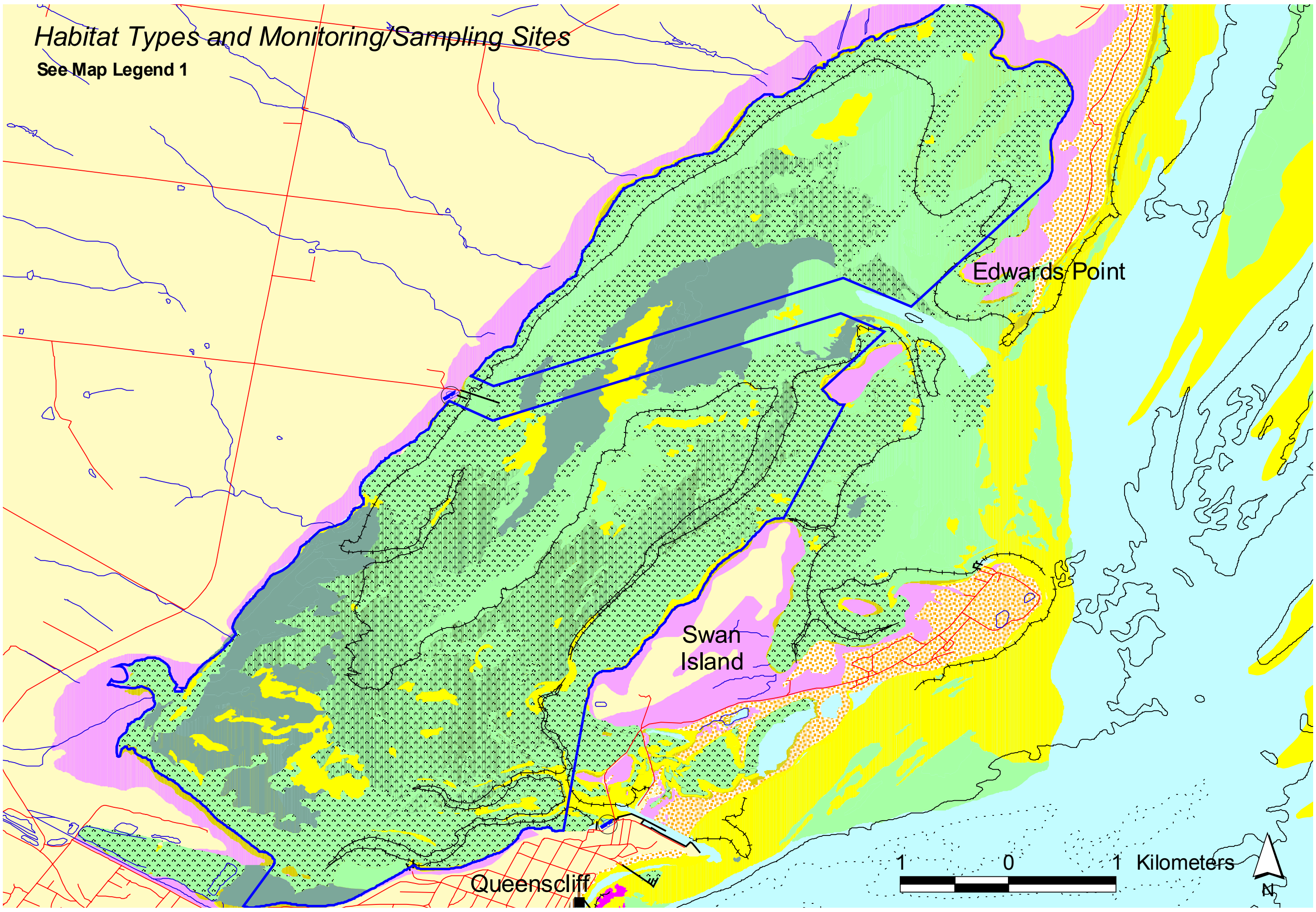

Figure A1.5a: Port Phillip Heads MNP - Swan Bay marine habitats and monitoring/sampling sites.

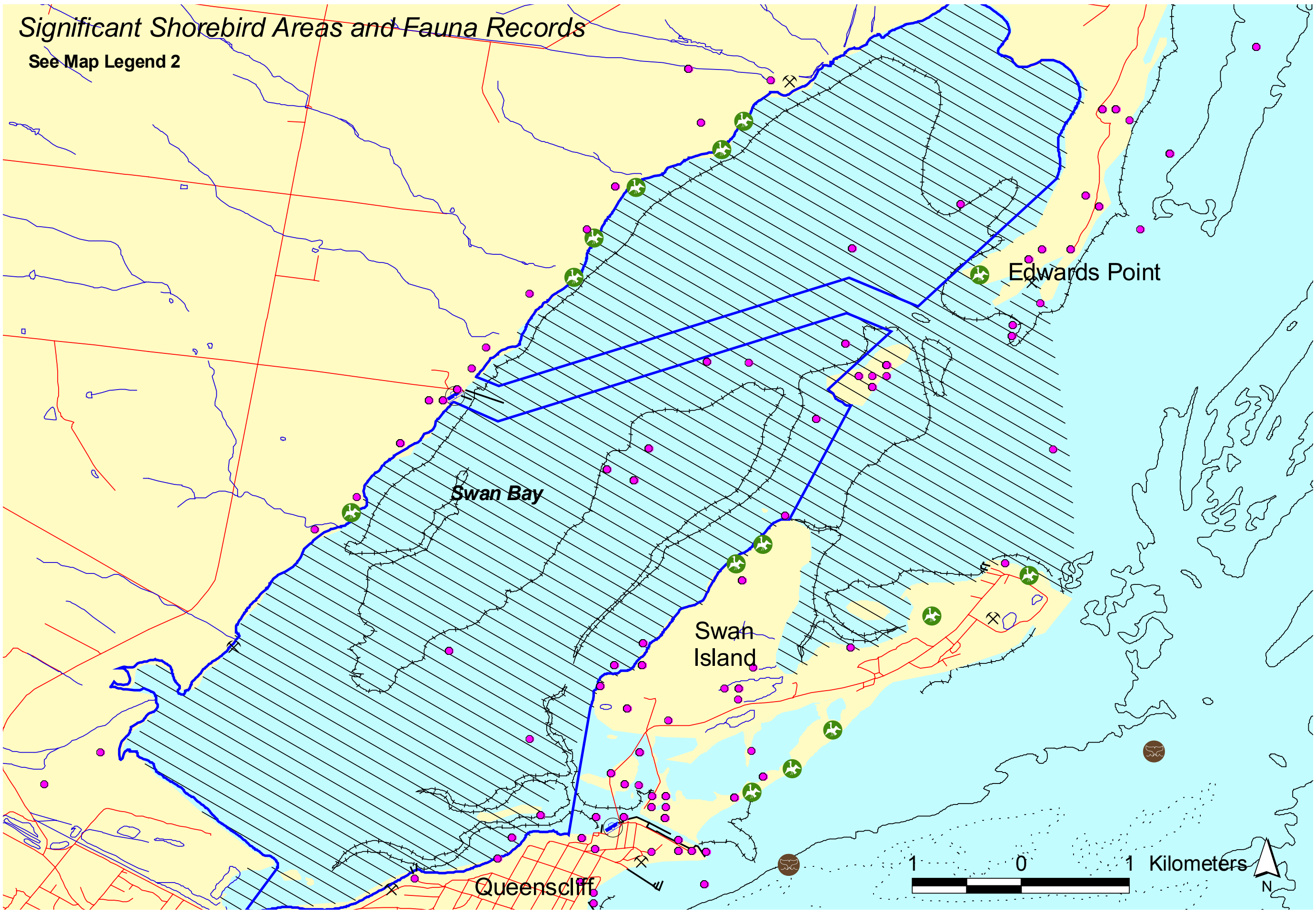

Figure A1.5b: Port Phillip Heads MNP - Swan Bay shorebird and fauna values (see Table 2.5.3 for threatened species list).

NB. due to a lack of available digital GIS data, no habitat map is presented for Popes Eye.

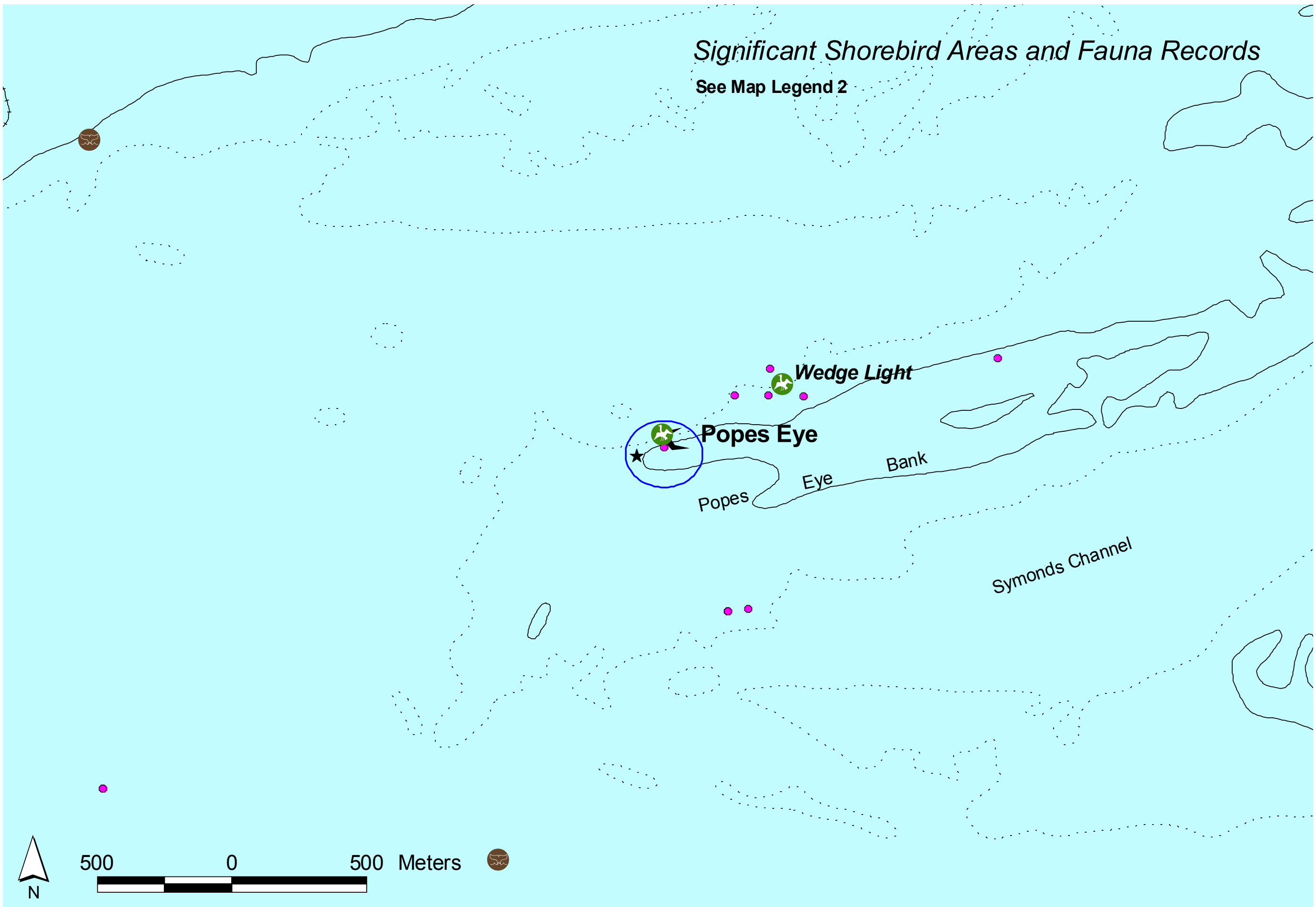

Figure A1.6b: Port Phillip Heads MNP – Popes Eye shorebird and fauna values (see Tables 2.6.3 & 2.6.4 for threatened species lists).

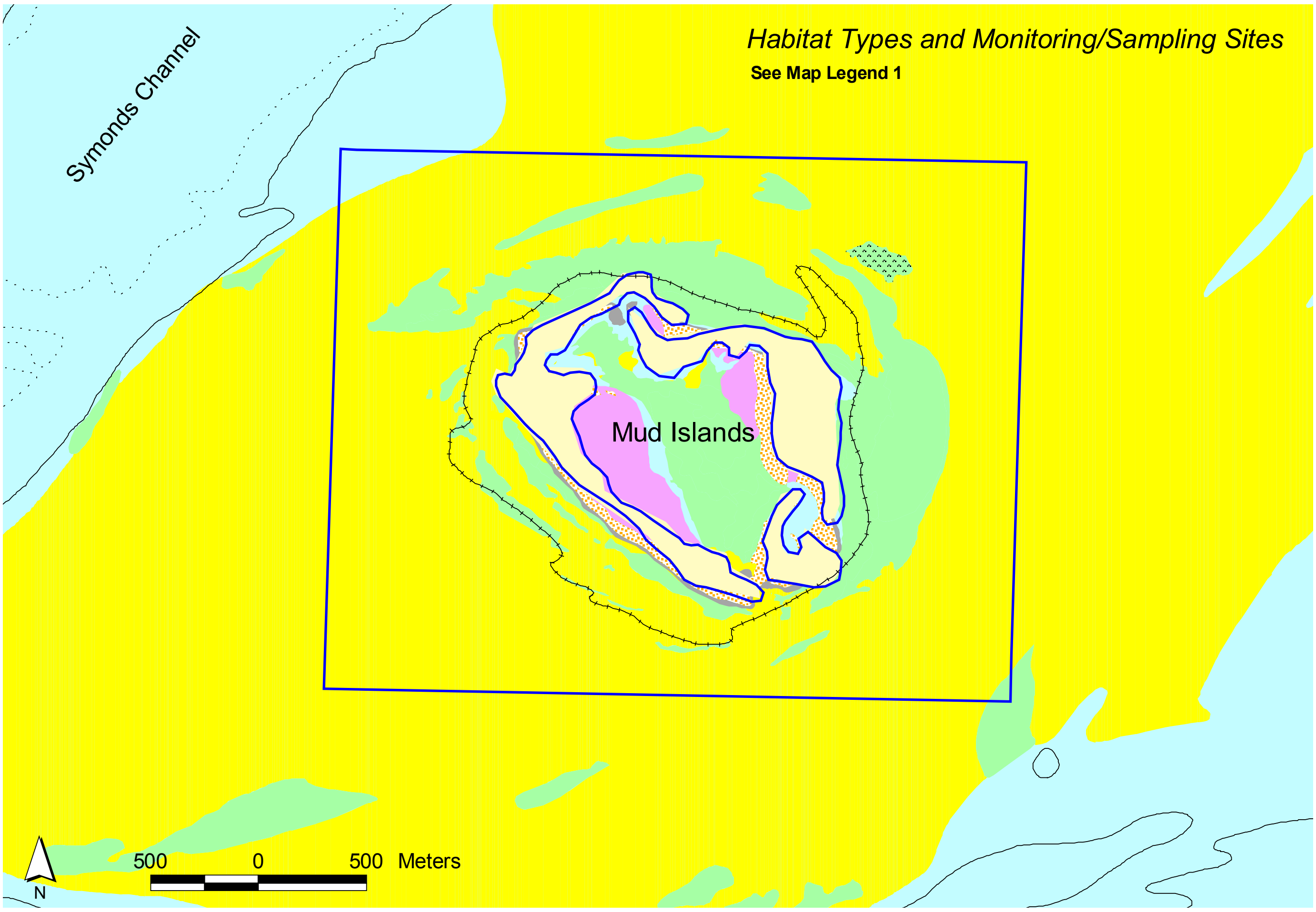

Figure A1.7a: Port Phillip Heads MNP – Mud Islands marine habitats and monitoring/sampling sites.

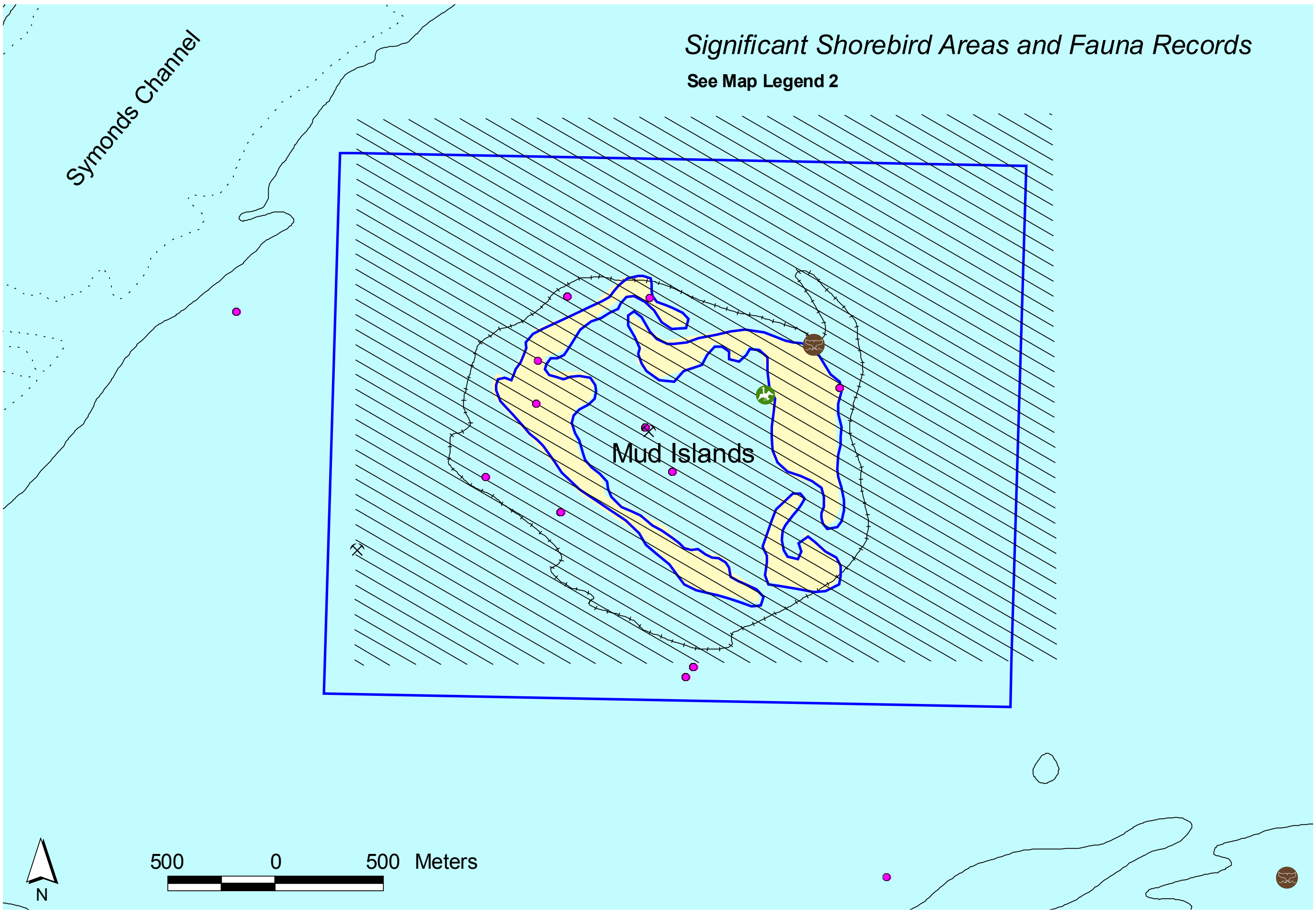

Figure A1.7b: Port Phillip Heads MNP – Mud Islands shorebird and fauna values (see Tables 2.7.3 & 2.7.4 for threatened species lists).

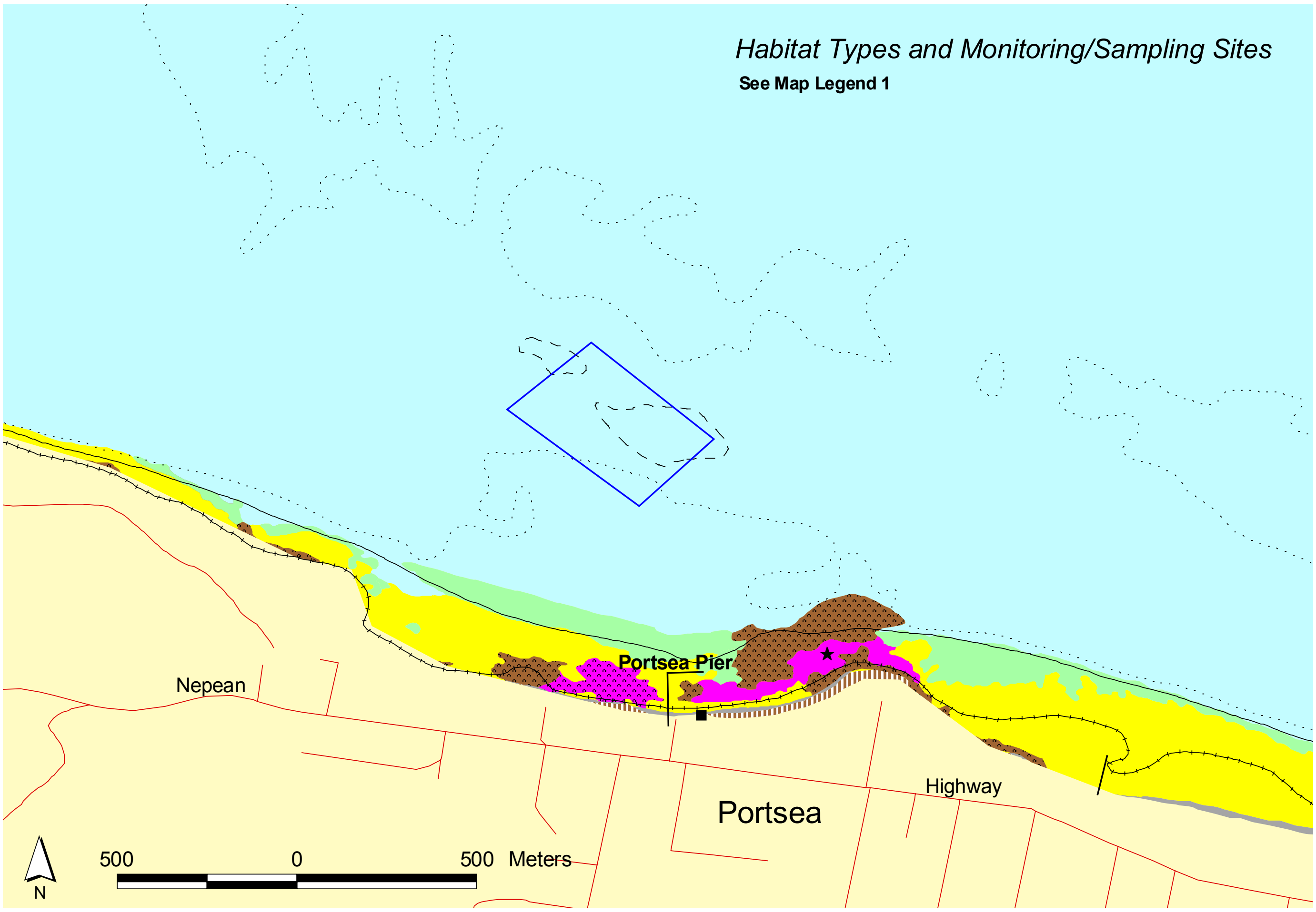

Figure A1.8a: Port Phillip Heads MNP – Portsea Hole marine habitats and monitoring/sampling sites.

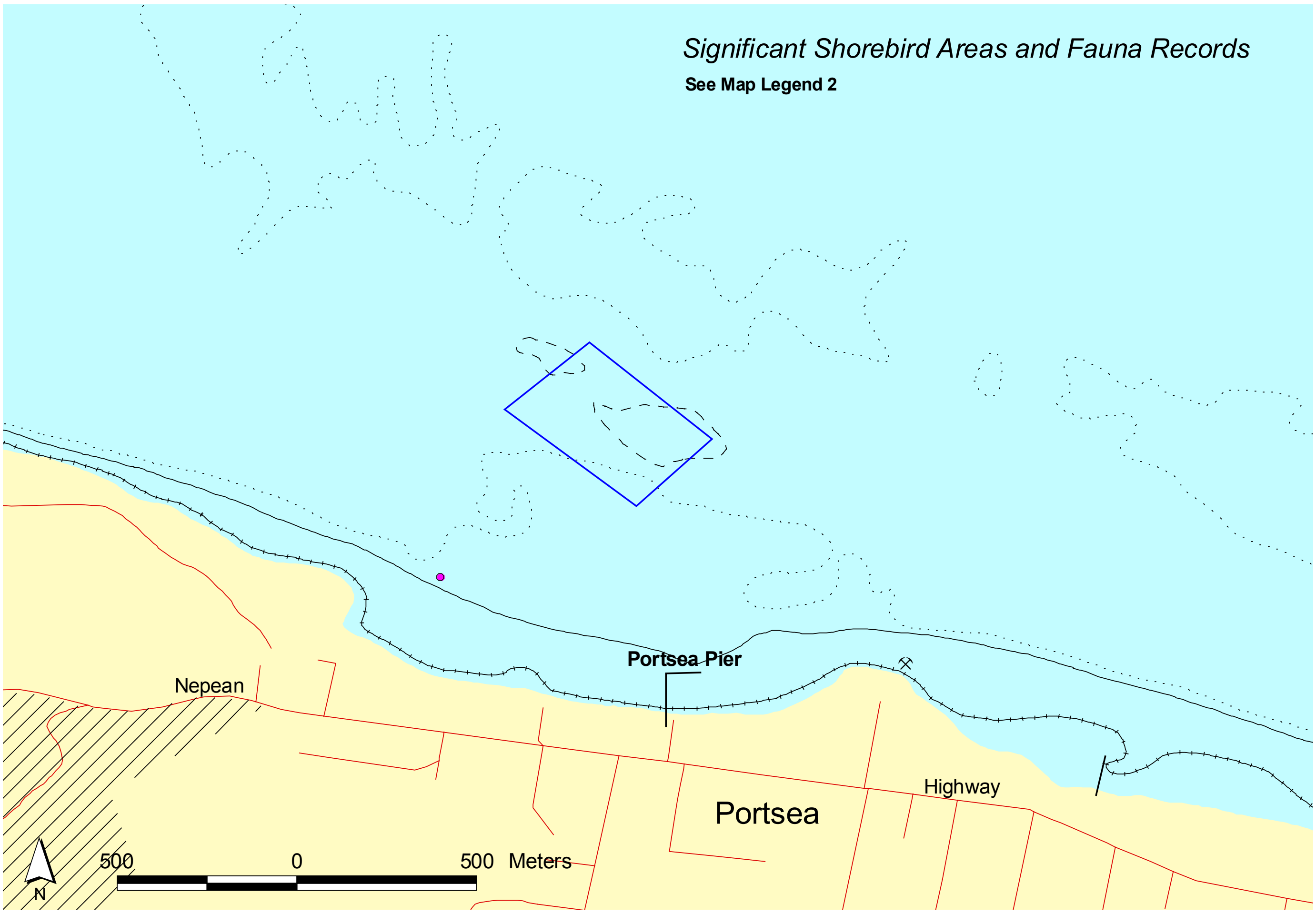

Figure A1.8b: Port Phillip Heads MNP – Portsea Hole shorebird and fauna values (no threatened species lists available).

