

# **Jervis Bay Marine Park**



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# RESEARCH WORK PLAN 2006-07

## Jervis Bay Marine Park

### INTRODUCTION

The Jervis Bay Marine Park (JBMP), located on the south coast of NSW, covers an area of approximately 22,000 hectares and spans over 100 km of coastline and adjacent ocean extending from Kinghorn Point in the north to Sussex Inlet in the south, including most of Jervis Bay. The marine environment of the Marine Park is biologically diverse, and while dominated by temperate species, also at times contains many subtropical species that arrive with warmer subtropical waters during summer. Within the Marine Park these species are found in a variety of habitats, including estuaries, intertidal rocky shores, island fringing and subtidal reefs, seagrass beds, sandy beaches and subtidal soft substrates. Ecological processes throughout the Marine Park are interconnected with both resident and migratory marine species relying on specific habitats for breeding, feeding and protection.

The Marine Park also caters for a wide range of user groups and is of social, cultural and economic importance to the area. In particular it is a popular site from recreational fishing and diving and is also a key training area for the Australian Defence Force (ADF). It is 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.

Monitoring and research provide information to make informed management decisions at the JBMP for the conservation and sustainable use of the park mandated by the *Marine Parks Act 1997*. The primary objective of the research program is to assess the effectiveness of zoning and other management actions. The program also aims to expand our knowledge and understanding of the marine environment, detect unforeseen changes to the health of marine ecosystems and also report on the nature and extent of activities occurring in the Marine Park.

This Research Work Plan 2006-07 outlines the research and monitoring projects that the Marine Parks Authority intends to undertake directly, or through collaboration with external research providers. It refers specifically to projects funded by the Marine Parks Authority and does not include research conducted within the Marine Park that is funded from other sources. Additional projects may be added to the plan during the year as further resources become available.

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**

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Each category is represented in the core monitoring program, where data collection is ongoing for several projects. These are ongoing to develop time-series data for performance assessment of zoning and to detect unforeseen changes in populations. The core program involves underwater visual census (UVC) of sub-tidal rocky reefs communities, distribution and abundance of sea eagles, dolphins and seals, effort distribution and catches rates of recreational fishers and monitoring of catchments processes.

The program also includes a variety of research projects, which are designed to answer specific question of interest and occur over a set time period. Research and monitoring are both often undertaken in collaborations with visiting scientists, university undergraduate and postgraduate research students. These include projects investigating tidal mudflats, pelagic fish and deep benthic fish. A project is also examining the specific impact of anthropogenic noise on the behaviour of dolphins.

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## Effectiveness of temperate Australian Marine Protected Areas as tools for biodiversity conservation and informing fisheries management

### Background

The Jervis Bay Marine Park sub-littoral reef monitoring project is part of the first continental-scale empirical assessment of the efficacy of Marine Parks. Following establishment of a monitoring system in Tasmania an extensive network of 250 monitoring sites has expanded the study to measure the effectiveness of biodiversity conservation and inform fisheries management in all State waters that contain temperate marine ecosystems. This monitoring network has been designed as a large-scale manipulative ecological experiment to provide critical information for decisions relating to issues such as appropriate number, size and configuration of Marine Parks. Quantitative baseline information on densities and size frequency of reef fishes, macro-invertebrates and macroalgae have been established for a total of 30 sites at Jervis Bay Marine Park. These are surveyed each year in May-June. Surveys were conducted in 1996, 2000, 2001, 2003, 2004, 2005 and 2006. This provides a rare Before-After-Control-Impact design as the management zoning of Jervis Bay Marine Park occurred in 2002. An Australian Research Council Linkage grant was obtained in 2005 for this project. The project was also expanded in 2005 to include baited underwater video assessment of fish communities.

### Objectives

- Measure direct effects of fishing on exploited populations of reef fishes and invertebrates over large spatial (continental) and temporal (inter-annual) scales
- Identify indirect effects of fishing on coastal reefs, including trophic cascades
- Quantify relationships between life-history traits, fishing, and recovery after fishing stops
- Determine relationships between relative densities of species and distance from Marine Parks
- Determine relationships between Marine Park size, boundary type and biotic response.

