
RESEARCH WORK PLAN 2007-08

Solitary Islands Marine Park



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INTRODUCTION

The marine environment of the Solitary Islands Marine Park (SIMP) is biologically diverse and contains a unique mix of tropical, subtropical and temperate species. Within the Marine Park these species are found in a variety of habitats, including estuaries, intertidal rocky shores, island fringing and subtidal reefs, sandy beaches, subtidal soft substrate and open ocean. There are also five major islands in the marine park, and a number of other significant rocky outcrops dispersed throughout the marine park. Ecological processes throughout the Marine Park are interconnected with both resident and migratory marine species relying on specific habitats for breeding, feeding and protection. Assessment of marine pollution and marine pests is critical to the conservation and protection of habitats and species found in the Marine Park.

The marine park also caters for a wide range of user groups and is of social, cultural and economic importance to the area. It is also culturally significant to local Aboriginal communities, with many spiritually significant sites occurring within and adjacent to the Marine Park, coupled with a continuing tradition of cultural resource use.

Research is a key component in the management of the Solitary Islands Marine Park and 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 the nature and extent of activities occurring in the Marine Park, and indicate the effectiveness of zoning and other management actions.

As identified in the NSW Marine Parks Authority Strategic Research Plan (2005-10), there are a number of key research areas covering a wide range of issues relevant to the ongoing management and assessment of the Solitary Islands Marine Park. The plan also lists a range of priority research issues and these relevant issues 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**

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 to provide for the conservation and sustainable use of Solitary Islands Marine Park to attain the objects of the *Marine Parks Act 1997*.

Reef fish and benthic program within Solitary Islands Marine Park

Background

The zoning plan for the Solitary Islands Marine Park changed on 1st August 2002. A monitoring program on reef-fish density was established to assess the effect of Sanctuary Zones (SZ). Fish densities are compared within and between sanctuary zones and other zones (where fishing can occur) using established transect methods on scuba. A variety of fish categories are used as indicators. The first baseline or benchmark survey was carried out during June – July 2002 immediately prior to commencement of the current zoning plan. Additional methods are used to increase the strength of comparisons, include baited remote videos and timed counts.

Sixteen sites are surveyed annually using diver transects. The design is balanced for statistical analysis, with half the sites being sanctuaries following rezoning. The influence of size of sanctuary zone can also be examined through this study. The same sites are resurveyed in winter each year. Six transects are haphazardly placed and surveyed at each site. Benthic video transects are also carried out biennially at the sixteen sites to examine changes in benthic cover.

Baited underwater video monitoring is conducted in four locations annually, with nine 30 minute baited video drops in each area. Two of the locations are in SZ's.

Reef-fish diversity has been surveyed at 70 sites from 46 locations within the marine park using timed counts to determine spatial patterns in diversity and indicate unique sites. Eighteen sites were monitored annually over three years to assess diversity within the marine park through time. All species observed are recorded using a log5 estimate of abundance.

Objectives

- Assess the effects of zoning and associated management on specific reef-fish abundance and size composition
- Determine differences in reef-fish community structure on reefs throughout the SIMP
- Evaluate the representation of reef-fish communities within higher protected areas
- Monitor the benthic cover at various taxonomic levels at several sites within various reefs
- Assess the status of threatened, protected and endemic species such as black cod, grey nurse shark and blue groper within the SIMP and monitor their status through time

Contacts

Hamish Malcolm

NSW Marine Parks Authority

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

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

Assessment of reef habitat condition in Solitary Islands Marine Park

Background

Low levels of coral bleaching have occurred throughout the past 7 years in the marine park, with occasional minor elevation of bleaching in some species at some sites. A major bleaching event did not occur during that time, although one did occur on the Great Barrier Reef. Sea temperature is being monitored throughout SIMP, and at other sites in northern NSW to gain an understanding of variability in sea temperature both spatially and through time, and provide a link between elevated temperature and bleaching should a bleaching event occur.

A disease (that causes rapidly spreading mortality through a colony) was detected through a tagging study that commenced in 2000. At least 18% of tagged colonies were affected by the spreading disease and in 10% of tagged colonies this disease resulted in total mortality by December 2002. This disease has caused extensive mortality in tabulate *Acropora*'s and Turbinarians, at some locations in some seasons and these corals are important components of coral communities in this area. Two PhD studies are currently examining coral disease in SIMP.

A number of other coral habitat-modifying influences that were observed during the bleaching program and other studies including coralimorph coverage increasing (anecdotal observations) and out-competing hard coral communities. This can result in reduction in habitat complexity and habitat availability to other plants and animals. Coralimorphs are being studied by the Solitary Islands Underwater Research Group (SURG) through an Envirofund grant, and with support by the MPA. The synthesis of these various components will increase understanding of the above processes and their effect on reef condition in the SIMP.

Objectives

- Increase knowledge of coral communities in this area and benchmark current reef habitat condition using indicators such as hard coral coverage
- Gain increased understanding of processes that are potentially (negatively) modifying coral reef habitat in this area
- Increase understanding of spatial differences and temporal patterns in sea-temperature in the marine park through a long term monitoring program
- Increase community capacity, knowledge and understanding of local marine systems and linkages, including strengthening collaborative ties

Contacts

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Bob Edgar	Solitary Islands Underwater Research Group

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

Biodiversity and Ecological Processes

- Examine habitat condition

Specific Impacts

- Investigate coral disease types and impacts

Mud crab (*Scylla serrata*) monitoring program

Background

This study measures the density and relative abundance of mud crabs *Scylla serrata* within three estuaries in the marine park. Each estuary includes areas that are both open and closed to crabbing. Mudcrabs are fished using 18 traps in each estuary for 3 nights, twice per year. The program commenced in 1999 so it can compare changes in abundance before and after the current marine park zoning scheme was adopted in 2002.