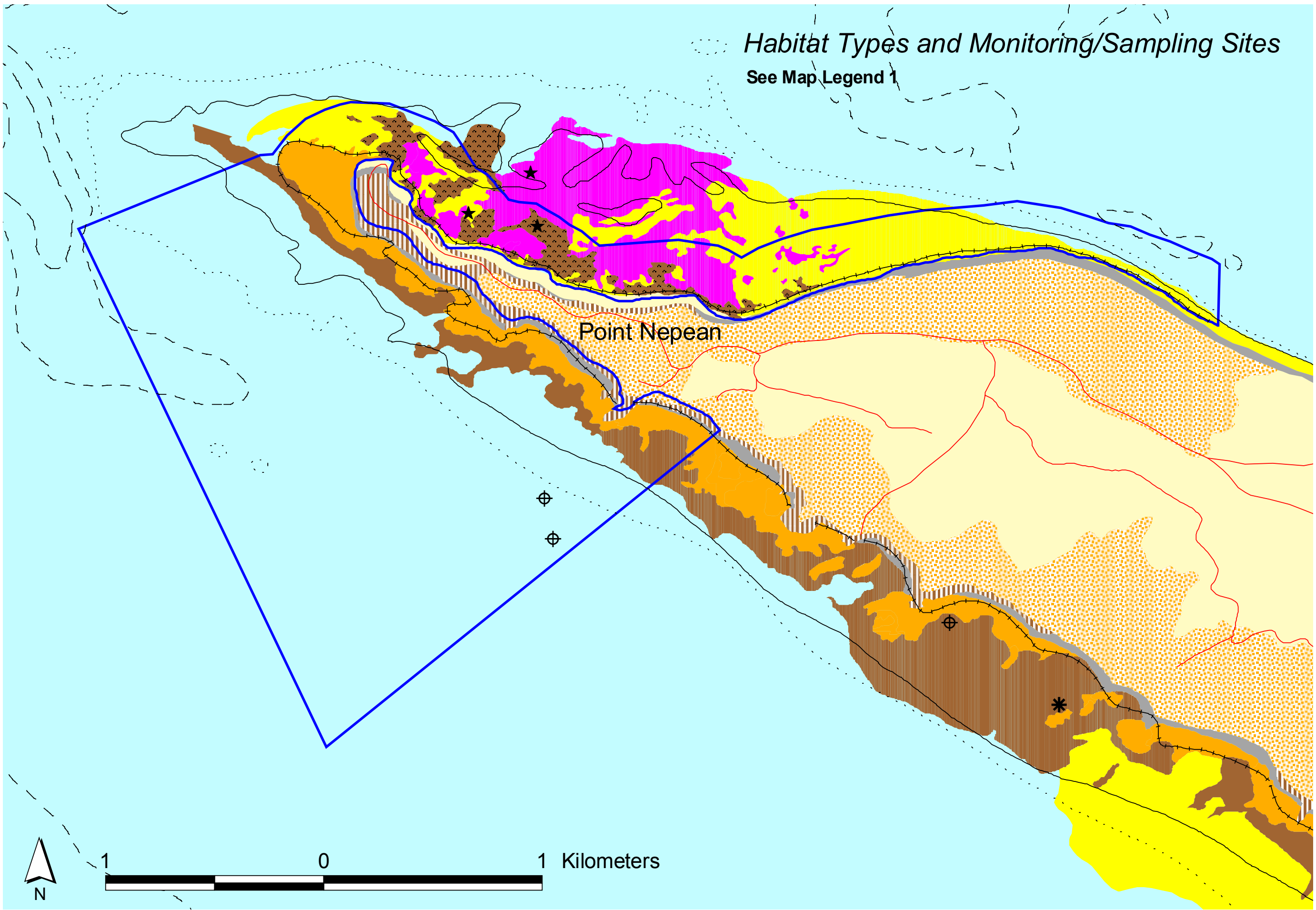

Figure A1.9a: Port Phillip Heads MNP – Point Nepean marine habitats and monitoring/sampling sites.

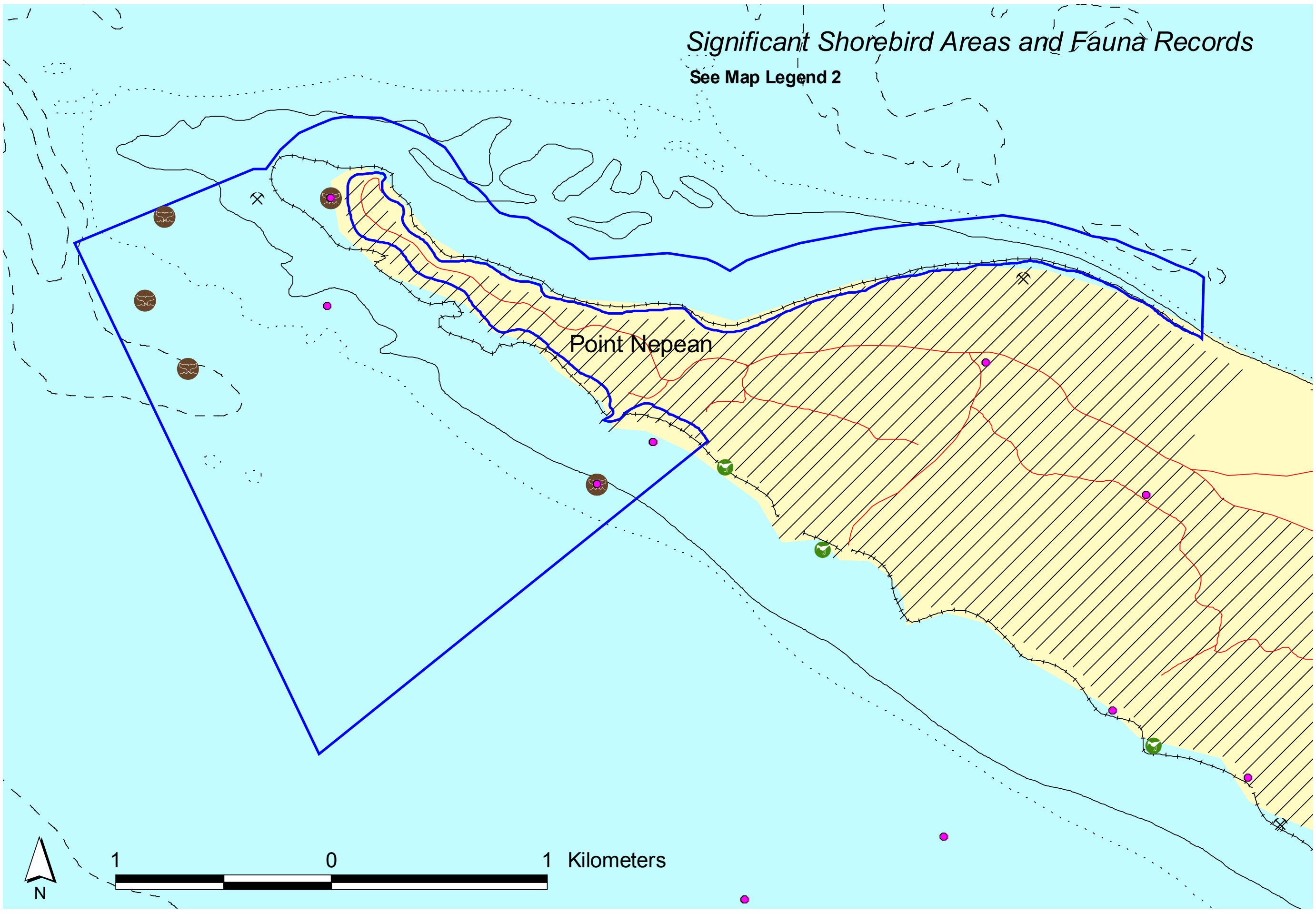

Figure A1.9b: Port Phillip Heads MNP – Point Nepean shorebird and fauna values (see Tables 2.9.3 & 2.9.4 for threatened species lists).

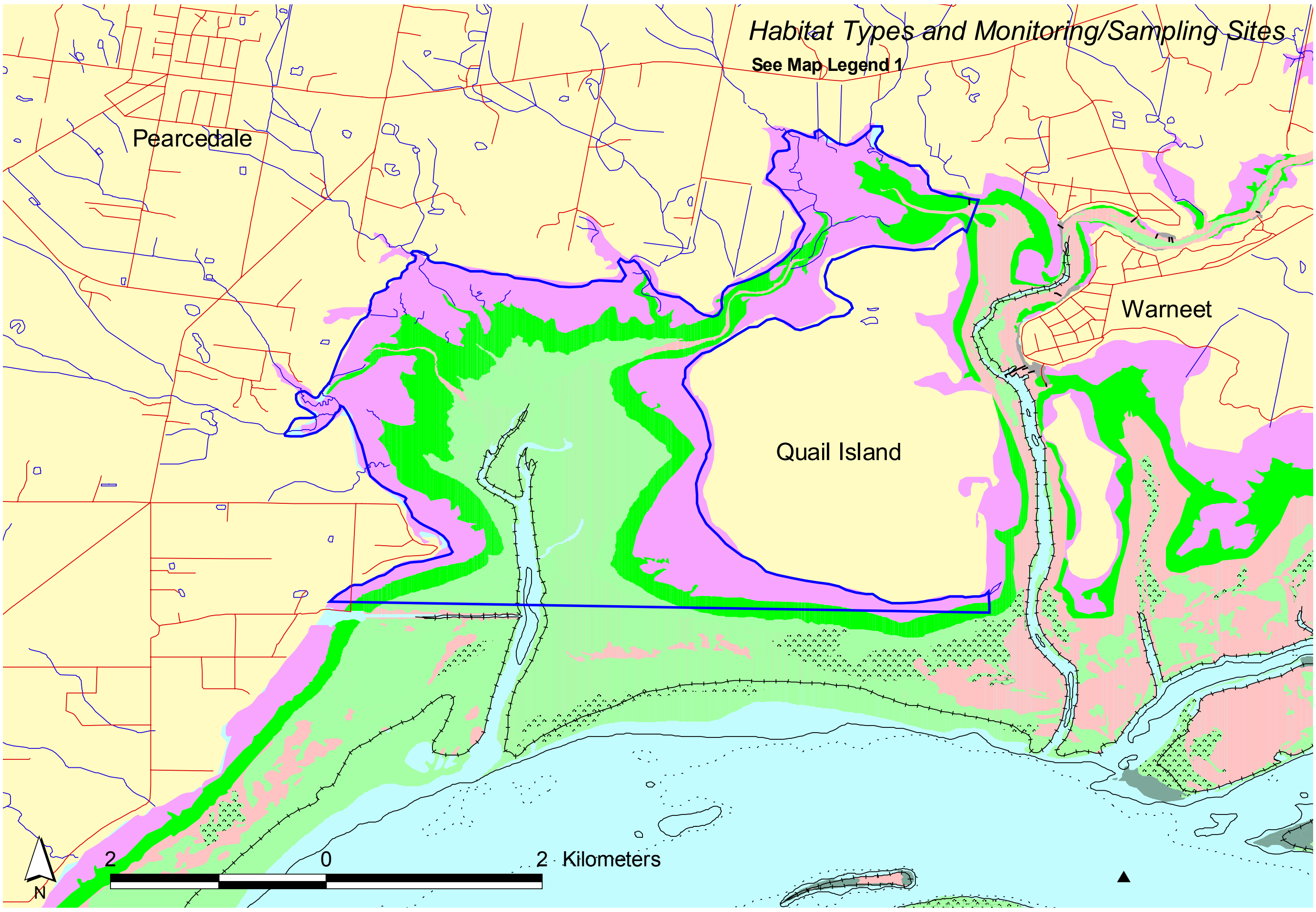

Figure A1.10a: Yaringa MNP marine habitats and monitoring/sampling sites.

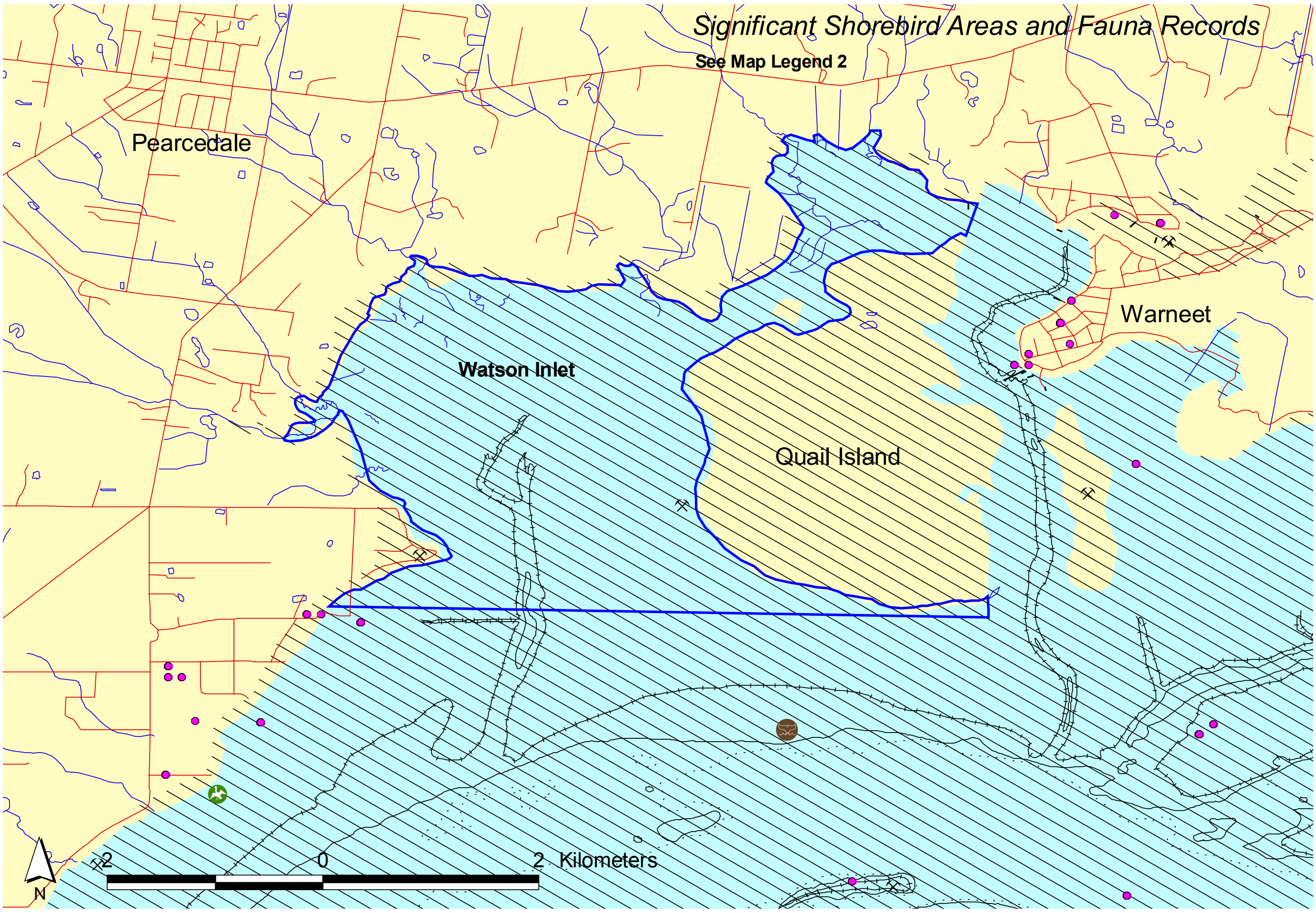

Figure A1.10b: Yaringa MNP shorebird and fauna values (see Tables 2.10.3 & 2.10.4 for threatened species lists).

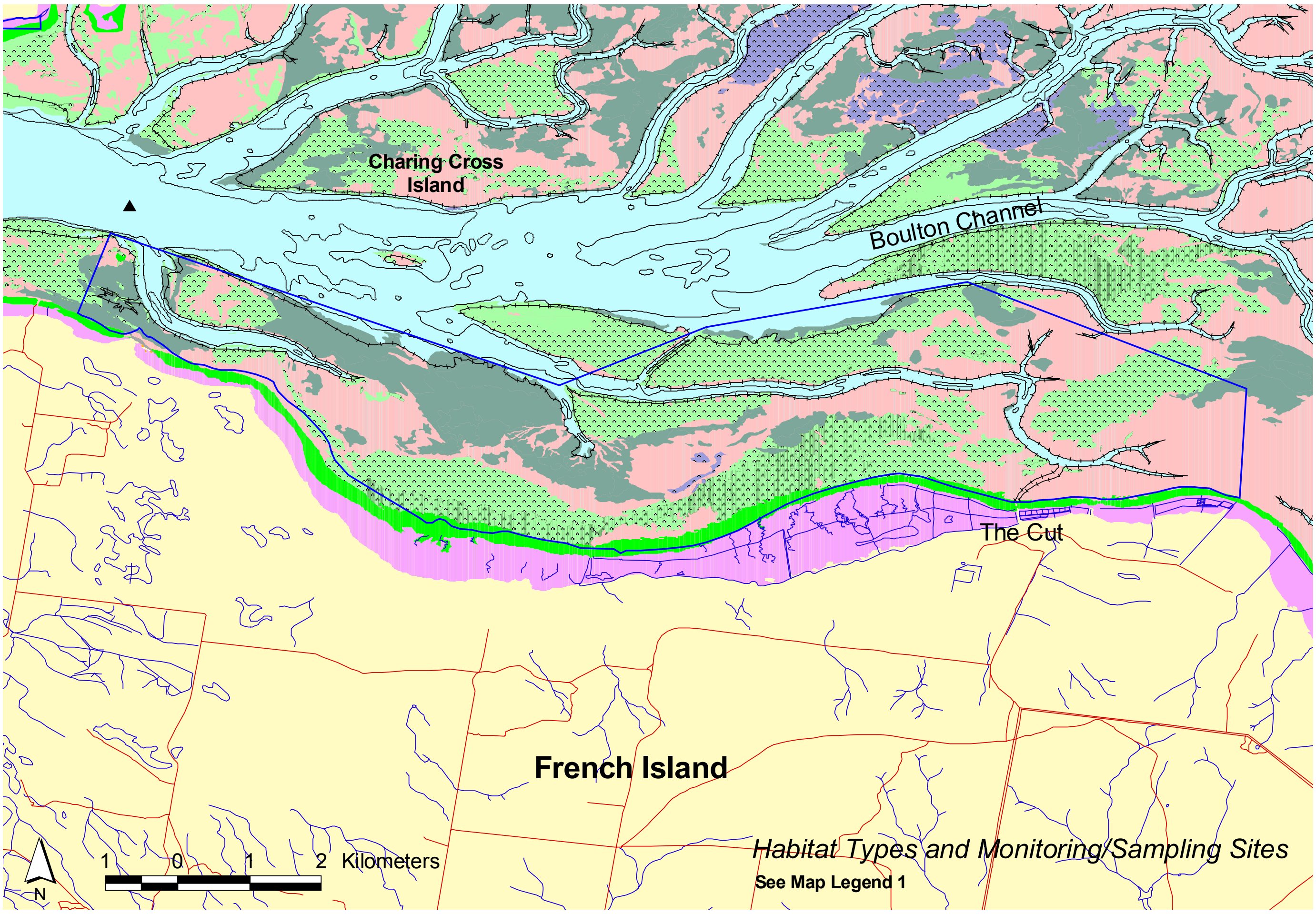

Figure A1.11a: French Island MNP marine habitats and monitoring/sampling sites.

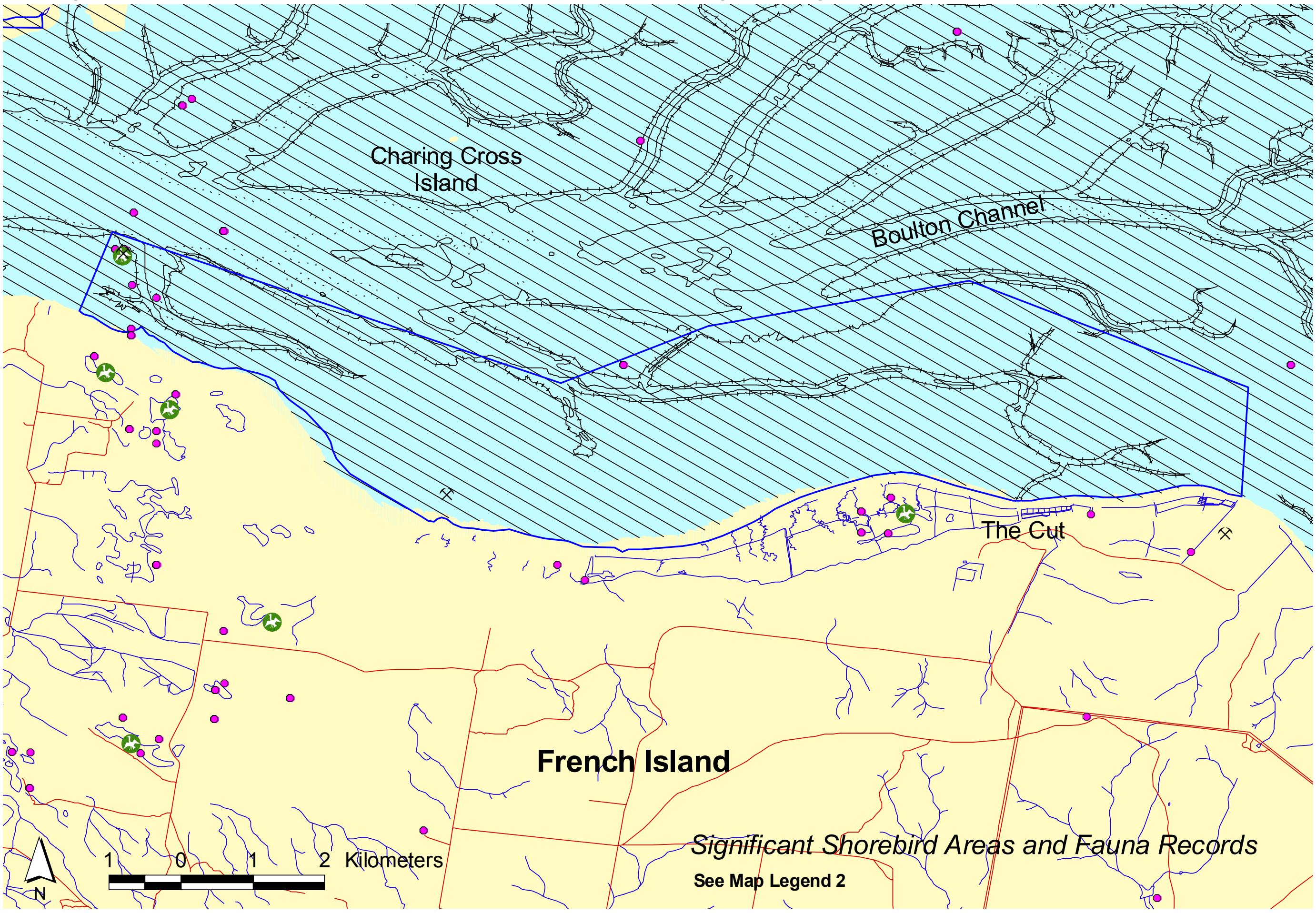

Figure A1.11b: French Island MNP shorebird and fauna values (see Table 2.11.2 for threatened species list).