### Project Contacts

Drs Graham Edgar and Neville Barrett	University of Tasmania
Dr Russ Babcock	CSIRO Division of Marine and Atmospheric Research
Dr Tim Lynch	NSW Marine Parks Authority

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

#### **Biodiversity and Ecological Processes**

- Conduct biodiversity assessments of selected taxa
- Identify appropriate indicator species or taxa
- Assess the spatial and temporal patterns of assemblages
- Examine multi-species linkages and mechanisms determining rocky reef assemblage structure and dynamics

#### **Ecologically Sustainable Use**

- Examine the optimum design of marine parks: size, patterns of zoning
- Abundance of key species of fish and invertebrates
- Effects of fishing on reef community structure and function

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## Temporal and spatial distribution of the White-bellied sea eagle (*Haliaeetus leucogaster*) in Jervis Bay

### Background

Each year 60 boat surveys are conducted to maintain a relative index of White-bellied Sea-Eagle abundance and distribution in Jervis Bay. Adult sighting rates differ between years and both adult and non-adult sea-eagle numbers differed between seasons. High sighting rates of non-adults each autumn (April) are thought to reflect not only the appearance of locally fledged juveniles but also an influx of sub-adult and immature birds from outside the study area. While it is common to observe single adult birds and pairs throughout the year, influxes of non-adults in Autumn generally lead to increases in observed group size. The largest groups contain as many as eight individuals and most groups larger than two contained both adults and non-adults. Observability is related to age class and behaviour, with perching behaviour common in adults but relatively rare for non-adults. The density of sea-eagles, and non-adults in particular, was highest on the undeveloped northern and southern headlands, which are military and conservation reserves, compared to the urban settlements on the western shore of the study area. Furthermore, sea-eagles are only observed perching in forest reserves interspersed between urbanised areas, despite the appearance of suitable perches throughout the coastal suburbs.

### Objectives

- To collect a relative index of White-bellied sea-eagle abundance and distribution in Jervis Bay

### Project Contacts

Dr Tim Lynch

NSW Marine Parks Authority

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

#### Ecologically Sustainable Use

- Abundance of key species of fish, invertebrates and mammals
- Impacts on shorebirds

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## Recreational fisher and other users groups monitoring project

### **Background**

Recreational anglers are the major extractive user group within Jervis Bay Marine Park (JBMP) targeting multiple species with a wide variety of techniques. The response of the fishery to the JBMP zone plan is of particular interest as is the relationship between fishing pressure and fisheries independent studies of reef species. This combination of studies is rare in marine parks. Each year the JBMP undertakes extensive sampling of the recreational fishery. Boat and ramp-based sampling of the fishery occurs in February, April and December. The study also builds on NSWF baseline work that investigated the daylight fishery of Jervis Bay in 1989-1990. The survey also collects distribution data on other users of the marine park. This includes data on sea kayakers, jet skiers, snorkelers and scuba divers.

Comparative results indicate that fishing effort, prior to the introduction of the zoning plan in 2002, doubled or tripled between study periods. There is also evidence of serial depletion of stocks. Modern sampling provides a more precise measure of the spatial distribution of fishing effort as anglers are now plotted using GPS. This data has since been used to model potential impacts on fishing effort by sanctuary zonings. Several other questions are currently under investigation. For instance whether fishing effort or distribution has changed since the introduction of the zoning plan and an independent assessment of compliance effectiveness. Two long-term aims of the project are to determine if fishing indices such as catch diversity, CPUE and the rate and distribution of effort change following zoning.

### **Objectives**

- To monitor the distribution of recreational fishing catch and effort in JBMP

### **Project Contacts**

Dr Tim Lynch

NSW Marine Parks Authority

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

#### **Ecologically Sustainable Use**

- Examine the distribution and composition of recreational fishing catch and effort

#### **Socio-economic impacts**

- Social & economic value of MPA's

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## Recreational SCUBA diving in the Jervis Bay Marine Park

### **Background**

Recreational SCUBA divers are a large and economically important user group within the Marine Park. This established project allows the park's four commercial dive operators to self-report dive effort in the bay. This is achieved by the use of a simple Access database, which has been updated with dive logbook records from 1996. To establish continuity in naming of the dive sites all known sites were plotted with a GPS in consultation with the dive operators and a display map made for each business. While SCUBA diving numbers have remained static over the last decade at Jervis Bay, increases in scuba divers numbers are often associated with the establishment of marine parks.

Most research has focused on the distribution and abundance of diving at high impact dive sites. A new avenue of inquiry will investigate icon or "adventure" dive sites, which are less frequently visited, but contribute to the intrinsic value of the park.