This information will be useful for assessing how the current zoning scheme is performing and for showing the benefits of sanctuary zones. Results to date have already shown strong benefits to mudcrab numbers in sanctuary zones in all three estuaries.

Mudcrabs are an ideal species as an indicator in this marine park, as they are a popular target by both commercial and recreational fishers in areas open to crabbing, and not crabled in the closed areas. Mud crabs also have a short life span (3 to 4 years) and their numbers can (potentially) increase quickly in response to changes in zoning protection.

This program also includes monitoring the relative abundance of mudcrabs in 4 ICOLL estuaries twice per year using nine traps per ICOLL over a single night.

Objectives

- Monitor and compare mudcrab densities in zones 'open' and 'closed' to crabbing, before and after zoning changes in 2002, to assess the influence of sanctuary zones in the three largest barrier estuaries in SIMP
- Monitor and compare relative abundance of mudcrabs (# crabs caught per trap) in four ICOLL's in SIMP to assess the influence of the sanctuary zone in Station Creek and the trapping closure in Arrawarra Creek
- Assess the influence of marine park zones by comparing the size (length, width) and sex ratio of mud crabs within and between different zones
- Monitor mudcrab populations (density / relative abundance) within areas open to fishing in SIMP, as a locally important fisheries resource
- Obtain information on patterns of use and compliance by fishers

Contacts

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

Ecologically Sustainable Use

- Examine the optimum design of marine parks : size, patterns of zoning
- Investigate the effectiveness of marine parks in increasing propagation, identifying areas of sources or sinks, extent of spillovers
- Age, growth, reproductive biology and movement of selected invertebrates
- Abundance of key species of invertebrates

A comparison of reef fish assemblages on different reef types in intermediate depths (25-60 m) in Solitary Islands Marine Park

Background

Recent swath mapping of the seafloor in SIMP has allowed a more comprehensive assessment of the distribution and structure of reefs of intermediate depths (25-60 m deep). This mapping provides the ability to quantify different reef types (in terms of reef profile, patchiness and slope) and use this to pre-select potential baited video sites according to a balanced sampling design, and determine the coordinates within GIS for field deployment.

At present reef habitats are defined on the basis of depth (0-25 m, 25-60 m and 60-200 m). While the separation at the 25 m contour line relates to an average depth where in many places benthic assemblages change from macroalgal and/or coral dominated to that containing mostly sessile invertebrates (mostly sponges, ascidians, bryozoans and cnidarians), there is little information on depth variation in fish assemblages. Offshore intermediate reefs within SIMP are under-represented within Sanctuary Zone (SZ), and the biodiversity of these offshore reefs and the relationships between habitat and spatial patterns of faunal assemblages are poorly known.

Further knowledge about these intermediate reefs is essential to facilitate effective planning. Information on the relationship between fish assemblages (as an indicator of biodiversity), benthos, and different types of intermediate reef habitat will provide an indication as to whether these reefs should be treated as a single 'habitat' type for representation within SZ (as per the current classification). This is an urgent planning need as 'habitat' forms a cornerstone of representative planning in NSW MPA's. These reef surveys will also provide 'benchmark' information as to relative abundance of reef target species (such as pearl perch) for future monitoring – although this is dependent on any future zoning changes.

The suitability of Baited Underwater Video to detect and compare assemblages within SIMP and elsewhere has been demonstrated and reported in the scientific literature. It can now be regarded as a useful standard method for sampling reef fish assemblages.

Objectives

- Compare reef fish assemblages between different types of intermediate reef (depth 25 to 60m) in SIMP based on morphological classification from swath acoustic data
- Compare benthic assemblages between the 'different' types of intermediate reef
- Compare fish assemblages on intermediate reefs with shallower assemblages in SIMP, and with assemblages detected using BUV in other NSW marine parks

Contacts

Hamish Malcolm

NSW Marine Parks Authority

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

Ecologically Sustainable Use

- Examine the optimum design of marine parks : size, patterns of zoning
- Investigate the effectiveness of marine parks in increasing propagation, identifying areas of sources or sinks, extent of spillovers
- Abundance of key species of invertebrates

Rock lobster in the Solitary Islands Marine Park: a ‘snapshot’ comparison of densities in different zones

Background

This study will measure the density of rock lobster (in particular green cray *Jasus verreauxi*) on nearshore reef inside and outside of sanctuary zones in SIMP. It will provide a ‘snapshot’ comparison five years after these zones were established. This project will also examine the influence and placement of sanctuary zone boundaries by including some reefs that are bisected by zone boundaries.

Rock lobster is a seasonally important commercial and recreational fishery in this area, with some inshore / nearshore reefs being extensively fished through commercial trapping, and recreational trapping and diving. The peak fishery season is between August and November. Surveys for this study will be carried out in October using standard quantitative diver methods. Underwater scooters will be used to survey large transects due to the clumped distribution of rock lobster. Habitat assessment along transects will also be conducted to incorporate ‘availability of suitable habitat’ into the assessment. Given that the benefits of sanctuary zones to rock lobster have been demonstrated elsewhere, the benefit of this study to the SIMP review process is to provide these findings in a local context.

Objectives

- Determine the species of rock lobster present in SIMP, with a preliminary indication as to their relative order of abundance in SIMP
- Compare densities of rock lobster inside and outside of sanctuary zone
- Compare densities on reef fully contained within sanctuary zone versus reef bisected by sanctuary zone.

Contacts

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

Ecologically Sustainable Use

- Examine the optimum design of marine parks : size, patterns of zoning
- Investigate the effectiveness of marine parks in increasing propagation, identifying areas of sources or sinks, extent of spillovers
- Abundance of key species of invertebrates