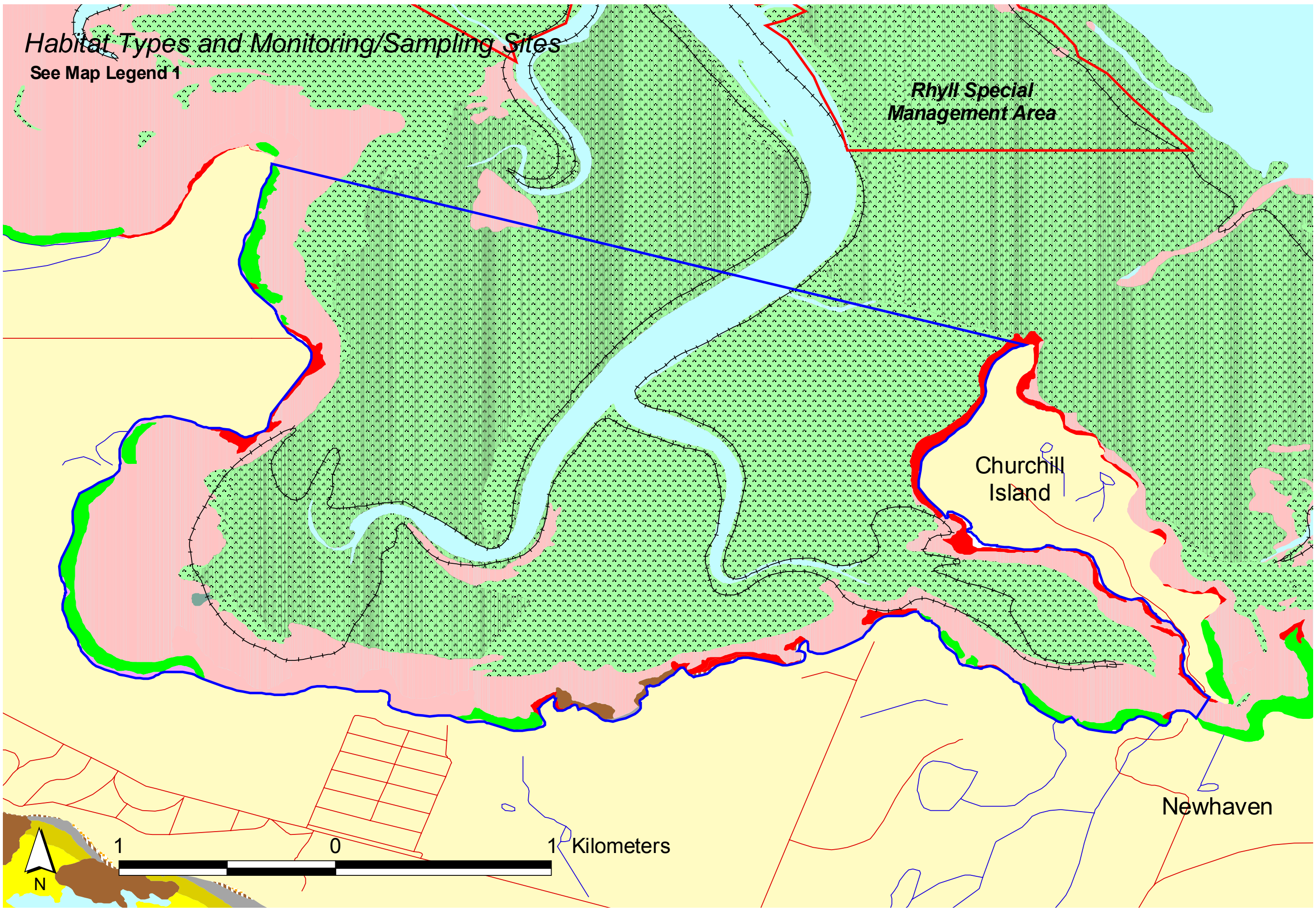

Figure A1.12a: Churchill Island MNP marine habitats and monitoring/sampling sites.

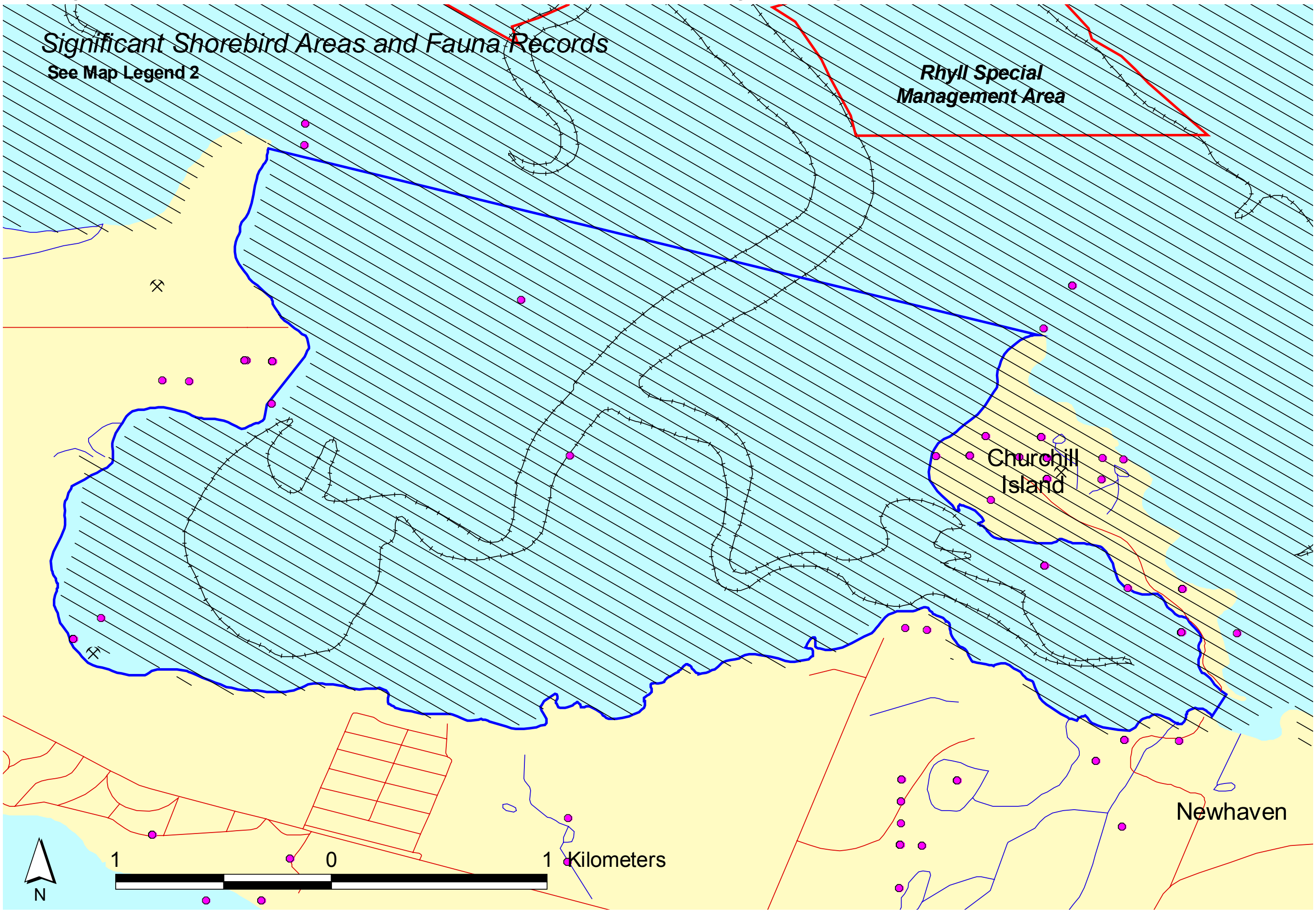

Figure A1.12b: Churchill Island MNP shorebird and fauna values (see Table 2.12.2 for threatened species list).

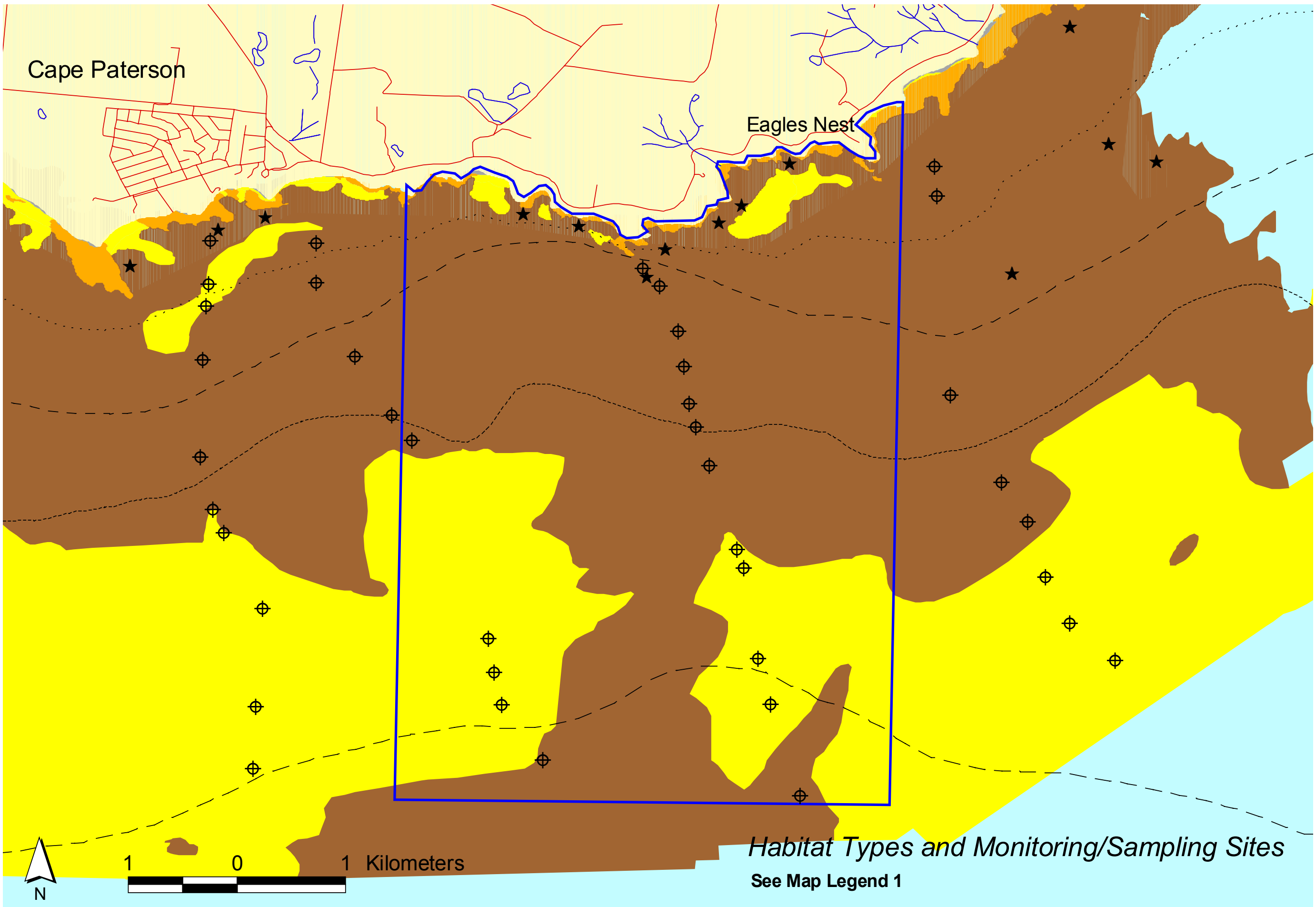

Figure A1.13a: Bunurong MNP marine habitats and monitoring/sampling sites.

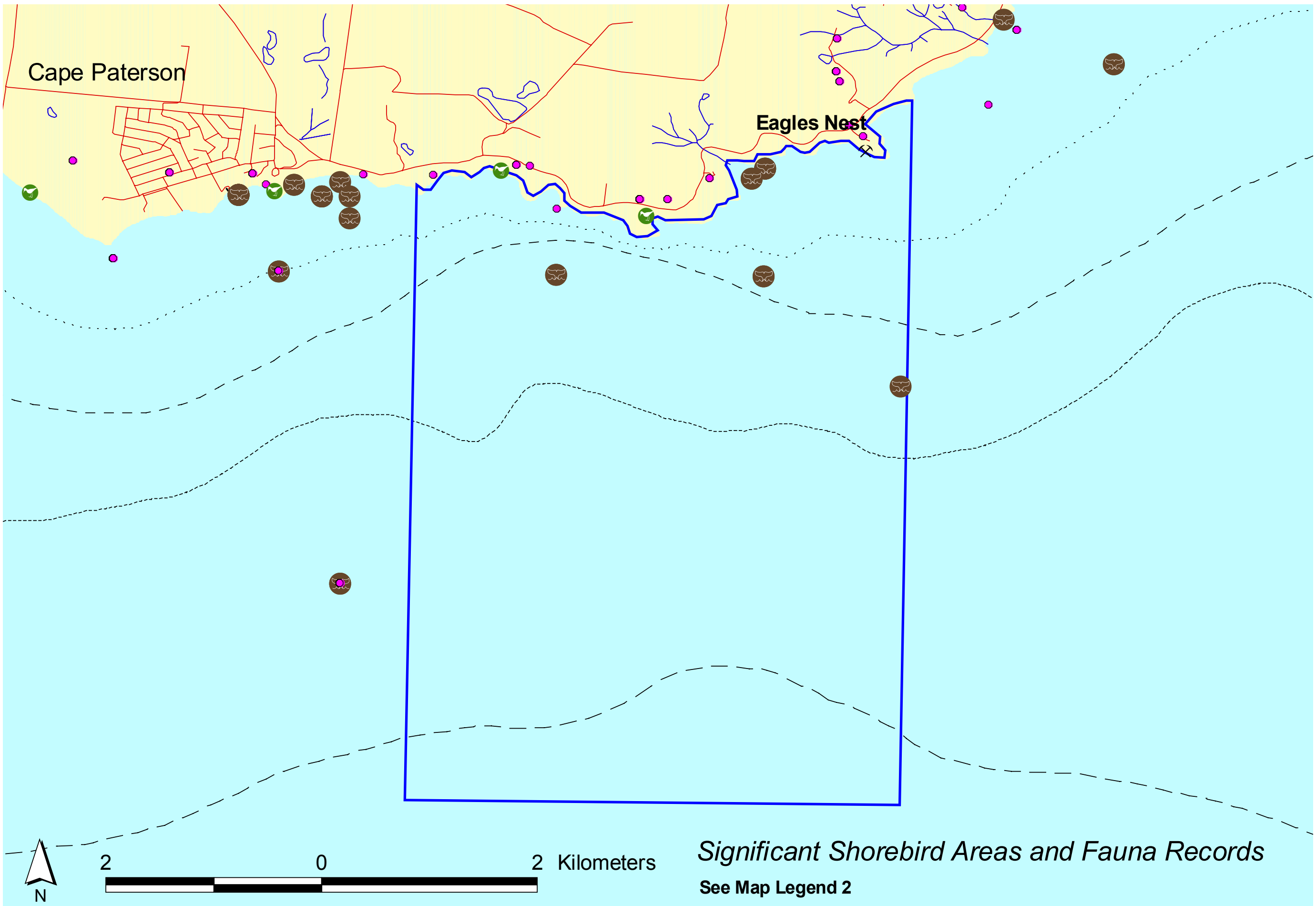

Figure A1.13b: Bunurong MNP shorebird and fauna values (see Tables 2.13.4 & 2.13.5 for threatened species lists).

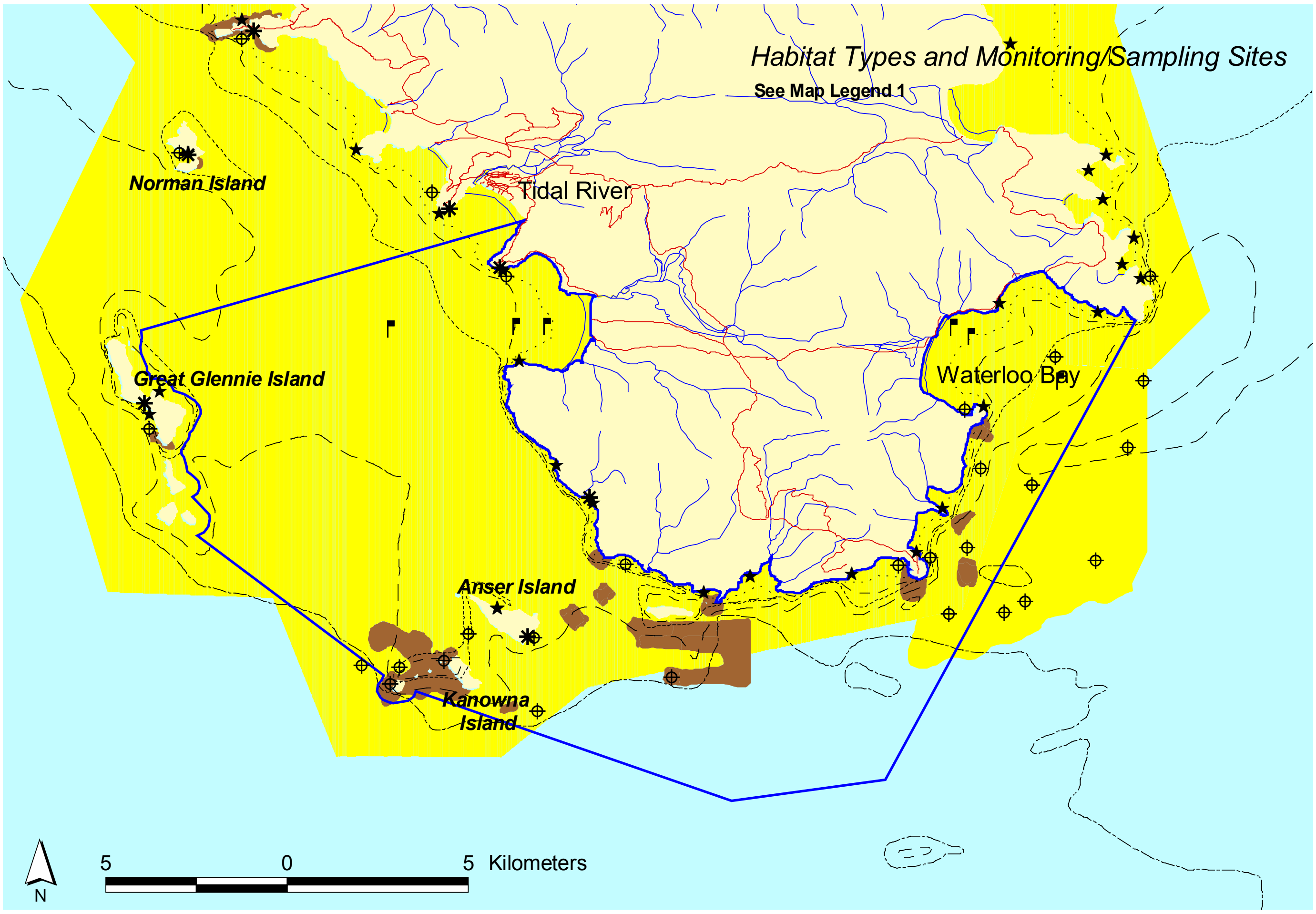

Figure A1.14a: Wilsons Promontory MNP marine habitats and monitoring/sampling sites.

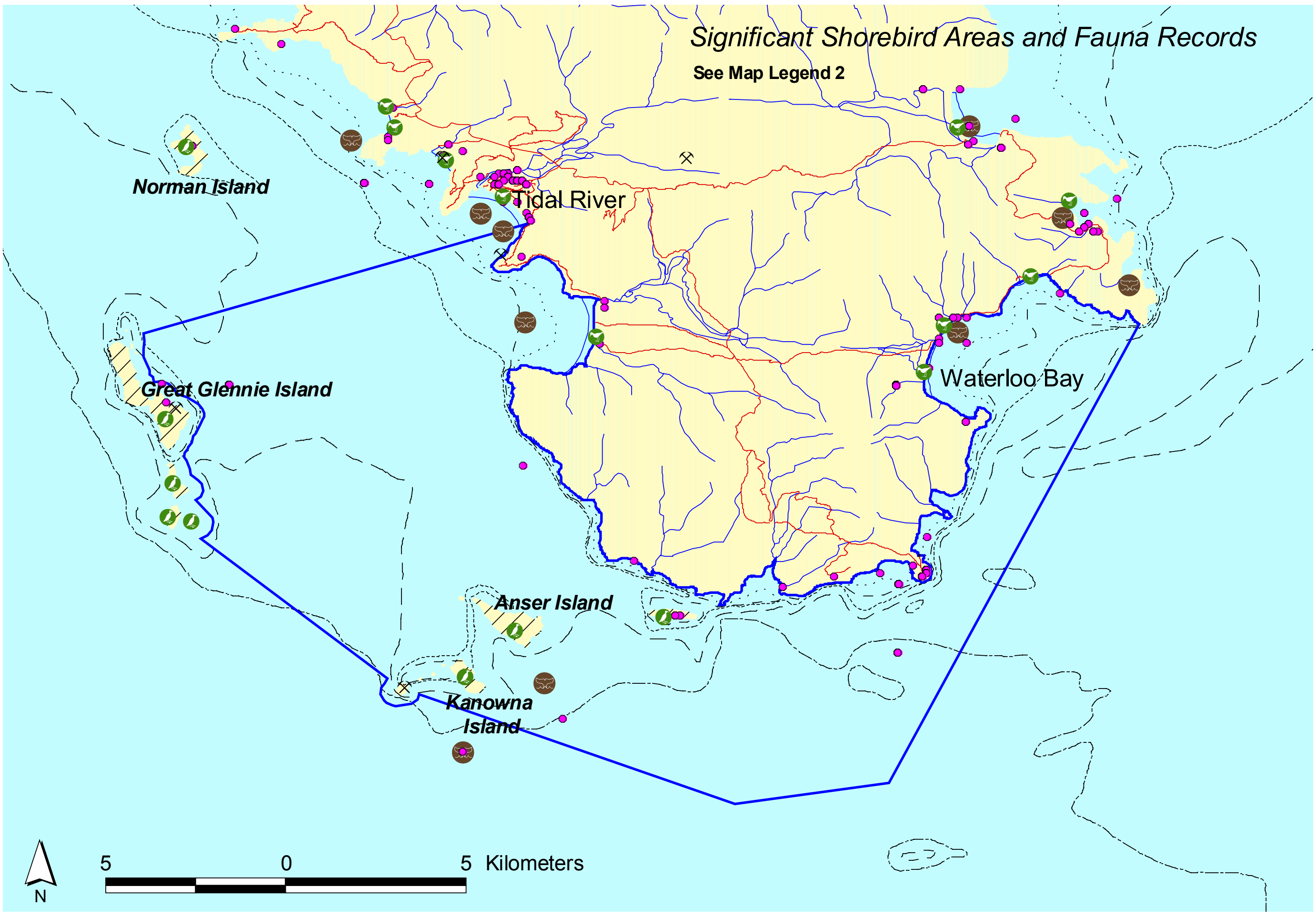

Figure A1.14b: Wilsons Promontory MNP shorebird and fauna values (see Tables 2.14.4 & 2.14.5 for threatened species lists).

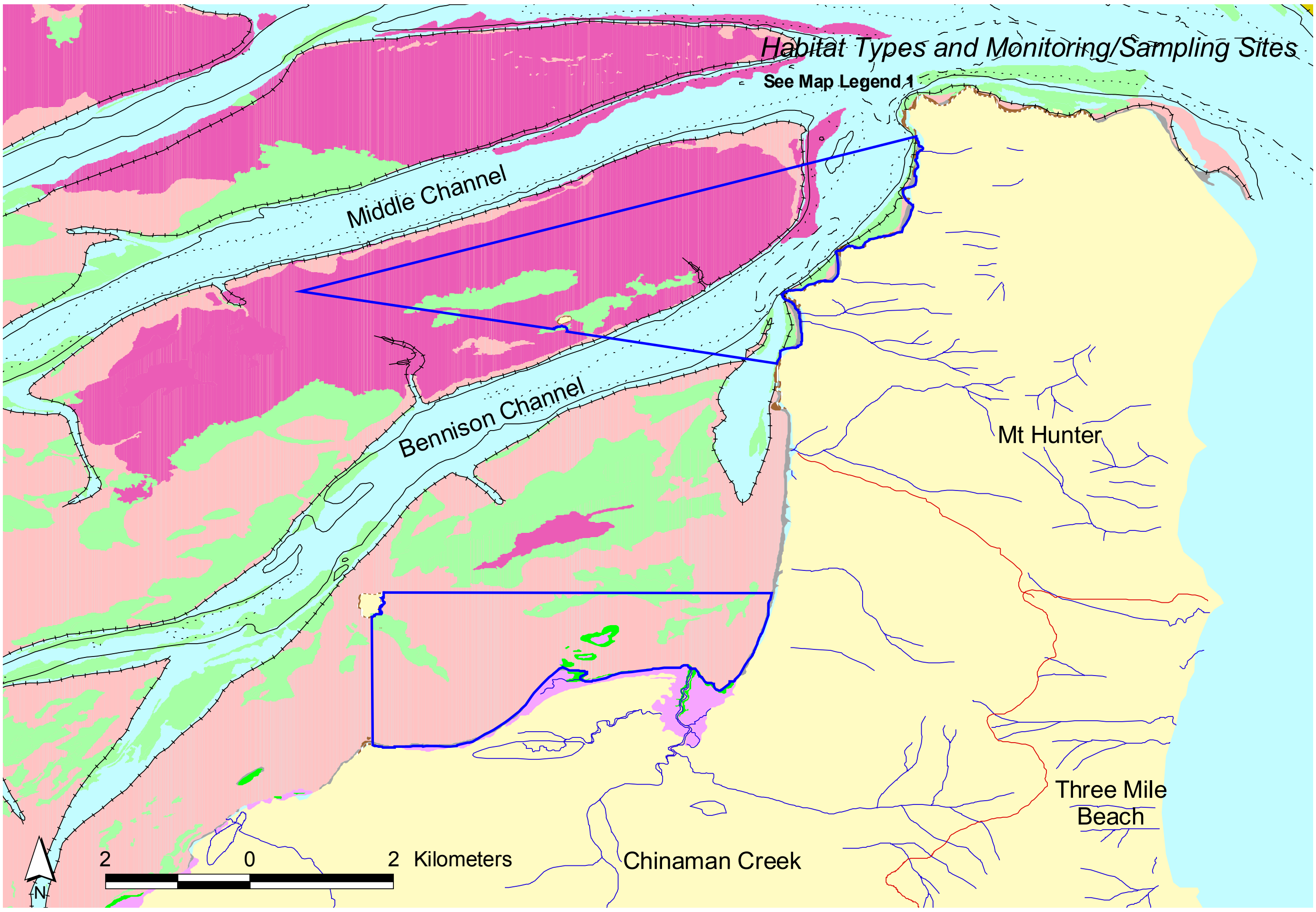

Figure A1.15a: Corner Inlet MNP marine habitats and monitoring/sampling sites.

