
RESEARCH WORK PLAN 2007-08

**Port Stephens-Great Lakes Marine
Park**



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INTRODUCTION

The marine environment in the Port Stephens-Great Lakes Marine Park is biologically diverse and contains a unique mix of subtropical and temperate species which are found in a variety of habitats, including estuaries, intertidal rocky shores, subtidal reefs, sandy beaches, subtidal soft substrate, seagrass beds and open ocean. Ecological processes throughout the region are interconnected with both resident and migratory marine species relying on specific habitats for breeding, feeding and protection. The region also caters for a wide range of user groups and is of social, cultural and economic importance to both local communities and tourists.

Research is a key component in the development of zoning arrangements within the Port Stephens-Great Lakes Marine Park. The research program seeks to expand our knowledge and understanding of the marine environment, provide a regular update on the health of marine ecosystems and obtain information on the nature and extent of activities occurring in the region. All of this information is essential in order to maximise the effectiveness of zoning and other management actions while minimising socio-economic and cultural impacts.

This Research Work Plan aims to outline the research and monitoring operations that the Marine Parks Authority intends to undertake directly or through collaboration with external research providers during 2007-08. Information from these projects will assist the assessment of zoning arrangements within the marine park that allows for both conservation and sustainable use consistent with the objects of the *Marine Parks Act 1997*.

As identified in the Strategic Research Plan (2005-10), there are a number of key research areas covering a wide range of issues relevant to the ongoing assessment of the Port Stephens-Great Lakes Marine Park. The plan also lists a range of priority research issues, and these are identified under each project.

The research and monitoring projects are categorised under five overall areas.

- 1. Biodiversity and ecological processes**
- 2. Indigenous and non-Indigenous culture and heritage**
- 3. Ecologically sustainable use**
- 4. Specific impacts**
- 5. Socio-economic impacts**

Assessment and monitoring of urchin barrens on shallow and deep reefs within Port Stephens-Great Lakes Marine Park

Background

Rocky reef areas devoid of foliose algae (barrens habitat) are known to be widespread throughout areas of NSW, and the extent and persistence of patches of barrens have important implications for the ecology of many species of algae, fishes and invertebrates. There is limited information on the distribution and temporal variability in extent of barrens along the coast, although evidence suggest they are maintained with only low levels of urchin grazing. In particular, there is little information on the extent of barrens in depths greater than around 15 m, although they commonly occur on deeper reefs in other temperate waters of Australia. Monitoring of barrens would involve measuring the extent of barrens from SCUBA and/or video surveys at fixed reef locations within PSGLMP.

The development of barren reef area due to the over-grazing of macroalgae by sea urchins can result in part from the reduction in the number of urchin predators due to fishing. Studies of a sanctuary zone in New Zealand found that once the numbers and average sizes of snapper and rock lobsters had recovered, these large predators began controlling the local sea urchin (*Evechinus chloroticus*), which had eaten extensive areas of kelp (predominantly *Ecklonia radiata*) resulting in barren areas. This resulted in a decrease in urchin density and a reduction in barrens to 14% of the reserve, compared to 40% in unprotected areas. The primary production of the marine reserve was estimated to be over 50 times greater than it was before protection from fishing.

Objectives

- To determine the distribution and extent of urchin barrens on both shallow and deep rocky reefs in the marine park
- To compare the extent and distribution of barrens at several sites within Sanctuary and Habitat Protection Zones

Contacts

William Gladstone – University of Newcastle

Alan Jordan – NSW Department of Environment and Climate Change

This project aims to address the following specific research issues identified in the Strategic Research Plan:

Biodiversity and Ecological Processes

- Map and assess the spatial extent and structure of seabed habitats and key taxa

Ecologically sustainable use

- Examine the optimum design of marine parks : size, patterns of zoning
- Assessment of impacts and threats of anthropogenic activity on habitats

Benthic fish assemblages in deep water habitats of the Port Stephens-Great Lakes Marine Park

Background

Seabed habitats are frequently used as a surrogate for spatial patterns in marine biodiversity, however, there is little information on the fish diversity and composition associated with many habitats in intermediate depths (>20 m) within the PSGLMP. The recent swath mapping of the region has identified considerable areas of rocky reef in depths >20 m throughout the marine park, some of which is represented within Sanctuary Zones.

Differences in species composition and population structures of fish in deeper reefs will be investigated using Baited Remote Underwater Video (BRUV) systems, a technique commonly used throughout Australia to examine fish assemblages at sites not suitable for diving. Standardised baits are used to attract fish to a viewing area, being recorded horizontally by a video camera. Using this system, information can be obtained on relative abundance and fish diversity on habitats deeper than can be routinely accessed through diver visual census.

The use of depth to divide rocky reefs into different habitat types for marine park zoning purposes assumes that assemblages of fish differ at increasing depths across the continental shelf. This has been commonly found at many sites throughout world but requires testing within the Port Stephens region to ensure zoning arrangements provide adequate protection to the full range of fish species. This is particularly important as deep reefs are commonly targeted by commercial and recreational fishers and BRUV allows for monitoring of these deeper benthic habitats. The study will also provide useful data on the abundance of fish in several of the sanctuary zones prior to the enforcement of the zoning plan.