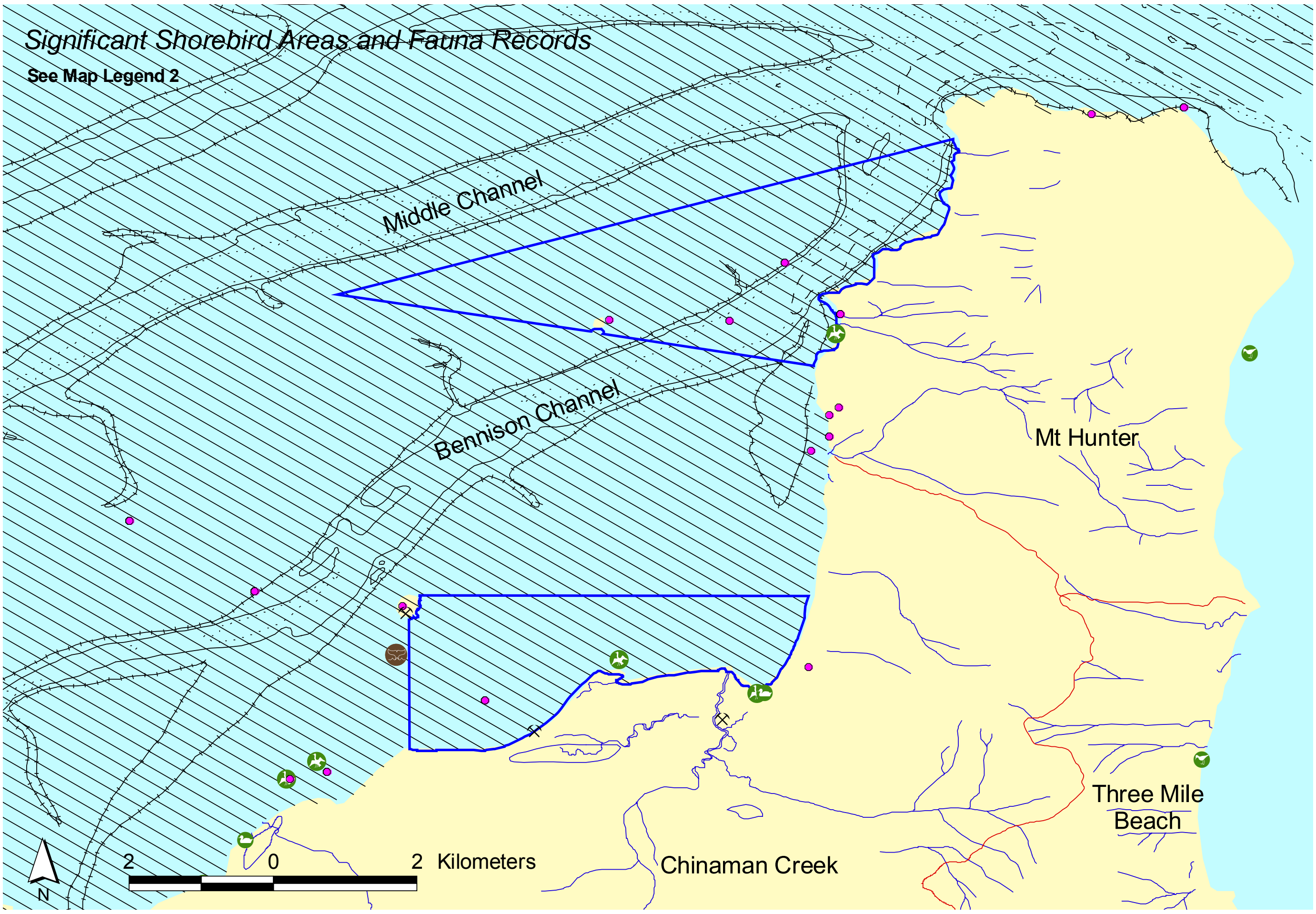

Figure A1.15b: Corner Inlet MNP shorebird and fauna values (see Tables 2.15.3 & 2.15.4 for threatened species lists).

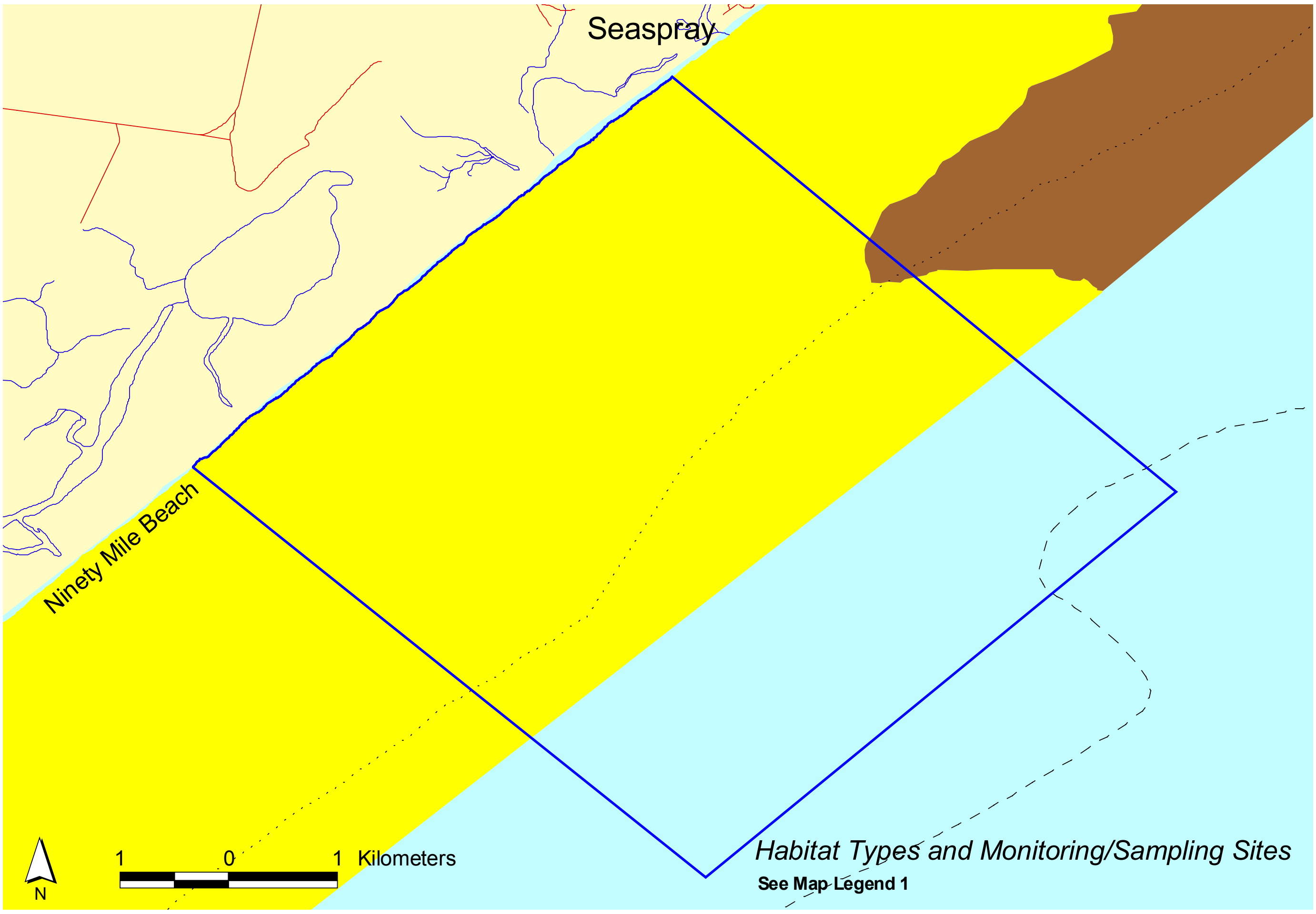

Figure A1.16a: Ninety Mile Beach MNP marine habitats and monitoring/sampling sites.

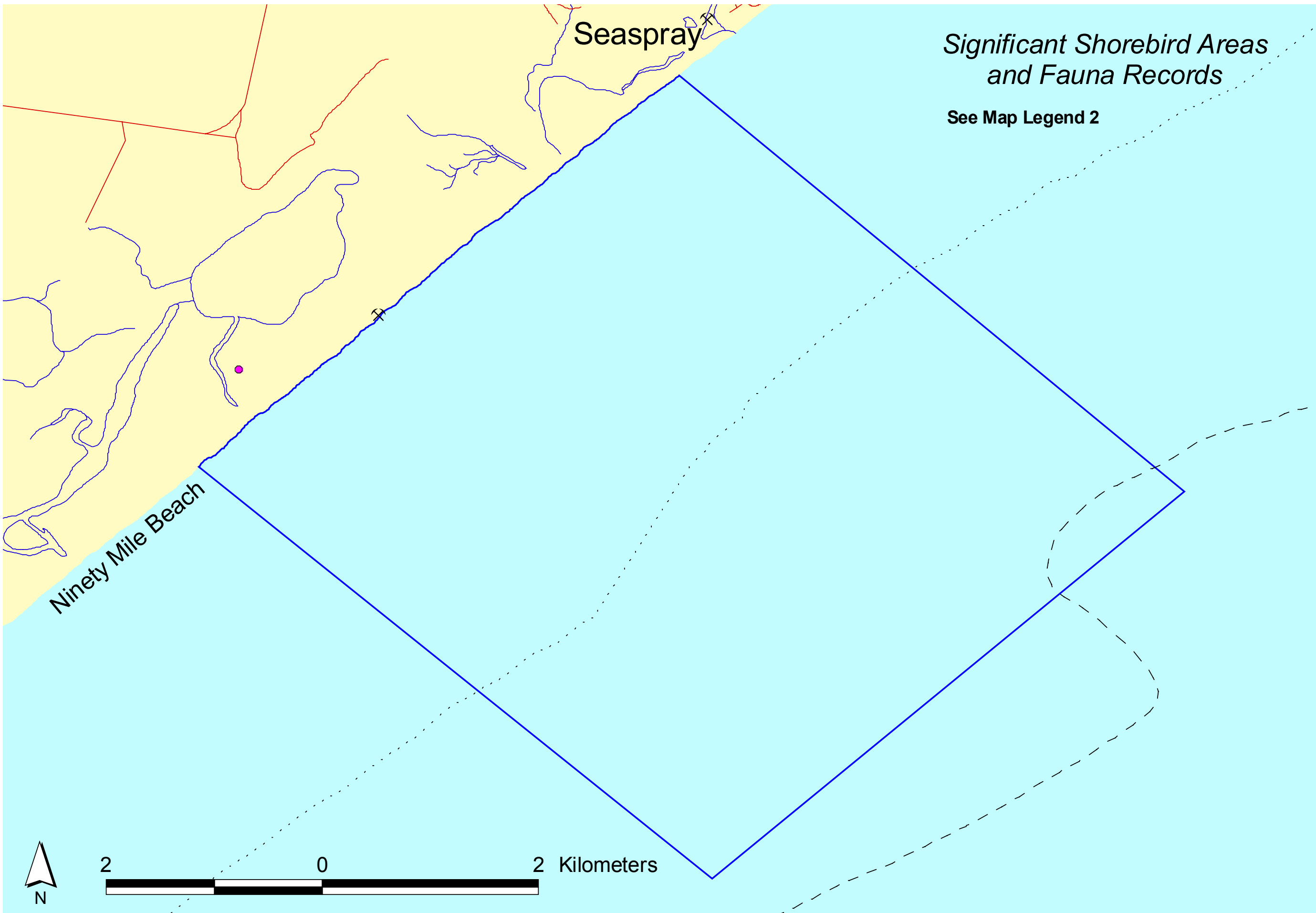

Figure A1.16b: Ninety Mile Beach MNP shorebird and fauna values (see Tables 2.16.4 & 2.16.5 for threatened species lists).

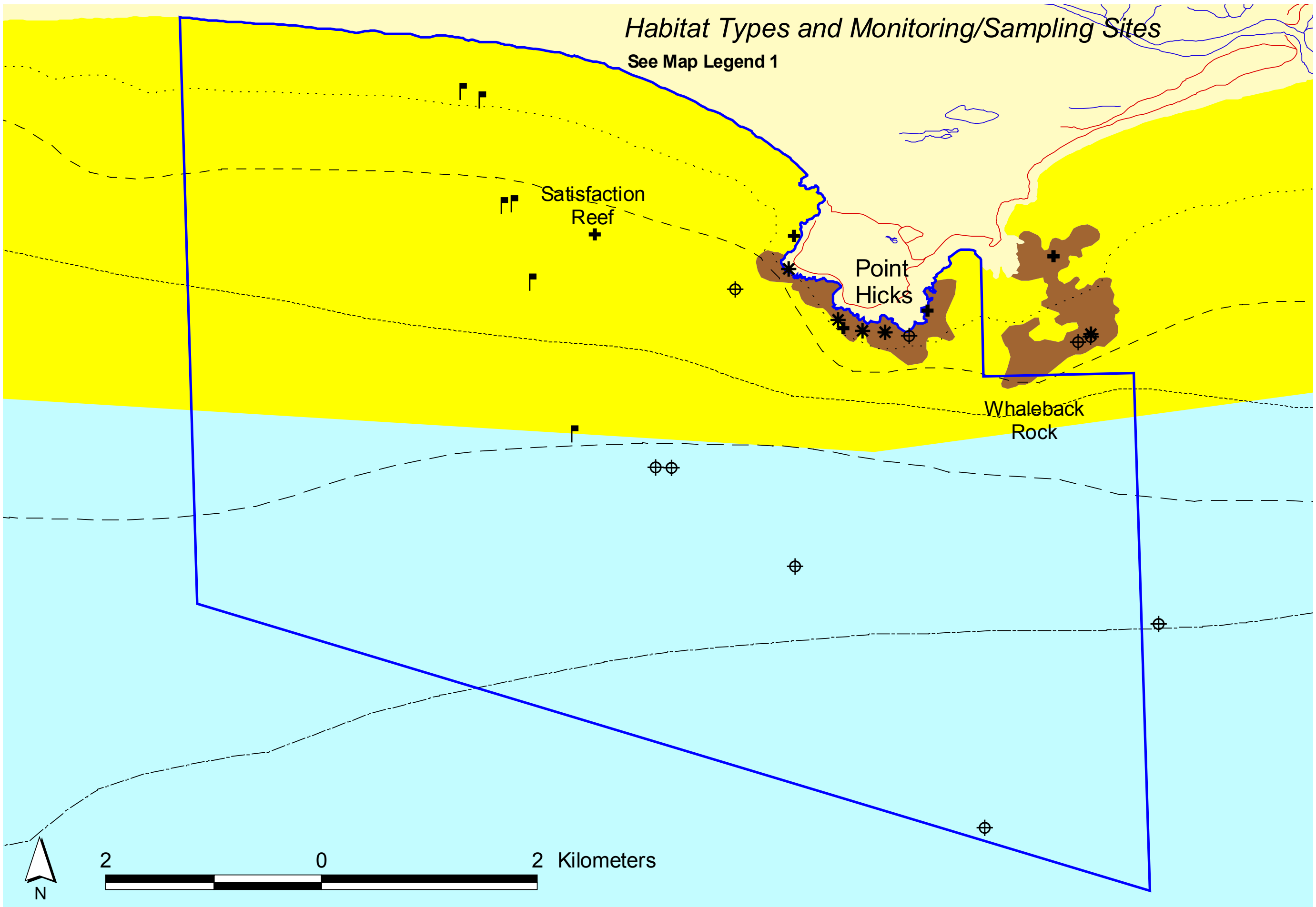

Figure A1.17a: Point Hicks MNP marine habitats and monitoring/sampling sites (this maps does not show all reef areas).

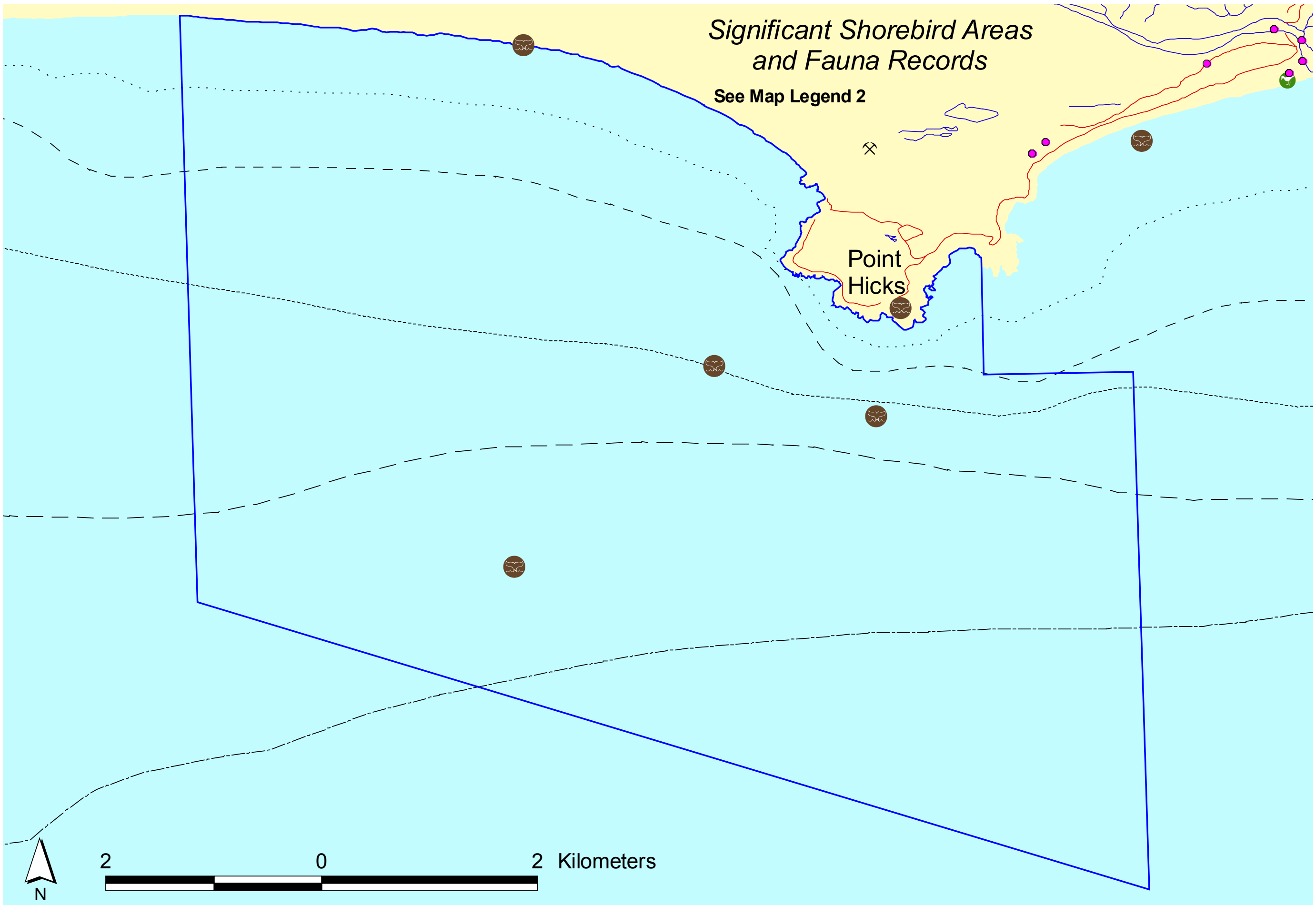

Figure A1.17b: Point Hicks MNP shorebird and fauna values (no threatened species lists available).

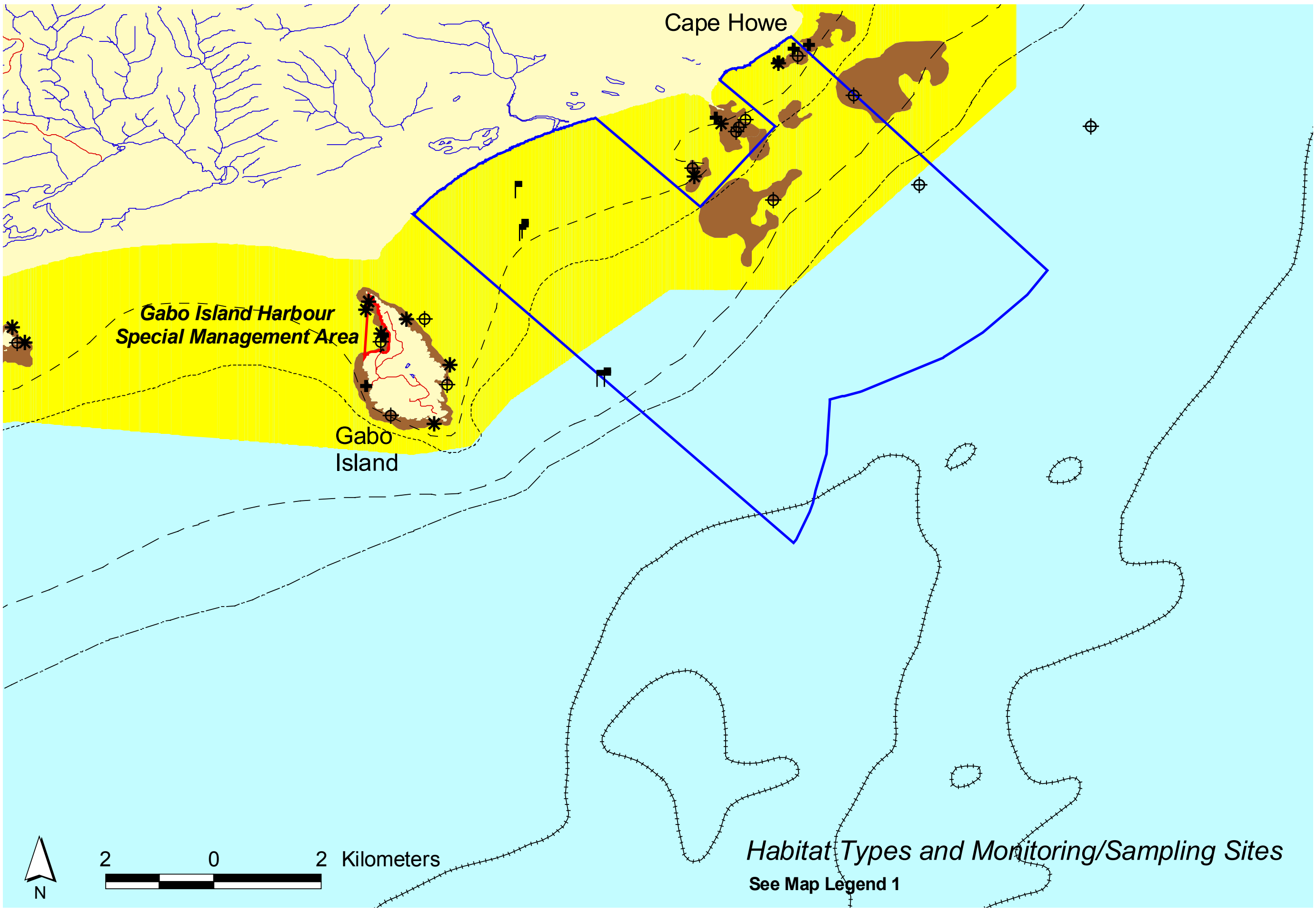

Figure A1.18a: Cape Howe MNP marine habitats and monitoring/sampling sites.

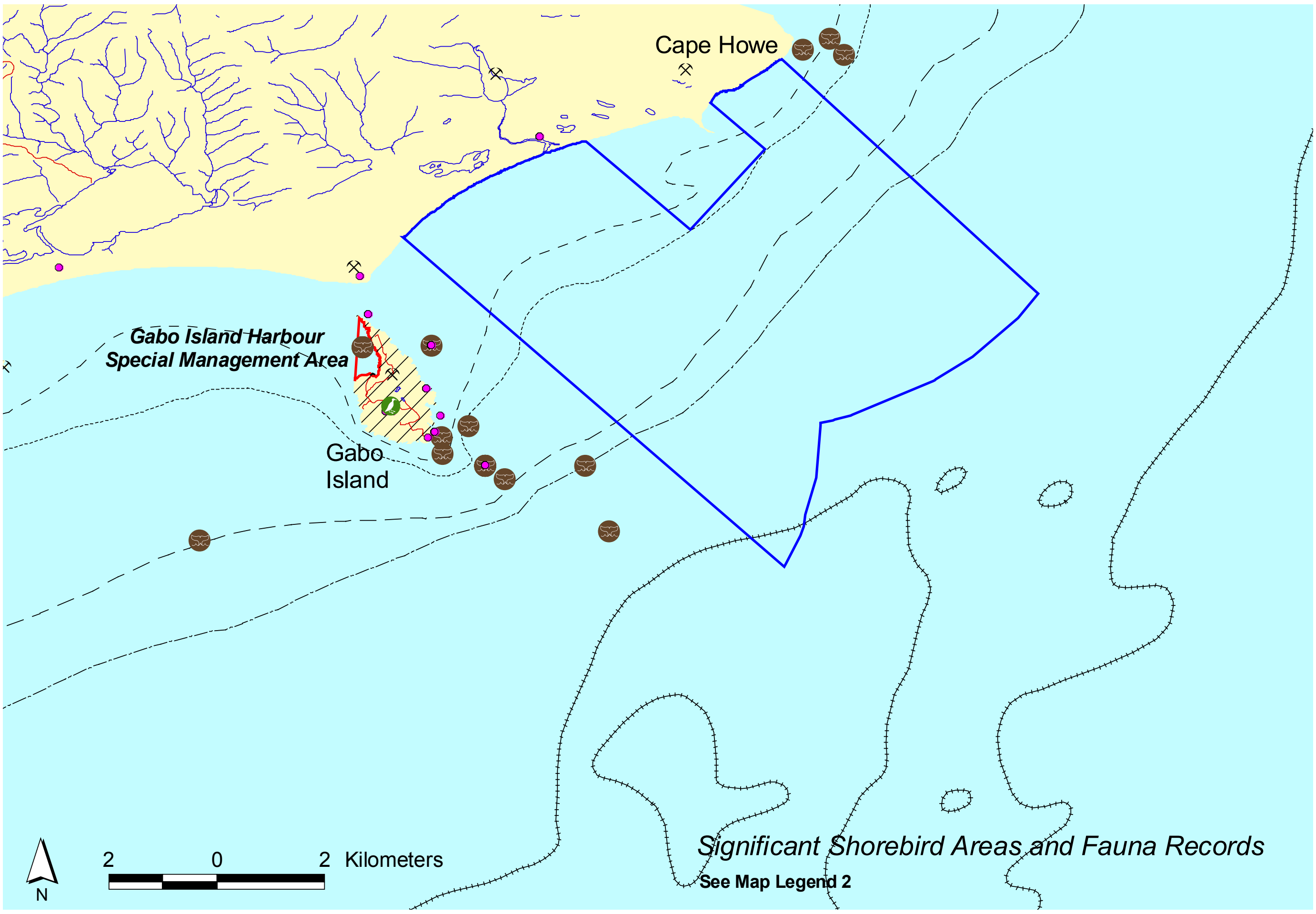

Figure A1.18b: Cape Howe MNP shorebird and fauna values (see Tables 2.18.3 & 2.18.4 for threatened species lists).

APPENDIX 2

MARINE SANCTUARY MAPS

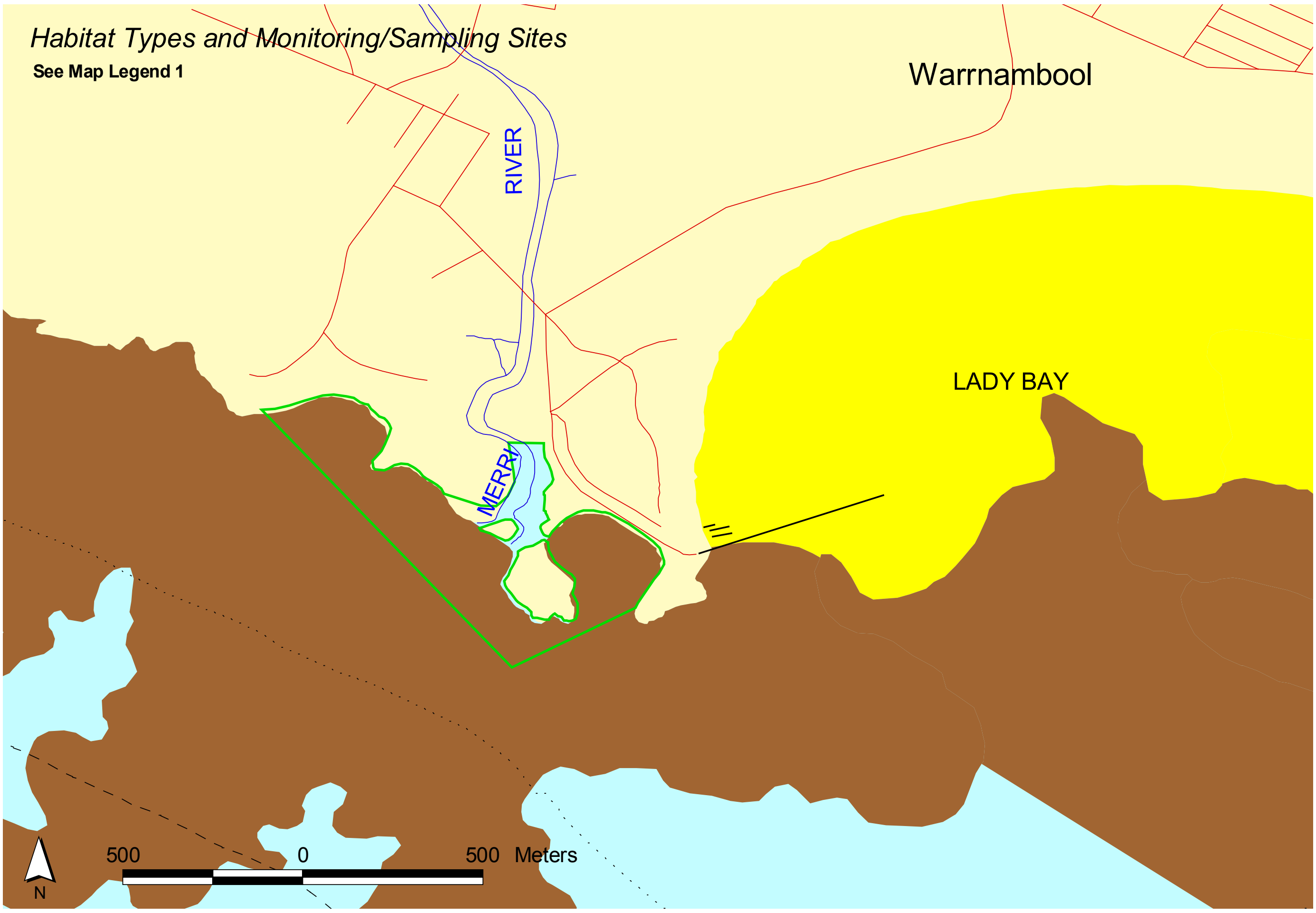

Figure A2.1a: Merri MS marine habitats and monitoring/sampling sites.

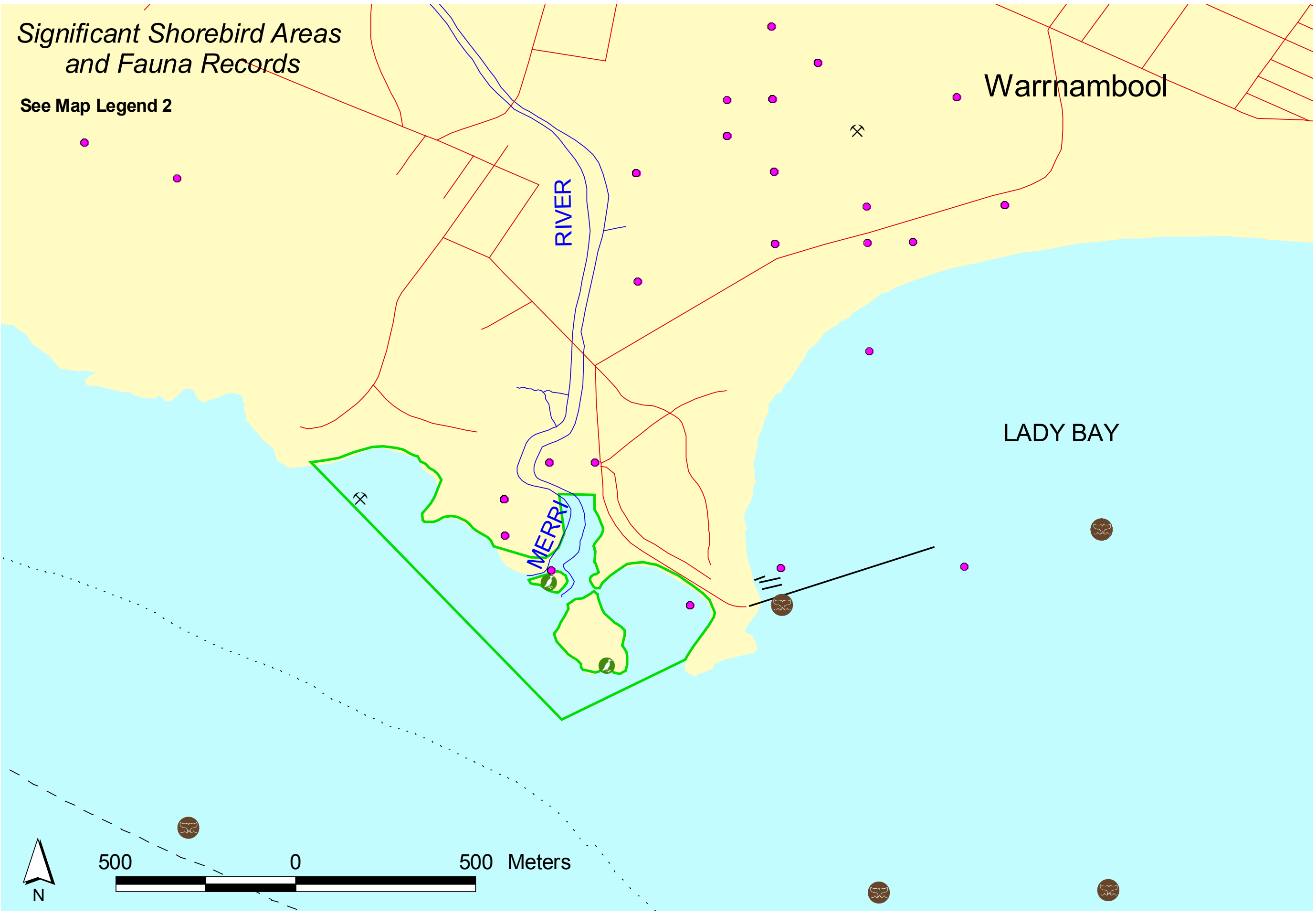

Figure A2.1b: Merri MS shorebird and fauna values (see Tables 3.1.4 & 3.1.5 for threatened species lists).

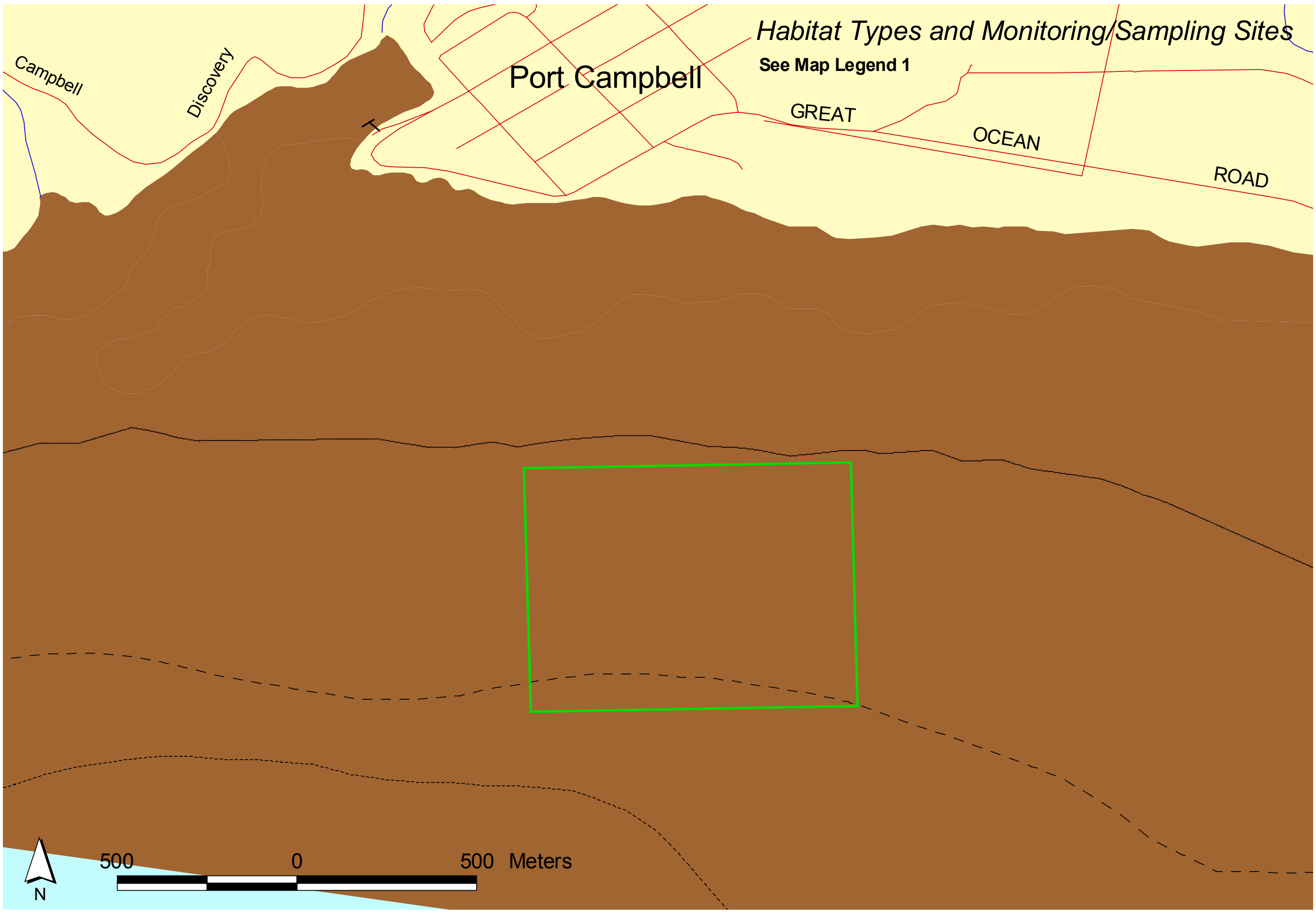

Figure A2.2a: The Arches MS marine habitats and monitoring/sampling sites (NB. this map probably overestimates the total reef area).

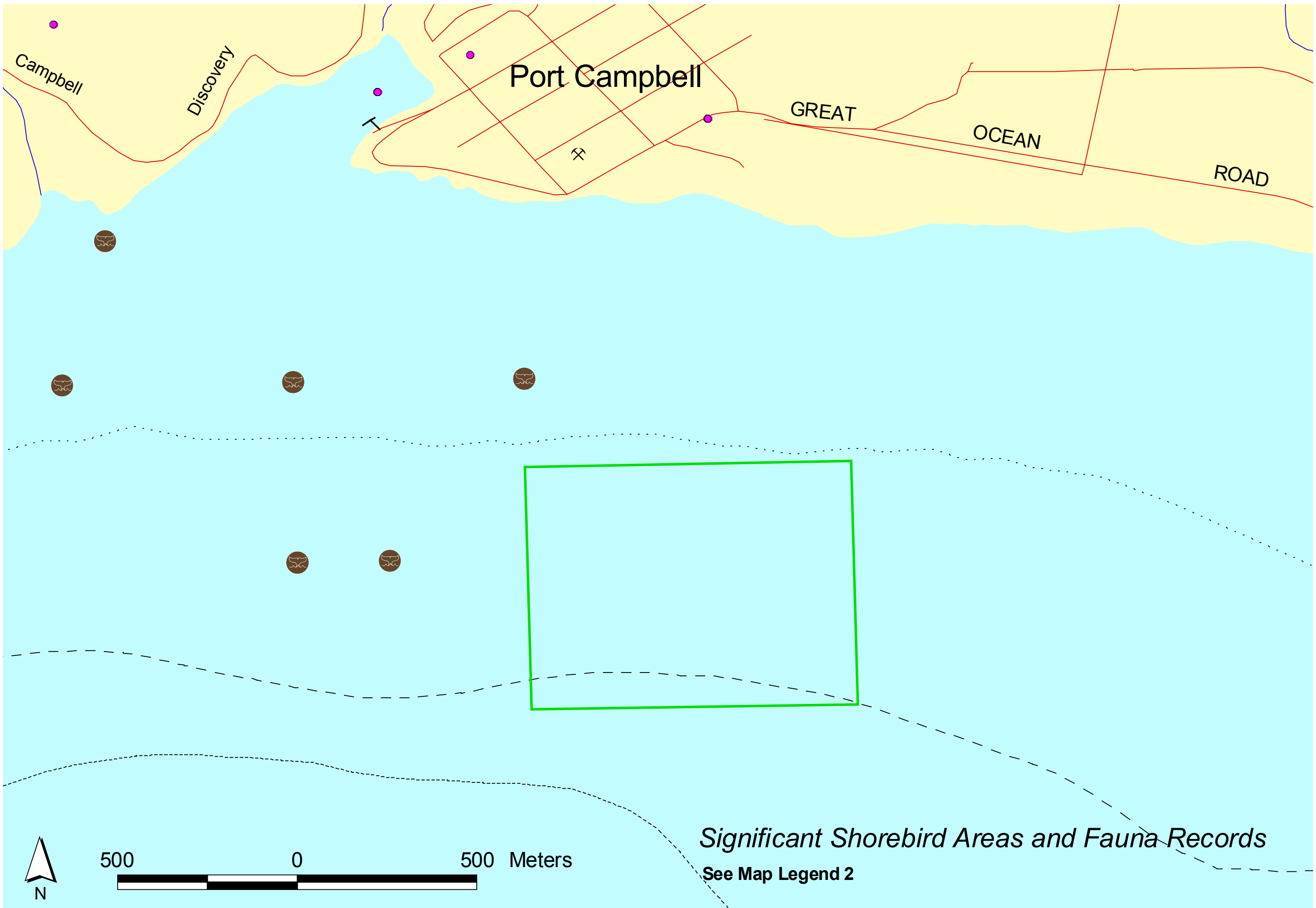

Figure A2.2b: The Arches MS shorebird and fauna values (see Tables 3.2.3 & 3.2.4 for threatened species lists).

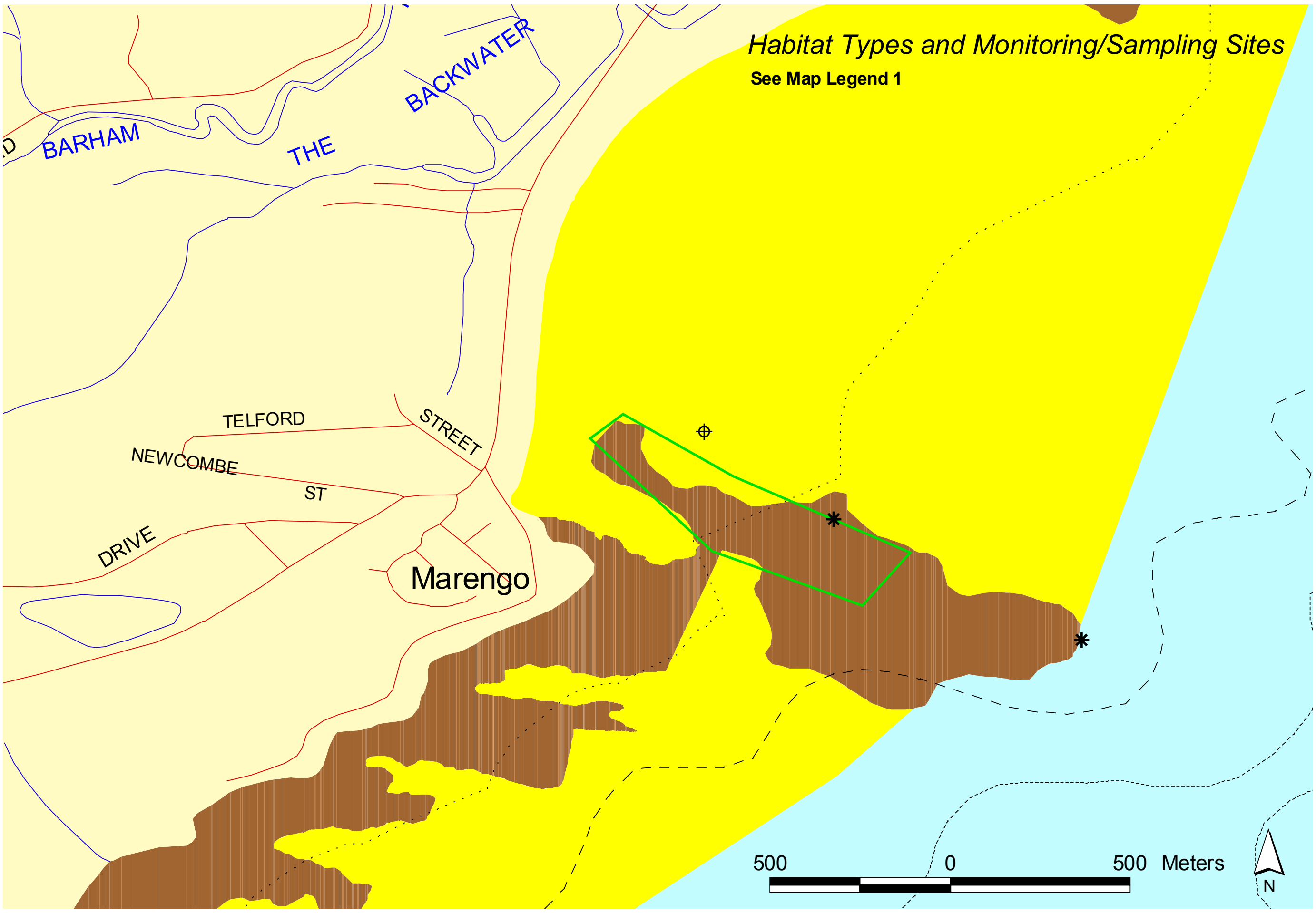

Figure A2.3a: Marengo Reefs MS marine habitats and monitoring/sampling sites.

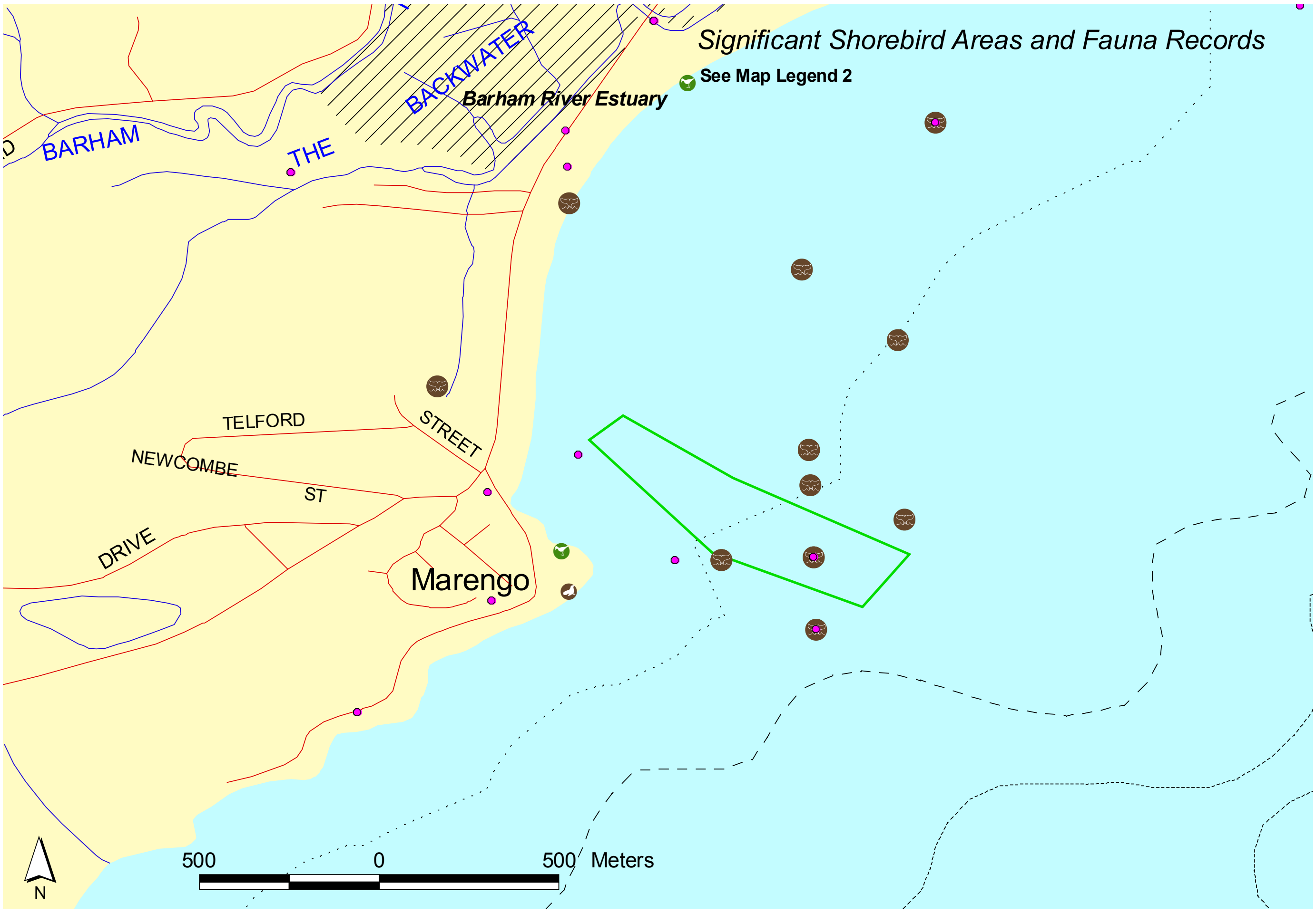

Figure A2.3b: Marengo Reefs MS shorebird and fauna values (see Tables 3.3.6 & 3.3.7 for threatened species lists).