Objectives

- To determine the composition and relative abundance of fish species on intermediate depth reefs within the PSGLMP
- To establish baseline information within Sanctuary and Habitat Protection Zones prior to implementation of the zoning plan

Contacts

William Gladstone – University of Newcastle

Alan Jordan – NSW Department of Environment and Climate Change

This project aims to address the following specific research issues identified in the Strategic Research Plan:

Biodiversity and ecological processes

- Conduct biodiversity assessments of selected taxa
- Assess the spatial and temporal patterns of assemblages

Ecologically sustainable use

- Abundance of key species of fish and invertebrate
- Examine the optimum design of marine parks: size, patterns of zoning

Evaluating the benefits of protection to fish and macroinvertebrates on shallow rocky reefs within the Port Stephens-Great Lakes Marine Park

Background

Currently most marine parks in the State have conducted underwater visual census projects examining densities and size frequency of reef fishes and selected mobile macroinvertebrates. Those within SIMP and JBMP have collected several years of data in order to measure the effectiveness of biodiversity conservation in Marine Parks. This monitoring network has been designed to provide critical information for decisions relating to issues such as appropriate number, size and configuration of Sanctuary Zones within Marine Parks.

A number of Underwater Visual Census (UVC) surveys of shallow rocky reefs have previously been conducted within the Port Stephens region. These surveys have provided some information on the composition of fish assemblages and densities of a number of species of macroinvertebrates. The power to detect spatial variations in abundance has also been examined providing some basis for designing an effective UVC survey in PSGLMP.

There is a clear need to monitor the effectiveness of marine park zoning within the PSGLMP, and the establishment of baseline information on the abundance of fish and mobile macroinvertebrates on shallow rocky reefs is one component of this evaluation.

Objectives

- Determine the abundance of fish and selected macroinvertebrates on shallow rocky reefs within Sanctuary and Habitat Protection Zones with Port Stephens-Great Lakes Marine Park
- Estimate the size composition of selected species of fish and macroinvertebrates

Contacts

William Gladstone

University of Newcastle

Alan Jordan

NSW Department of Environment and Climate Change

This project address the following issues identified in the Strategic Research Plan:

Biodiversity and Ecological Processes

- Conduct biodiversity assessments of selected taxa
- Assess the spatial and temporal patterns of assemblages

Ecologically Sustainable Use

- Examine the optimum design of marine parks: size, patterns of zoning
- Abundance of key species of fish and invertebrates

Ascidian ecology, population dynamics and threats in the Port Stephens region

Background

A detailed understanding of the distribution, diversity and genetic structure among populations of marine organisms is critical to the development and management of Marine Parks. Currently, the ecology of many species living in marine seabed habitats is largely unknown and research on marine species richness and diversity is poor for many invertebrate groups. The scarcity of biological data for community and species level variation in the Manning Shelf Bioregion of NSW was a major constraint on the mapping of the area for assessment of this new marine park.

The taxonomy and ecological knowledge of marine invertebrates in Australia is generally poor, with ascidians (sea squirts) a particularly poorly studied group of marine invertebrates. Ascidians are sessile filter feeders belonging to the subphylum Urochordata which exist as either individual zooids (solitary ascidians), aggregations (social ascidians) or as colonies (compound or colonial). The diversity of ascidians along Australian coast is relatively high and they make up a substantial component of subtidal rocky reef communities in NSW, and often dominate subtidal sessile assemblages. Ascidians also maintain substantial epifaunal assemblages that use them for shelter and as feeding grounds.

The current deficit in our knowledge about ascidians makes it virtually impossible to assess whether there are any threatened species of these groups in Australia. This study will contribute to the data required to assess the habitat association, diversity and connectivity of ascidian populations and assist with an assessment of rocky reef diversity within the Port Stephens region.

Objectives

- Document the diversity and distribution of ascidian species inhabiting different habitats within the Port Stephens area, NSW
- Study environmental parameters that are important to the survival of ascidian populations
- Determine the genetic structure, dispersal characteristics and population connectivity of the colonial ascidian *Botrylloides leachi* within Port Stephens and along the east coast of New South Wales.

Contacts

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NSW Department of Primary Industries

This project aims to address the following specific research issues identified in the Strategic Research Plan:

Biodiversity and Ecological Processes

- Conduct biodiversity assessments of selected taxa
- Identify appropriate indicator species or taxa

Towards the long-term management of the dolphin population in the 'Dolphin-Watching Capital of Australia'

Background

Research into the dolphin population in Port Stephens has included analyses of abundance, group and social structure, site fidelity, genetics, usage patterns, and boating impacts. The Port Stephens' dolphin population is small and genetically distinct from the adjacent coastal dolphins, with four main female bands in the area and several male alliances. Three of the bands, as well as several male alliances, concentrate their activities in the eastern section of the Port where high levels of commercial dolphin-watching and recreational boating activity occurs.

Dolphin responses to interactions with boats in this area include disruption to their social structure and changes in time allocated to different behavioural activities. Similar short-term changes in behaviour to those reported in Port Stephens have been recently linked to long-term impacts on relative abundance, and possibly reproductive success of Indo-Pacific bottlenose dolphins in a population exposed to a small number of boats in Shark Bay, WA. The study showed that as the number of dolphin-watch boats increased from one to two, there was a significant decline in local dolphin abundance of about 15%. There is a clear need for information on population size and use of habitats by the dolphins when formulating management options for the dolphin-watching industry in Port Stephens.

Objectives

The main goal of this project is to continue to obtain scientific data pertinent to the long-term management of the bottlenose dolphin population in Port Stephens.

The specific objectives are to:

- assess trends in bottlenose dolphin population size using a long-term photo-identification dataset
- identify ecologically important habitat through an integrated GIS approach

Contacts

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This project address the following issues identified in the Strategic Research Plan:

Ecologically Sustainable Use

- Interactions with marine mammals
- Abundance of key species