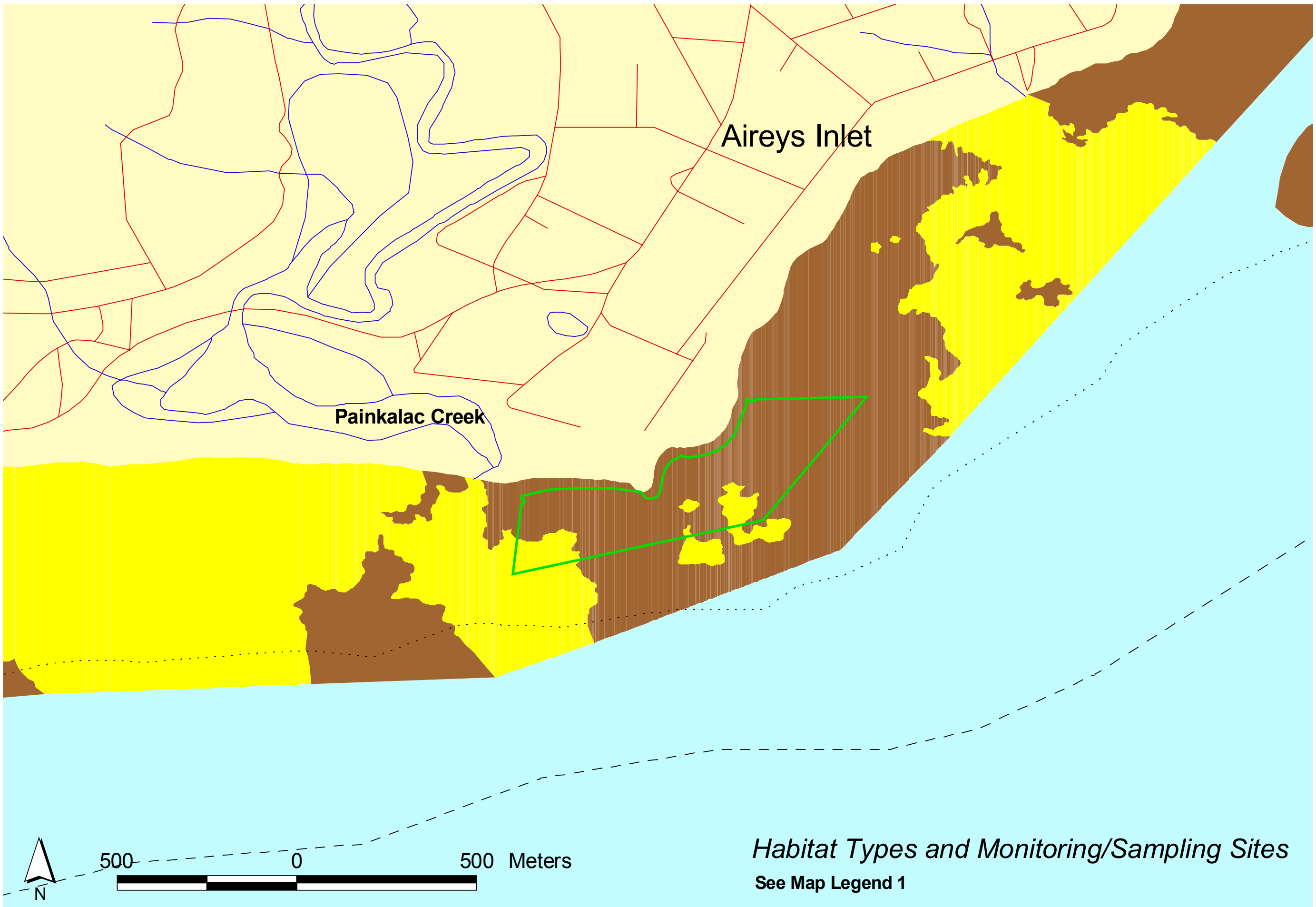

Figure A2.4a: Eagle Rock MS marine habitats and monitoring/sampling sites.

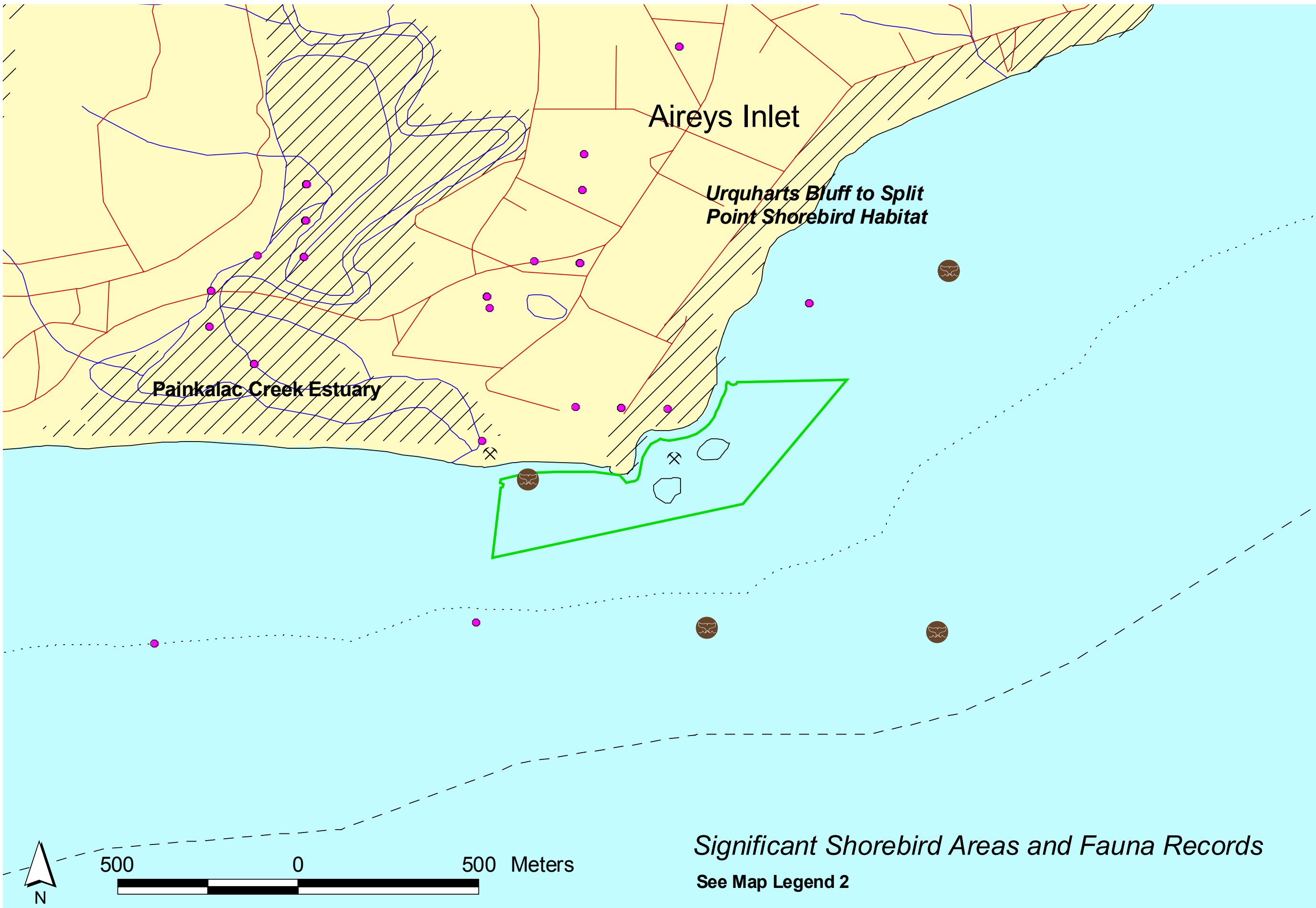

Figure A2.4b: Eagle Rock MS shorebird and fauna values (see Tables 3.4.4 & 3.4.5 for threatened species lists).

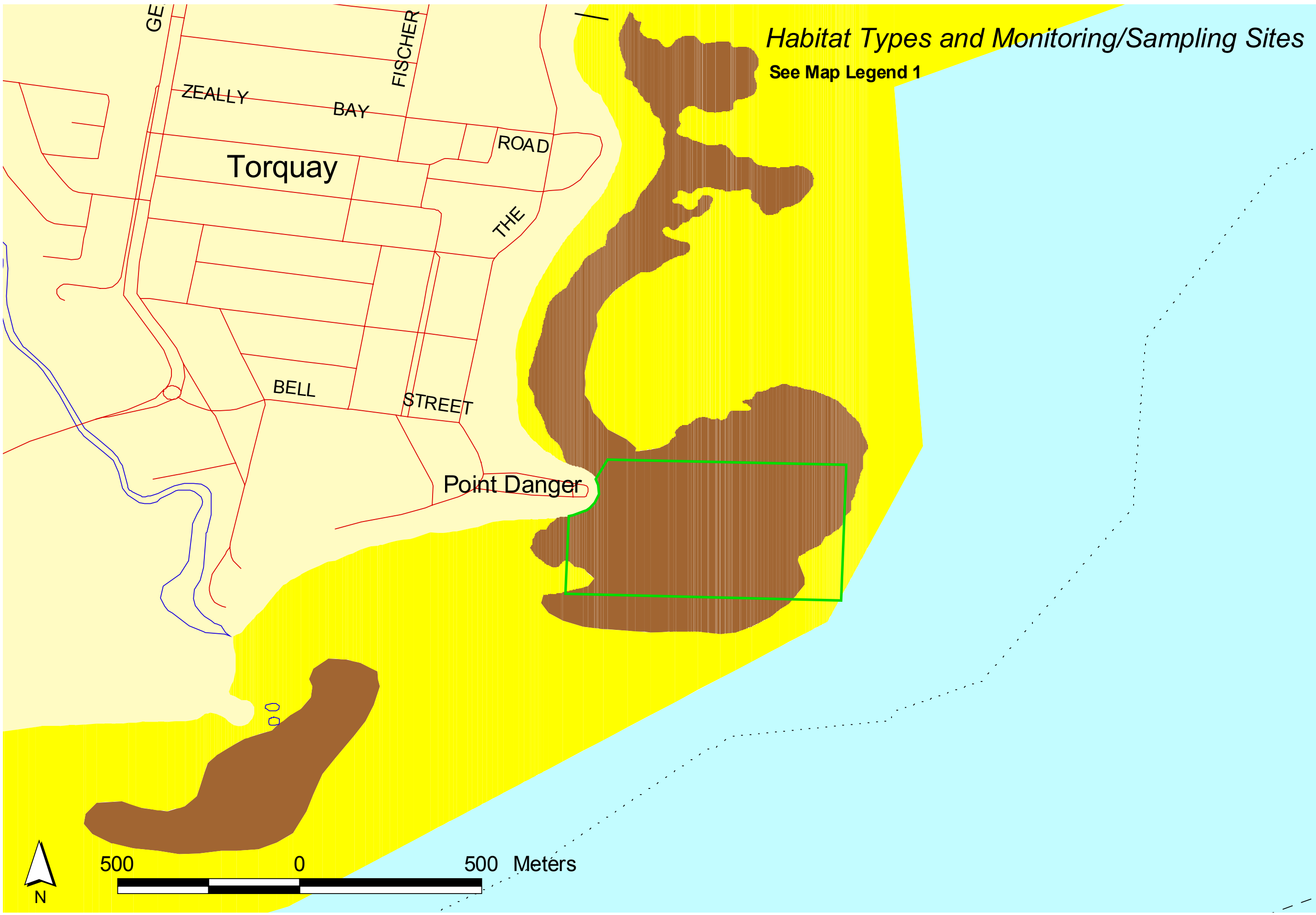

Figure A2.5a: Point Danger MS marine habitats and monitoring/sampling sites.

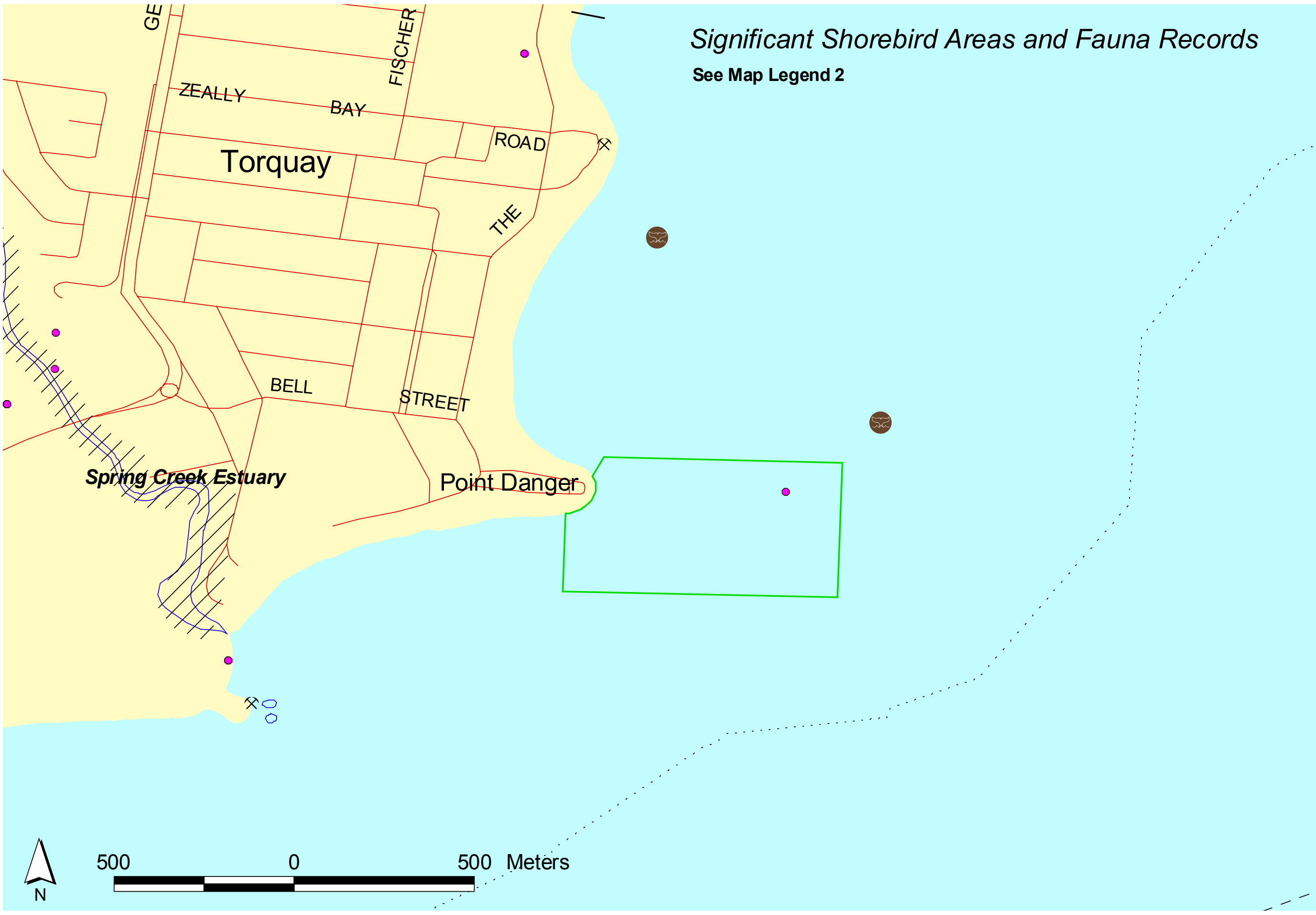

Figure A2.5b: Point Danger MS shorebird and fauna values (see Tables 3.5.5 & 3.5.6 for threatened species lists).

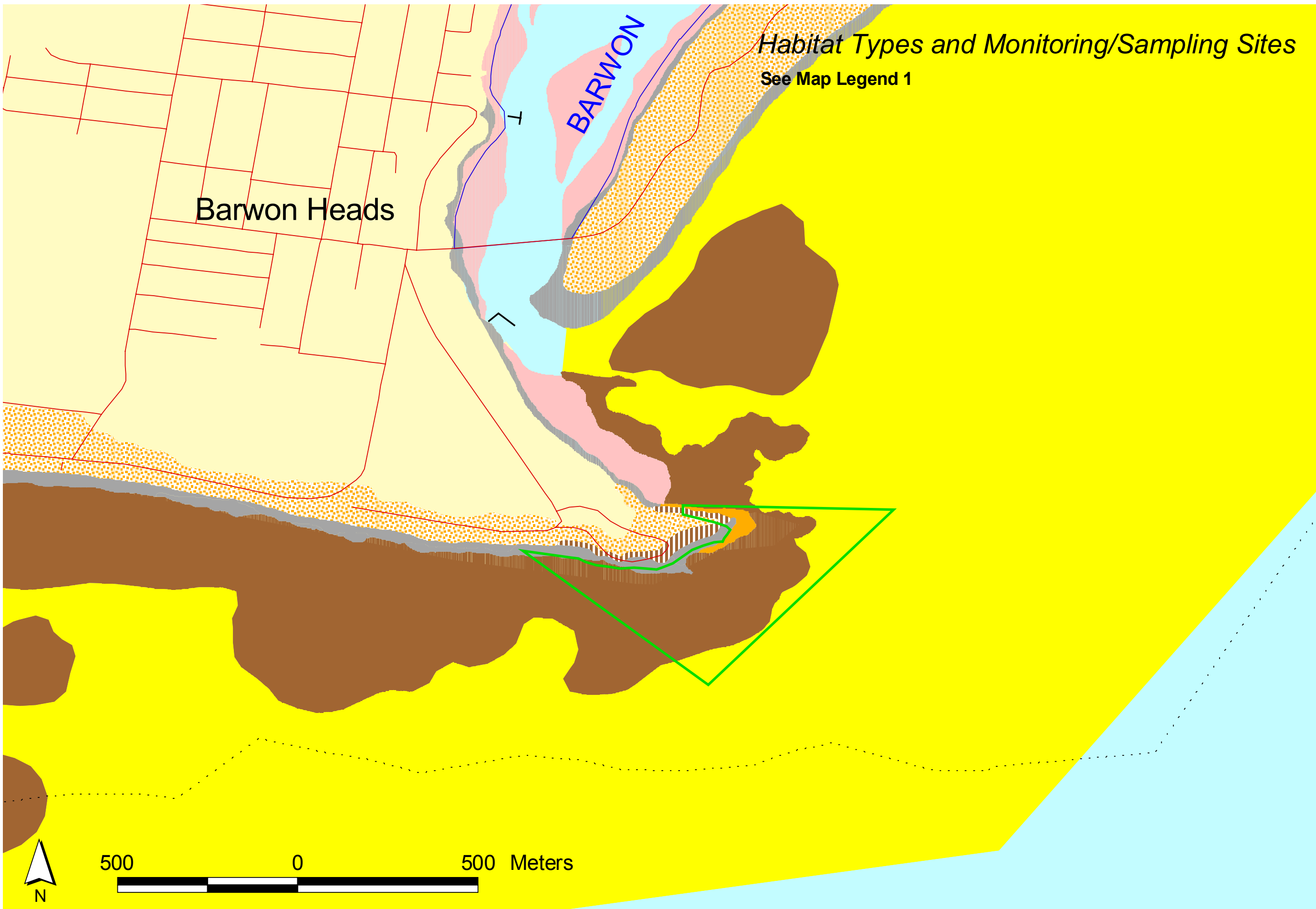

Figure A2.6a: Barwon Bluff MS marine habitats and monitoring/sampling sites.

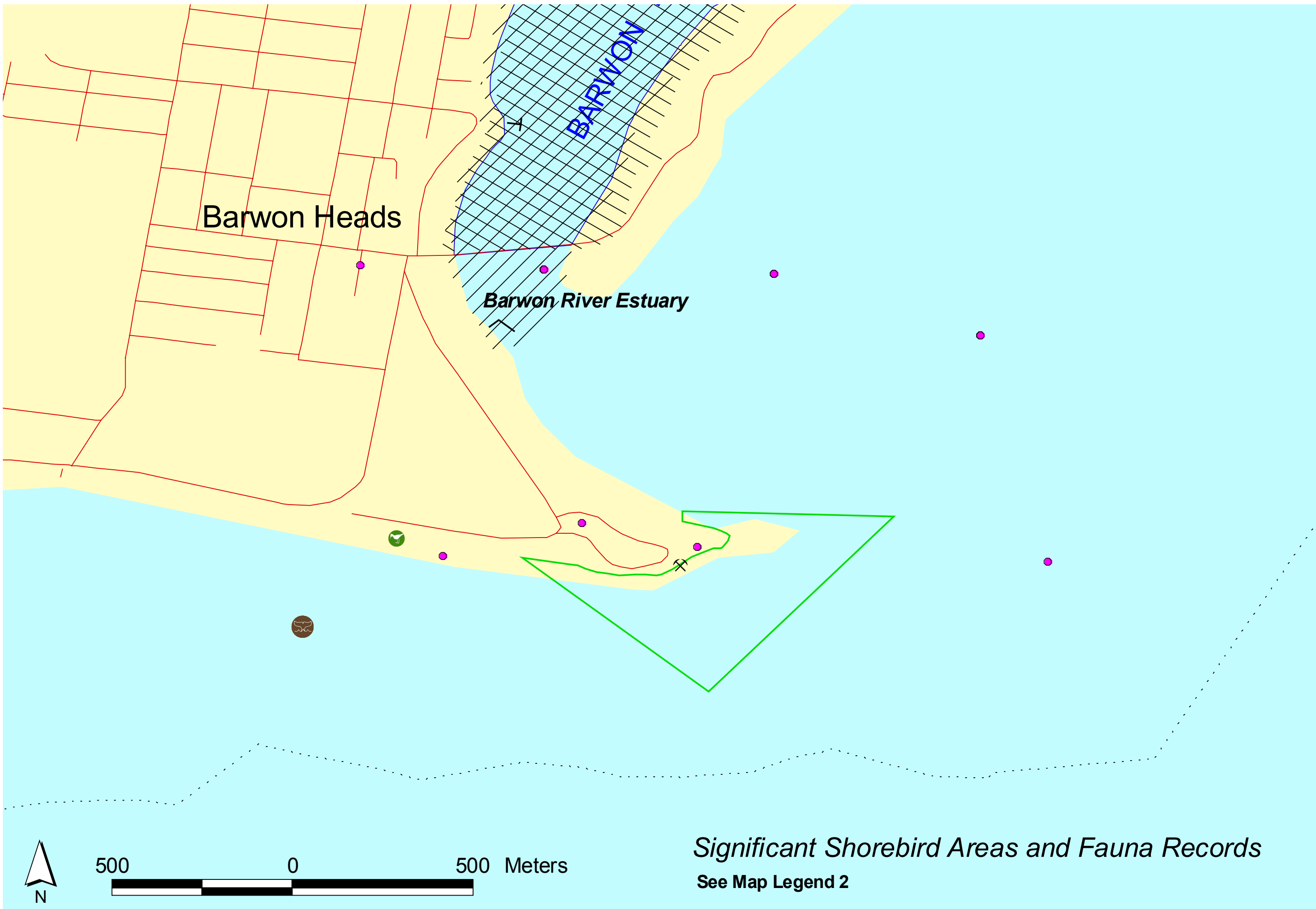

Figure A2.6b: Barwon Bluff MS shorebird and fauna values (see Tables 3.6.6 & 3.6.4 for threatened species lists).

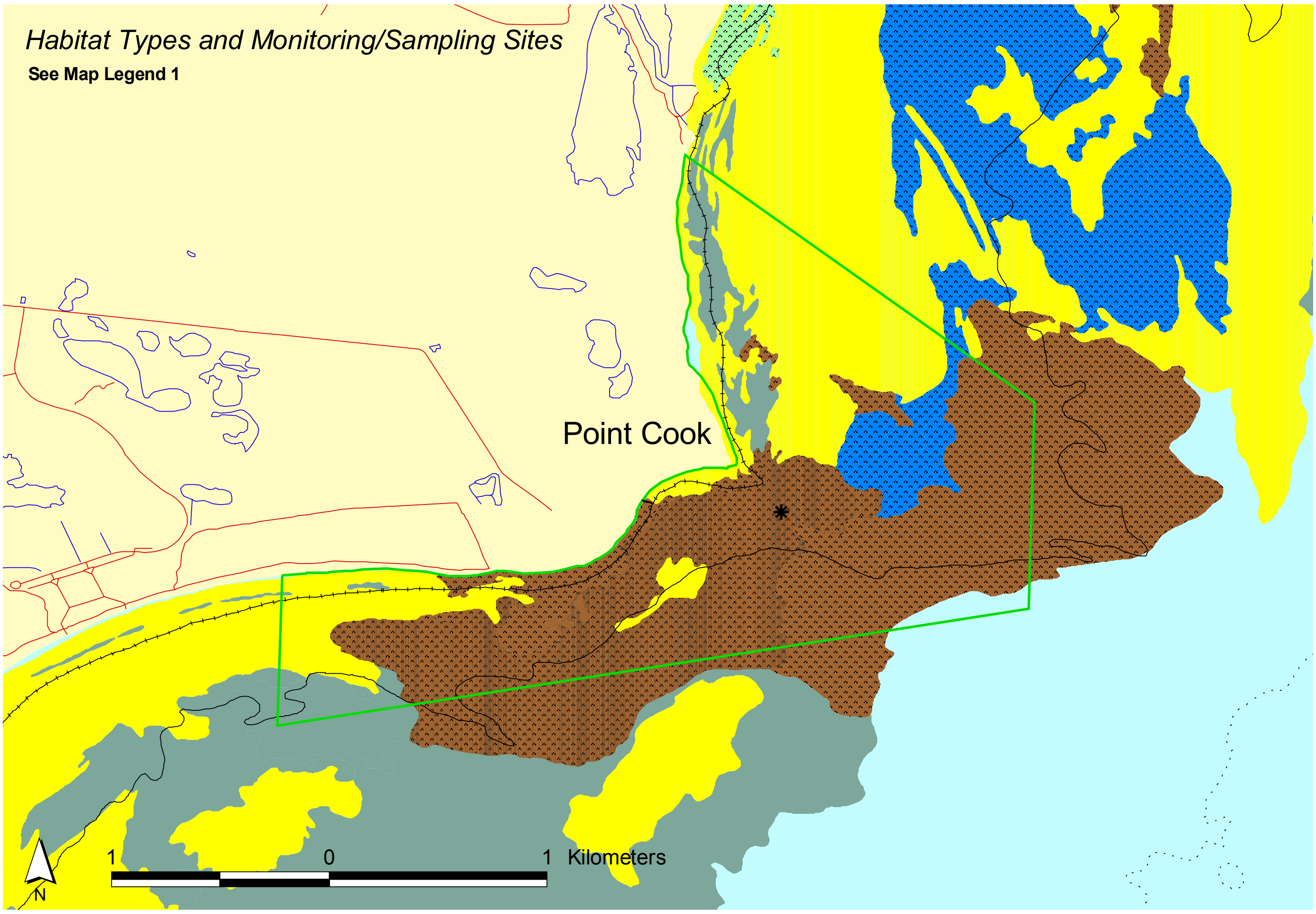

Figure A2.7a: Point Cooke MS marine habitats and monitoring/sampling sites.

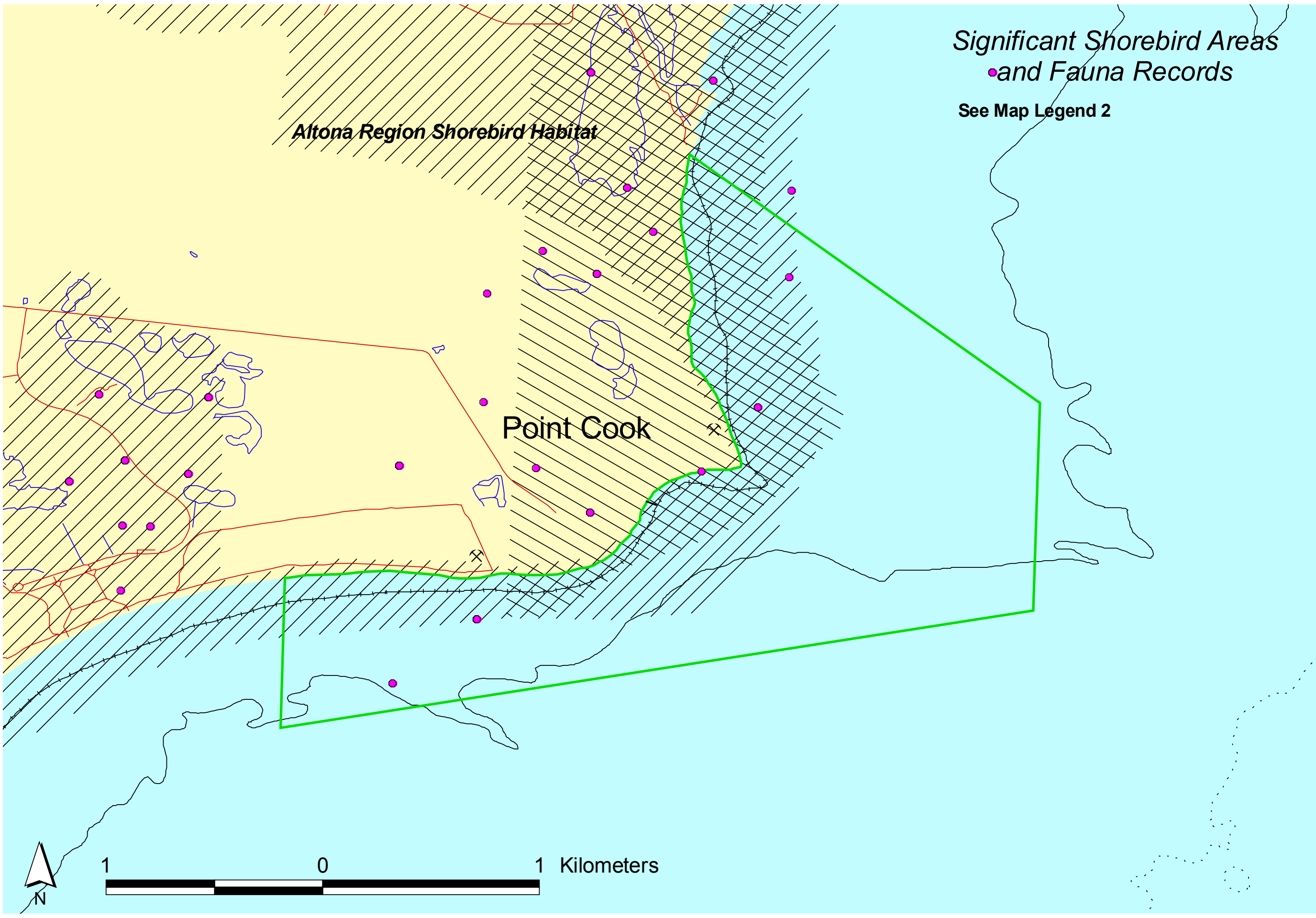

Figure A2.7b: Point Cooke MS shorebird and fauna values (see Tables 3.7.4 & 3.7.5 for threatened species lists).

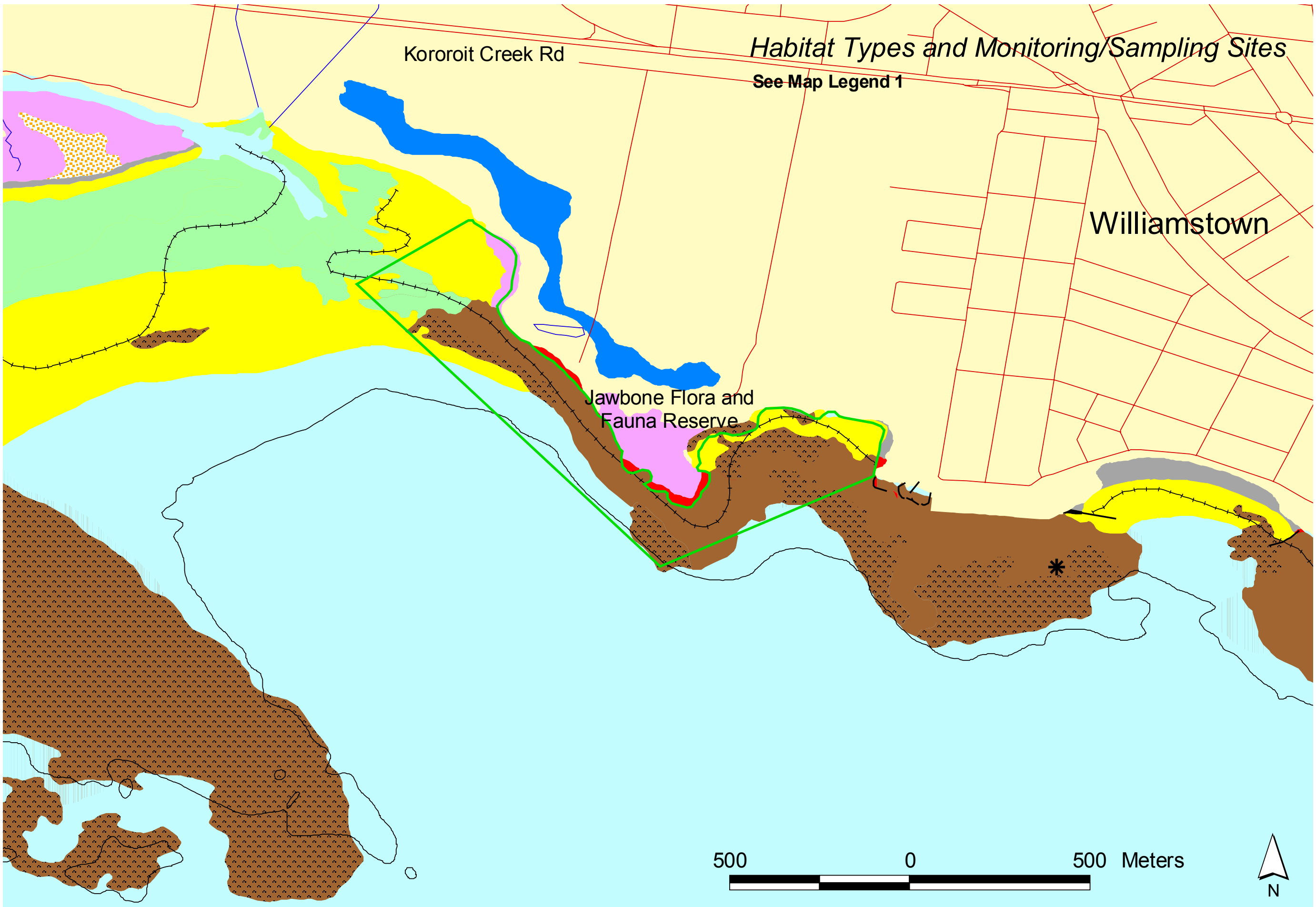

Figure A2.8a: Jawbone MS marine habitats and monitoring/sampling sites.

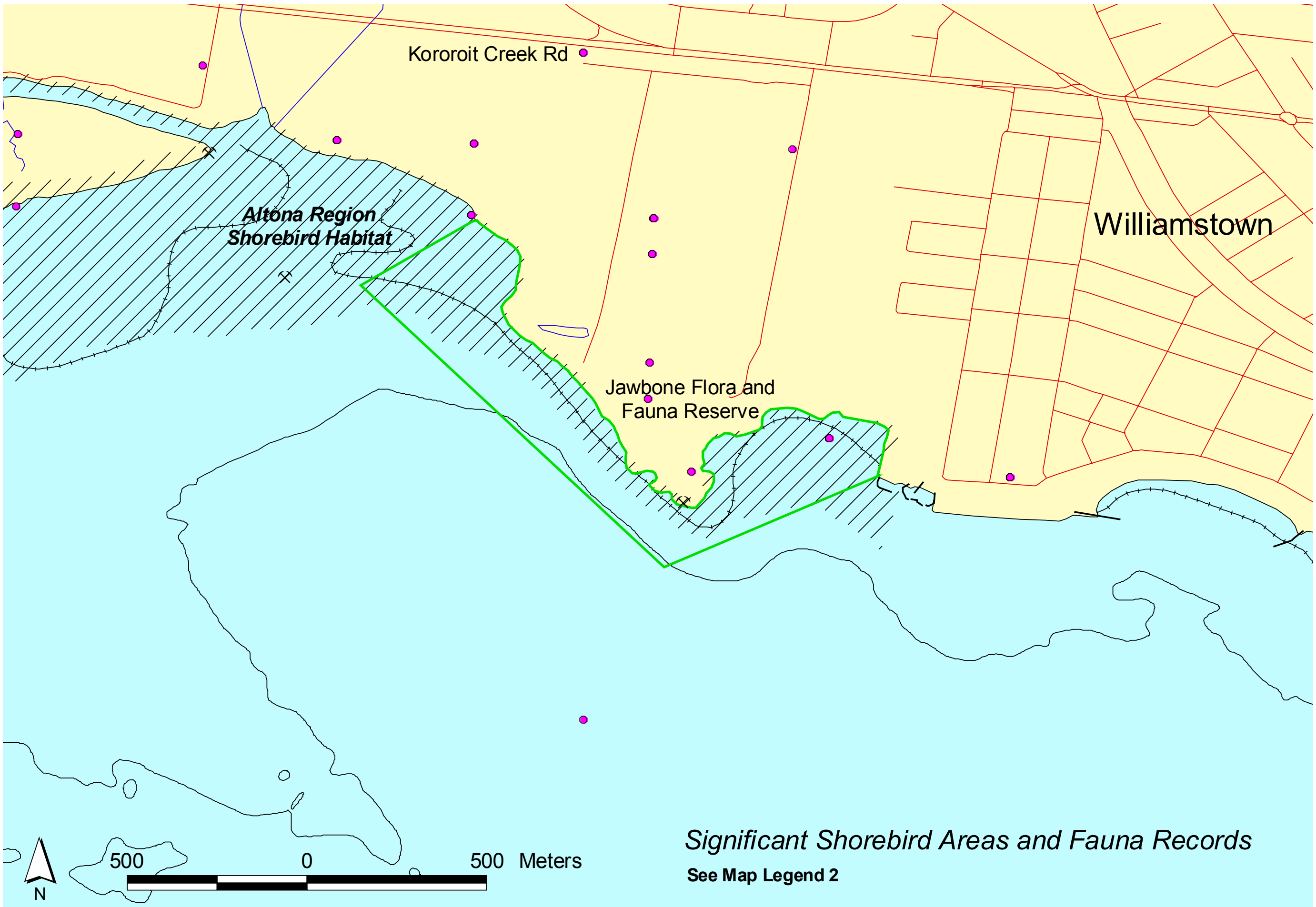

Figure A2.8b: Jawbone MS shorebird and fauna values (see Table 3.8.4 for threatened species list).

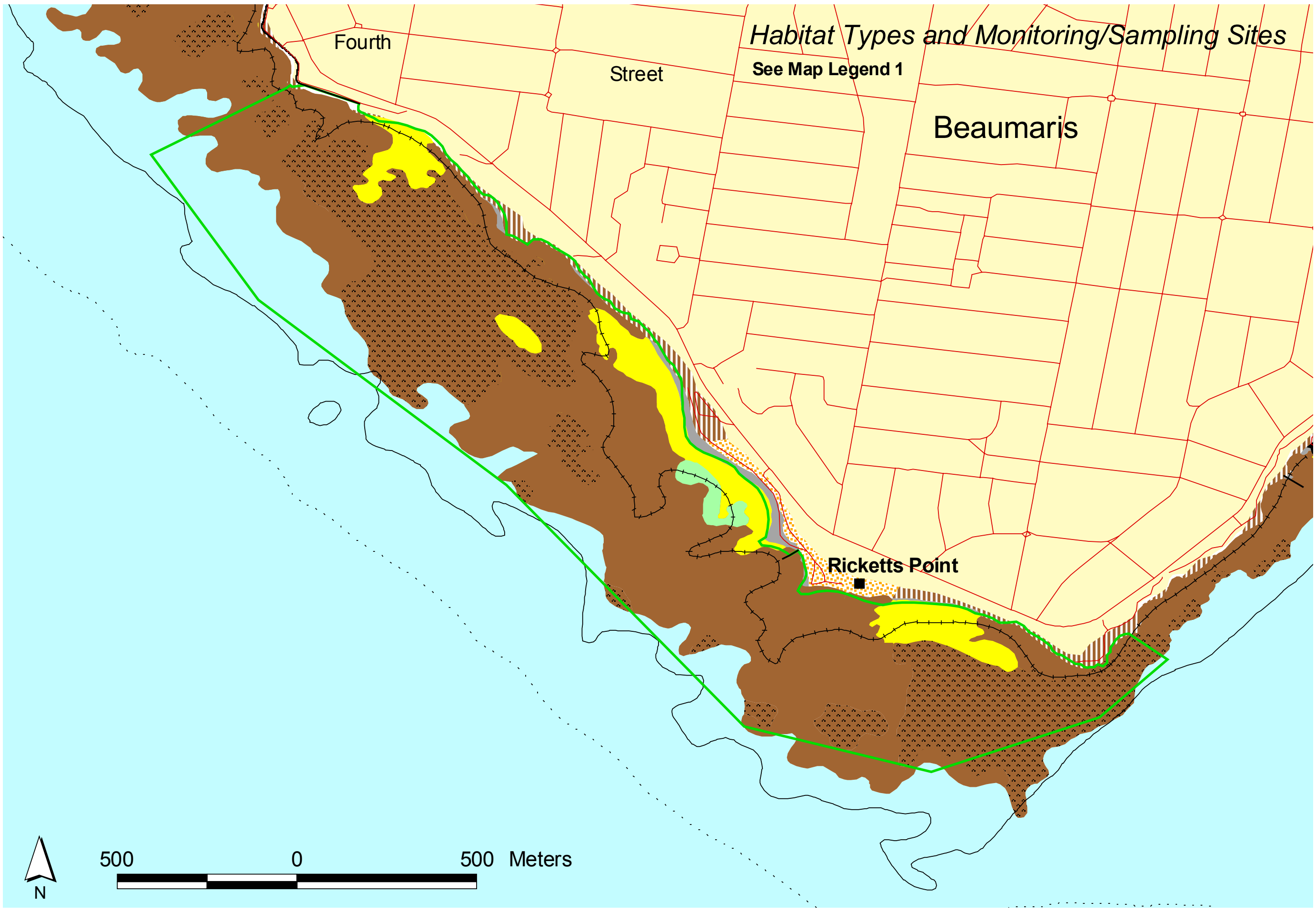

Figure A2.9a: Ricketts Point MS marine habitats and monitoring/sampling sites.

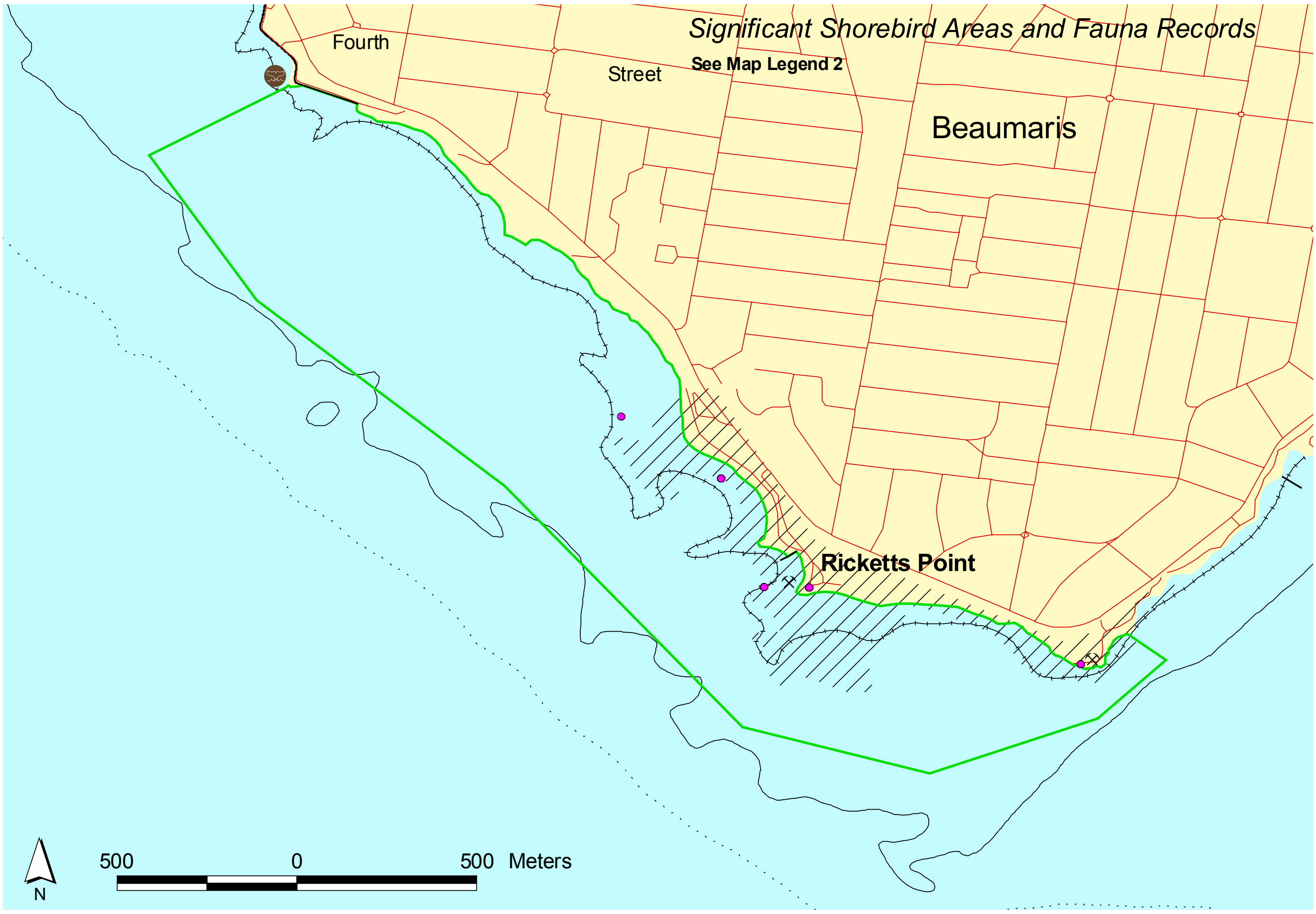

Figure A2.9b: Ricketts Point MS shorebird and fauna values (see Tables 3.9.3 & 3.9.4 for threatened species lists).

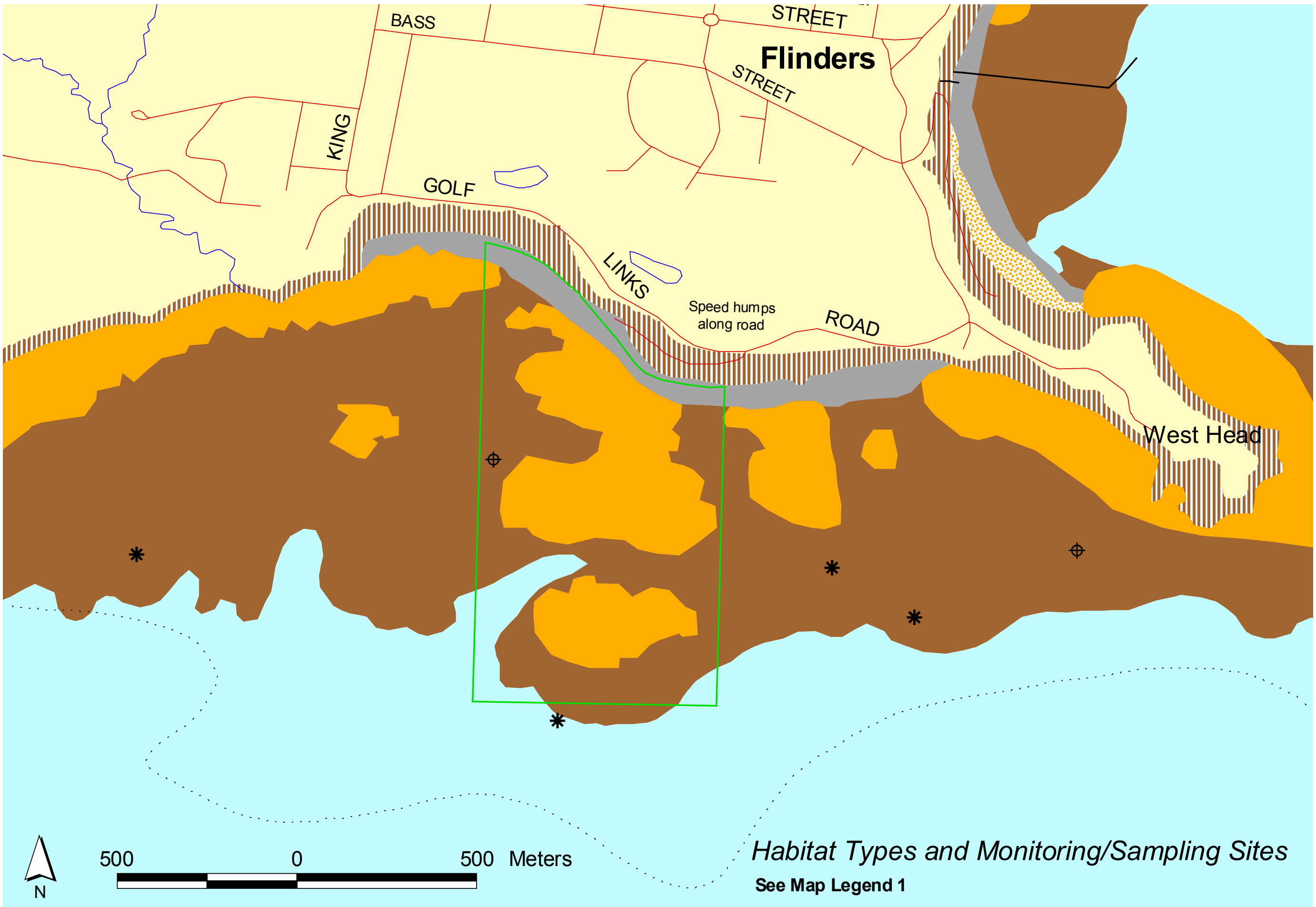

Figure A2.10a: Mushroom Reef MS marine habitats and monitoring/sampling sites.

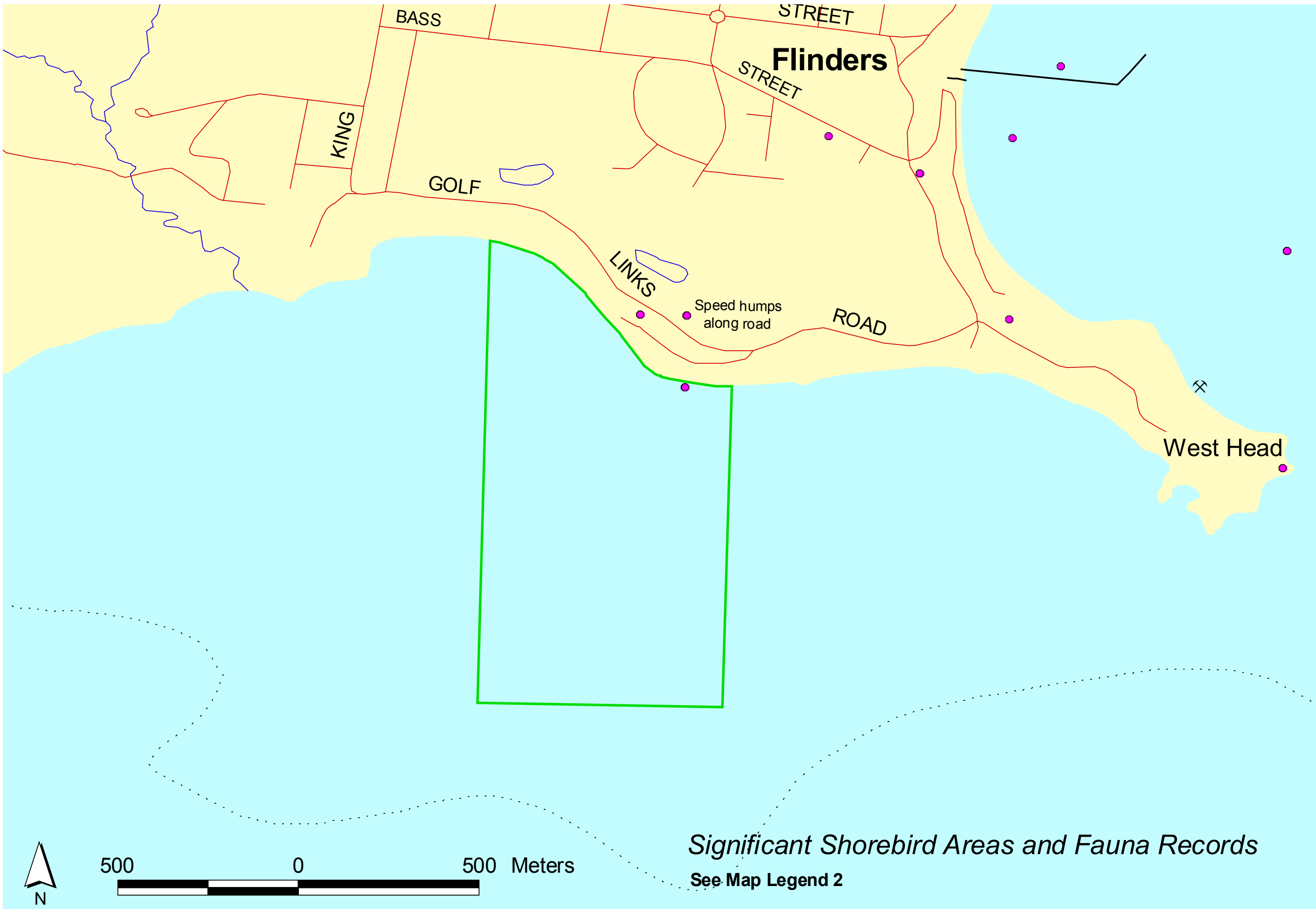

Figure A2.10b: Mushroom Reef MS shorebird and fauna values (see Tables 3.10.4 & 3.10.5 for threatened species lists).

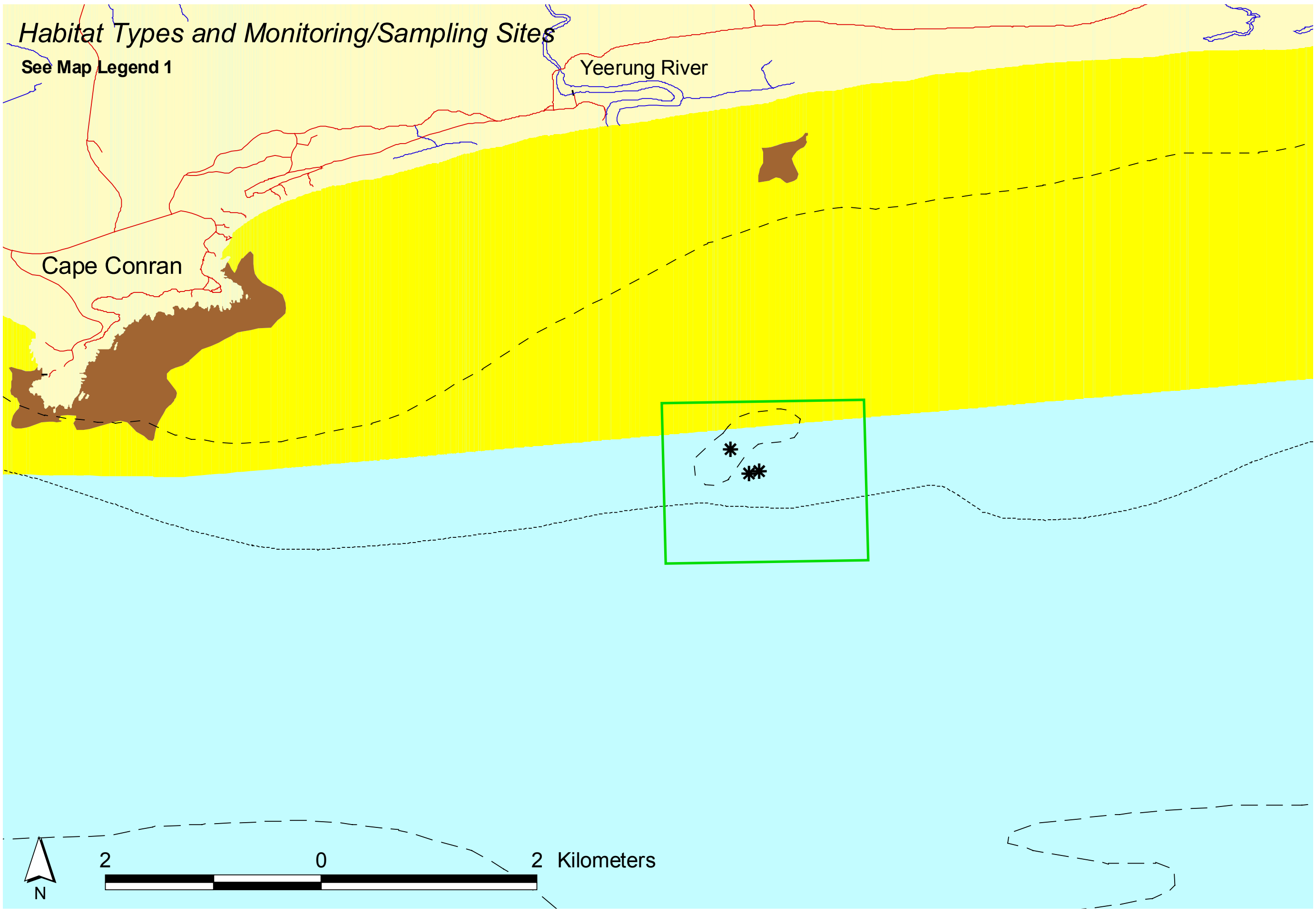

Figure A2.11a: Beware Reef MS marine habitats and monitoring/sampling sites.

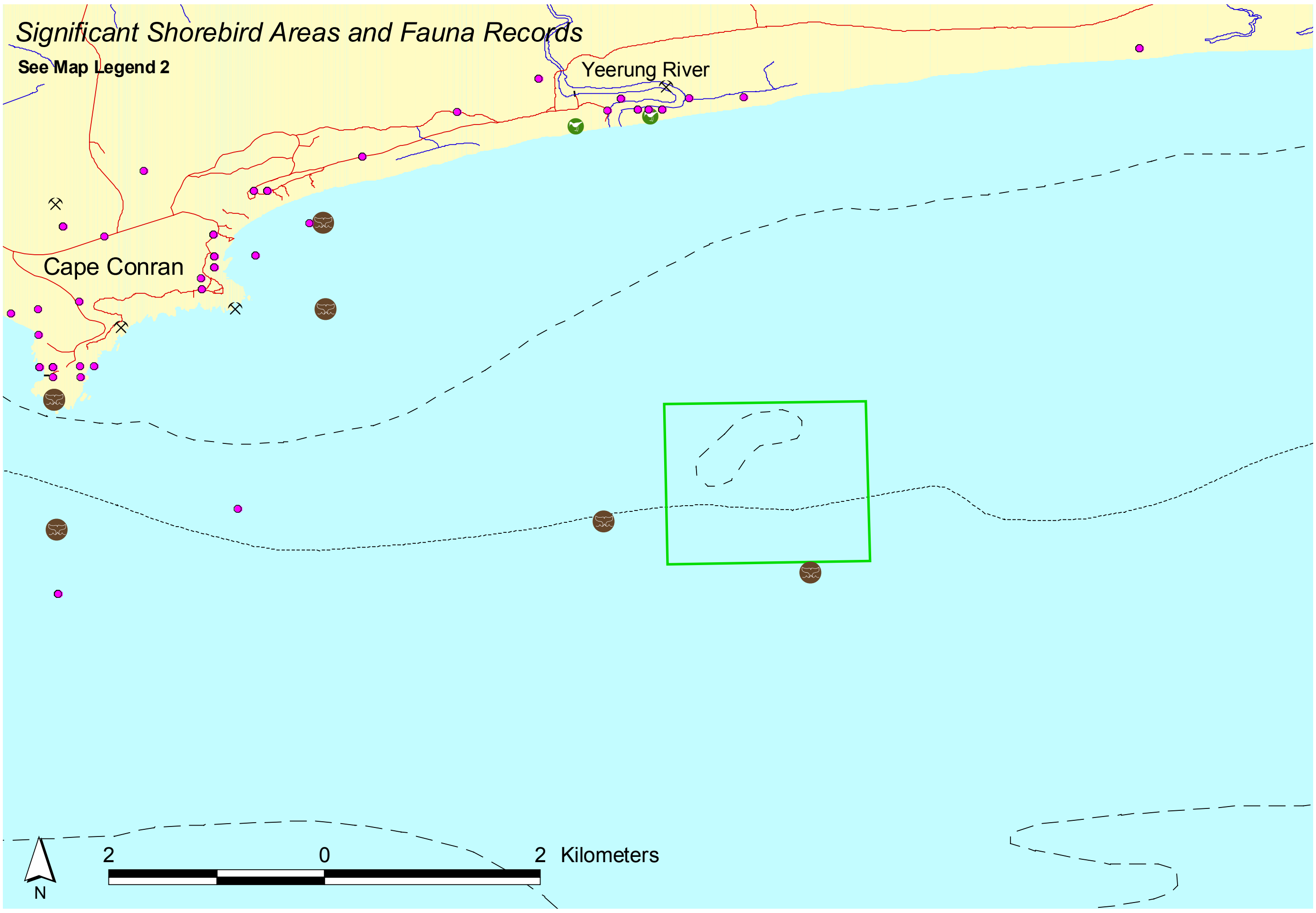

Figure A2.11b: Beware Reef MS shorebird and fauna values (see Tables 3.11.5 & 3.11.6 for threatened species lists).

APPENDIX 3

Categories of Rare or Threatened fauna in Victoria

Threatened fauna (shorebirds and marine mammals) species identified in this report have been characterised according to the following threatened species categories.

National Status: Environment Protection and Biodiversity Conservation Act (EPBC)

The EPBC categories are based on the IUCN Red List categorisation (IUCN 1994). In order to qualify for a threat category, a taxon must meet one or more assessment criteria, based on features such as numbers of individuals and populations, previous or projected declines in numbers or habitat, extent of occurrence, area of occupancy and extreme fluctuations in numbers or habitat. Abbreviated definitions of the IUCN categories used in the EPBC list are as follows:

End Endangered: A taxon is Endangered when it is facing a very high risk of extinction in the wild in the near future.

Ext Extinct: A taxon is Extinct when there is no reasonable doubt that the last individual has died.

Vul Vulnerable: A Taxon is Vulnerable when it is not Endangered but is facing a high risk of extinction in the wild in the medium-term future.

State Status: Threatened Wildlife of Victoria (TWV)

Cen Critically Endangered: A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.

End Endangered: A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future.

Ext Extinct: A taxon is Extinct in Victoria when there is no reasonable doubt that the last individual has died.

Ins Data Deficient: A taxon is Data Deficient when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution or population status. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future investigation will show that a threatened classification is appropriate.

LR Lower Risk - near threatened: A taxon is Lower Risk - near threatened when it has been evaluated, does not satisfy the criteria for any of the threatened categories, but which is close to qualifying for Vulnerable. In practice, these species are most likely to move into a threatened category should current declines continue or catastrophes befall the species.

Vul Vulnerable: A Taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future.

End Endangered: A taxon is Endangered when it is facing a very high risk of extinction in the wild in the near future.

Ext Extinct: A taxon is Extinct when there is no reasonable doubt that the last individual has died.

Vul Vulnerable: A Taxon is Vulnerable when it is not Endangered but is facing a high risk of extinction in the wild in the medium-term future.

R/R Rare

Ins Data Deficient: A taxon is Data Deficient when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution or population status. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future investigation will show that a threatened classification is appropriate.

In practice, these threat categories may include species whose populations are beginning to recover as a result of remedial action, but whose recovery is insufficient to justify their transfer to another category.

Flora and Fauna Guarantee Act (FFG)

L Listed: A taxon is listed under the *Flora and Fauna Guarantee Act* 1988).

Treaties

C CAMBA: A taxon is listed under the China Australia Migratory Bird Agreement, a treaty for the "protection of migratory birds and their environment" between China and the Government of Australia.

J JAMBA: A taxon is listed under the Japan Australia Migratory Bird Agreement, a treaty for the protection of migratory birds and birds in danger of extinction and their environment" between Japan and the Government of Australia.

APPENDIX 4

Ocean and Shorebirds with a threatened status or subject to international treaties recorded in Bass Strait (ARI 1999)

Common Name	Scientific Name	National Status	State Status	Treaties
Arctic Jaeger	*Stercorarius parasiticus*			J
Asian Dowitcher	*Limnodromus semipalmatus*			CJ
Australasian Gannet	*Morus serrator*		Vul	
Baird's Sandpiper	*Calidris bairdii*			J
Bar-tailed Godwit	*Limosa lapponica*			CJ
Black-tailed Godwit	*Limosa limosa*			CJ
Blue Petrel	*Halobaena caerulea*	Vul		
Broad-billed Sandpiper	*Limicola falcinellus*			CJ
Brown Booby	*Sula leucogaster*			CJ
Cape Gannet	*Morus capensis*		CEn	
Caspian Tern	*Sterna caspia*		Vul	CJ
Common Diving-Petrel	*Pelecanoides urinatrix*		LR	
Common Greenshank	*Tringa nebularia*			CJ
Common Noddy	*Anous stolidus*			CJ
Common Tern	*Sterna hirundo*			CJ
Crested Tern	*Sterna bergii*		LR	
Curlew Sandpiper	*Calidris ferruginea*			CJ
Dunlin	*Calidris alpina*			C
Dusky Moorhen	*Numenius madagascariensis*		LR	CJ
Fairy Prion	*Pachyptila turtur*	Vul	LR	
Fairy Tern	*Sterna nereis*		Vul	
Flesh-footed Shearwater	*Puffinus carneipes*			J
Gould's Petrel	*Pterodroma leucoptera*	End		
Great Frigatebird	*Fregata minor*			CJ
Great Knot	*Calidris tenuirostris*			CJ
Greater Sand Plover	*Charadrius leschenaultii*			CJ
Grey Phalarope	*Phalaropus fulicaria*			CJ
Grey Plover	*Pluvialis squatarola*			CJ
Grey-headed Albatross	*Diomedea chrysostoma*	Vul		
Grey-tailed Tattler	*Heteroscelus brevipes*			CJ
Gull-billed Tern	*Sterna nilotica*		End	
Hooded Plover	*Thinornis rubricollis*	Vul	End	
Kelp Gull	*Larus dominicanus*		CEn	
Leach's Storm-Petrel	*Oceanodroma leucorhoa*			CJ
Lesser Frigatebird	*Fregata ariel*			CJ
Lesser Sand Plover	*Charadrius mongolus*			CJ
Little Curlew	*Numenius minutus*			CJ
Little Ringed Plover	*Charadrius dubius*			C
Little Tern	*Sterna albifrons*	End	Vul	CJ
Long-tailed Jaeger	*Stercorarius longicaudus*			J
Long-toed Stint	*Calidris subminuta*		Ins	CJ
Marsh Sandpiper	*Tringa stagnatilis*			CJ
Northern Giant-Petrel	*Macronectes halli*		End	
Oriental Plover	*Charadrius veredus*			J
Pacific Golden Plover	*Pluvialis fulva*			CJ
Pacific Gull	*Larus pacificus*		LR	

Pectoral Sandpiper	*Calidris melanotos*		Ins	J
Pomarine Jaeger	*Stercorarius pomarinus*		Ins	CJ
Providence Petrel	*Pterodroma solandri*			J
Red Knot	*Calidris canutus*			CJ
Red-necked Phalarope	*Phalaropus lobatus*			CJ
Red-necked Stint	*Calidris ruficollis*			CJ
Royal Albatross	*Diomedea epomophora*	Vul		
Ruddy Turnstone	*Arenaria interpres*			CJ
Ruff	*Philomachus pugnax*			CJ
Sanderling	*Calidris alba*			CJ
Sharp-tailed Sandpiper	*Calidris acuminata*			CJ
Short-tailed Shearwater	*Puffinus tenuirostris*			J
Shy Albatross	*Diomedea cauta*	Vul		
Soft-plumaged Petrel	*Pterodroma mollis*	Vul		
Sooty Albatross	*Phoebetria fusca*	Vul		
Sooty Oystercatcher	*Haematopus fuliginosus*			
Sooty Shearwater	*Puffinus griseus*			CJ
Southern Giant-Petrel	*Macronectes giganteus*		End	
Streaked Shearwater	*Calonectris leucomelas*			CJ
Terek Sandpiper	*Xenus cinereus*			CJ
Wandering Albatross	*Diomedea exulans*	Vul	CEn	J
Wedge-tailed Shearwater	*Puffinus pacificus*			J
Whimbrel	*Numenius phaeopus*			CJ
Whiskered Tern	*Chlidonias hybridus*		LR	
White-faced Storm-Petrel	*Pelagodroma marina*		Vul	
White-tailed Tropicbird	*Phaethon lepturus*			CJ
White-winged Black Tern	*Chlidonias leucopterus*			CJ
Wilson's Storm-Petrel	*Oceanites oceanicus*			J
Wood Sandpiper	*Tringa glareola*			CJ
Yellow-nosed Albatross	*Diomedea chlororhynchos*			

APPENDIX 5

Preliminary checklist of fishes from Gabo Island. October 2000.

Prepared by Dr Mark Norman and Dustin Marshall Department of Zoology University of Melbourne
(? = **tentative identification)**

Family Heterodontidae	
Heterodontus portusjacksoni	Port Jackson Shark
Family Orectolobidae	
Orectolobus maculatus	Wobbegong
Family Scyliorhinidae	
Asymbolus sp.	Unidentified catshark
Cephaloscyllium nascione	Draughtboard Shark
Family Myliobatidae	
Myliobatis australis	Southern Eagle Ray
Family Ophichthidae	
Ophisurus serpens	Giant Snake Eel
Family Moridae	
?Pseudophycis bachus	Red Cod
Family Hemiramphidae	
Hyporhamphus melanochir	Southern Sea Garfish
Family Scorpaenidae	
? *Scorpaena papi/losa*	Red Rock Cod
Family Plesiopidae	
Trachinops taeniatus	Yellow Hulafish
Family Dinolestidae	
Dinolestes lewini	Longtin Pike
Family Carangidae	
Pseudocaranx dentex	White Trevally
Trachurus declivis	Jack Mackeral
Family Mullidae	
Upeneichthys lineatus	Blue-lined Goatfish
Family Pempheridae	
Pempheris multiradiata	Common Bullseye
Family Scorpididae	
Scorpis aequipinnis	Sea Sweep
Scorpis lineolata	Silver Sweep
Family Kyphosidae	
Kyphosus sydneyanus	Silver Drummer
Family Girellidae	
Girella elevata	Black Drummer Luderick
Girella tricuspidata	Zebra Fish
Girella zebra	Mado
Family Microcanthidae	
Atypich thys strigatus	
Family Chironemidae	
Chironemus marmoratus	Kelpfish

Family Aplodactylidae	
Aplodactylus arctidens	Southern Sea Carp
Crinodus lophodon	Rock Cale
Family Cheilodactylidae	
Cheilodactylus fuscus	Red Morwong
Cheilodactylus nigripes	Magpie (Morwong) Perch
Cheilodactylus spectabilis	Banded Morwong
Nemadactylus douglasi	Blue Morwong
Family Latrididae	
Latridopsis forsteri	Bastard Trumpeter
Family Pomacentridae	
Parma microlepis	White Ear
Family Labridae	
Achoerodus viridis	Eastern Blue Groper
Eupetrichthys angustipes	Snakeskin Wrasse
Notolabrus fucicola	Saddled Wrasse
? *Notolabrus gymnogenis*	Crimson Banded Wrasse
Notolabrus tetricus	Bluethroat Wrasse
Ophthalmolepis lineolata	Maori Wrasse
Pictilabrus laticlavius	Senator Wrasse
Family Odacidae	
Odax acroptilus	Rainbow Cale
Odax cyanomelas	Herring Gale
Family Monacanthidae	
Eubalicthys bucephalus	Black Reef Leatherjacket
Meuschenia flavolineata	Yellowstriped Leatherjacket
Meuschenia freycineti	Sixspined Leatherjacket
Family Tetraodontidae	
Tetractenos hamiltoni	Common Toadfish
Family Diodontidae	
Dicotylichthys punctulatus	Three-bar Porcupinefish
Diodon nichthemerus	Globefish

APPENDIX 6

Preliminary checklist of marine invertebrates from Gabo Island. October 2000.

Prepared by Dustin Marshall and Dr Mark Norman Department of Zoology University of Melbourne

PHYLUM CNIDARIA	
Class Scyphozoa	
Order Semaeostomae	
Cyanea capillata	Lion's Mane Jellyfish
Class Hydrozoa	
Order Hydroida	
Aequorea eurhodina	(moderate-size pale blue jellyfish)
Turritopsis nutricula	(small pink jellyfish)
Class Anthozoa	
Order Actiniaria	
Actinia tenebrosa	Waratah Anemone
Anthothoe albocincta	(green and white striped anemone)
Aulactinia veratra	(intertidal green anemone)
Oulactis muscosa	Magpie Anemone
Phlyctenactis tuberculosa	Wandering Anemone
Order Corallimorpharia	
Corynactis australis	Jewel Anemone
Order Alcyonacea	
Erythropodium hicksoni	(sheet soft coral)
PHYLUM PLATYHELMINTHES	
Thysanozoon sp.	(rough flatworm)
PHYLUM ANNELIDA	
Family Serpulidae	
Galealaria caespitasa	Sydney Tube Coral
PHYLUM ARTHROPODA	
SUBPHYLUM CRUSTACEA	
Class Cirripedia	
Lepas australis	Gooseneck Barnacle
Catomeras polymerus	(abundant barnacle)
Tetraclitella purpurascens	(ribbed barnacle)
Austromegabalanus nigrescens	Surf Barnacle
Class Malacostraca	
Order Decapoda	
Family Rhynchocinetidae	
Rhynchocinetes rugulosus	(blue-striped hinge-back shrimp)
Family Palinuridae	
Jasus verreauxi	Eastern Rock Lobster
Family Portunidae	
Ovalipes australiensis	Surf Crab
Family Grapsidae	
Cyclograpsus sp.	(shore crab)
PHYLUM MOLLUSCA	
Class Polyplacophora	
Rhyssoplax calliozona	(chiton)
Class Gastropoda	
Family Haliotidae	
Haliotis rubra	Blacklip Abalone
Haliotis laevigata	Greenlip Abalone
Family Fissurellidae	
Scutus antipodes	Elephant Snail

Family Patellidae	
Cellana tramoserica	(large limpet)
Family Trochidae	
Austrocochlea odontis	(checked top shell)
Family Neritidae	
Nerita atramentosa	(black nerite)
Family Muricidae	
Dicathais orbita	Dog Winkle or Cartrut Shell
Lepsiella vinosa	(intertidal whelk)
Class Bivalvia	
Family Mytilidae	
Mytilus edulis	Blue Mussel
Class Cephalopoda	
Family Sepiidae	
Sepia apama	Giant Cuttlefish
Family Loliginidae	
Sepioteuthis australis	Southern Calamari Squid
Family Argonautidae	
Argonauta argo	Greater Argonaut
Argonauta nodosa	Knobbed Argonaut
Family Octopodidae	
Octopus kaurna	Southern Sand Octopus
Octopus tetricus	Common Sydney Octopus
PHYLUM BRYOZOA	
Membranipora membranacea	(kelp bryozoan)
Tryphyllozoon moniliferum	Lace Bryozoan
Celloporaria sp.	(purple or orange encrusting bryozoan)
PHYLUM ECHINODERMATA	
Class Asteroidea	
Patiriella exigua	(little green sea star)
Class Echinoidea	
Centrostephanus rodgersii	(common black sea urchin)
Heliocidaris erythrogramma	(common pale sea urchin)
PHYLUM CHORDATA	
Class Ascidiacea	
Pyura gibbosa	Sea Tulip
Pyura stolonifera	Cunjevoi
Amphicarpa meridiana	(brown-grey colonial sea squirt)
Botrylloides leachi	(brilliant blue and yellow colonial sea squirt)
Clavelina sp.	(transparent small colonial sea squirt with few dark blue spots)
Herdmania momus	(large subtidal sea squirt)