### **Objectives**

- To monitor the distribution and abundance of recreational scuba divers in JBMP

### **Project Contacts**

Dr Tim Lynch

NSW Marine Parks Authority

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

#### **Ecologically Sustainable Use**

- Diving impacts on sensitive habitats and species

#### **Socio-economic impacts**

- Social & economic value of MPA's

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# Monitoring the Jervis Bay Marine Park population of Bottlenose Dolphins (*Tursiops aduncus*)

## Background

The work will compare various data sets that have been compiled on dolphin distribution, abundance, and reproductive status and habitat preference in Jervis Bay since 1990. This includes two sources of ongoing monitoring data which are collected by the JBMP and a commercial dolphin watching operator. A comparison will be made by modelling different types of dolphin ecology data gathered by non-scientific (commercial operators) methods and the more scientific method. The research aims to provide information on dolphin population dynamics and areas of habitat utilisation, and will supply baseline data for management of the dolphins in the area. The usefulness of commercial dolphin-watch data as a long term monitoring technique will also be assessed. This information is important for management of both recreational use of JBMP and for Defence training. The project will provide detailed information on the spatial and temporal distribution of dolphins within Jervis Bay. By incorporating the distribution and vocal behaviour data, human impact on the dolphin population may be assessed. Furthermore, by identifying which vessels may cause disturbances to cetacean activity, management can be targeted to minimise impacts.

## Objectives

- To investigate the effects of human-induced disturbance
- To compare various data sets that have been compiled on dolphin distribution, abundance, and reproductive status and habitat preference in Jervis Bay

## Project Contacts

Dr Michelle Lemon  
Dr Tim Lynch

Defence Science and Technology Organisation  
NSW Marine Parks Authority

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

### Ecologically Sustainable Use

- Abundance of key species of mammals
- Interactions with marine mammals

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## Estuaries, saltmarsh, mangroves and catchments

### **Background**

This project is part of a regional (NSW and Victorian) program to examine processes linked to the decline of saltmarsh, in particular the relationship between sedimentation, sea level rise and upper-level soil compaction. It will allow monitoring of changes/fluctuations in sediment load entering Jervis Bay Marine Park (JBMP) estuaries over time. Ongoing monitoring of sediment loads will allow for modelling of catchment inputs into Jervis Bay and enable park management to better address development proposals. Changes in catchment sediment loads have also been implicated in community scale change to marine and estuarine vegetation.

Changes in estuary vegetation from saltmarsh to mangroves have been tentatively linked to changes in sediment regimes from catchments. It is hoped that this work will be able to accurately monitor and link catchment inputs to these and other marine and estuary processes.

In collaboration with the JBMP, NSW Department of Environment and Conservation have installed nine sediment monitoring base stations in the Currumbene Creek wetland and six stations at Carama Inlet. Further sites have been established at Moona Moona creek in response to a development proposal to sub-divide parts of the creek's catchment. The DEC is currently collecting baseline information from all of these sites and others in NSW and VIC.

### **Objectives**

- Monitor sediment loads in selected creeks within JBMP
- Provide information relevant to assessing development within the catchments of JBMP.

### **Project Contacts**

Dr Neil Saitlian

NSW Department of Environment and Conservation

Dr Tim Lynch

NSW Marine Parks Authority

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

#### **Biodiversity and Ecological Processes**

- Determine the response of marine estuaries to catchment development

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## Monitoring the Steamers Head seal colony

### Background

This study investigates the newly established fur seal colony at Steamers Head, NSW. In 1999 seasonal trends in haul-out numbers, environmental effects and disturbances to the colony were investigated with a view to establish a long-term monitoring program. In 2004, another round of data collection was undertaken in collaboration with Booderee National Park. The haul-out site is occupied by Australian, *Arctocephalus pusillus doriferus* and New Zealand, *A. forsteri*, fur seals, with *A. pusillus* the more abundant species. For both species, adult males, sub-adults and juveniles were present; the sub-adult seals were the most numerous age groups. The seasonal pattern of site occupation in 1999 suggests that the colony is a non-breeding haul-out site.

Numbers of seals hauled-out increased from occasional solitary individuals in May, peaked in September, and declined in October. Daily haul-out numbers varied considerably. Two declines in numbers hauled out coincided with a landslide at the site and naval bombardment of the Beecroft Weapons Range. No diurnal or tidal effects on haul-out behaviour were observed, though more *A. pusillus* hauled in strong winds and warm air temperatures. At the site, which is sheltered, shaded, steep and has a southerly aspect, environmental effects have different influences on the haul-out behaviour of fur seals compared to their behaviour at more exposed sites. Thus generalisation along species lines in response to environmental conditions may need to be viewed with caution.

### Objectives

- To monitor the abundance of Australian and New Zealand fur seals colony at Steamers Head colony

### Project Contacts

Mr Nick Dexter

Booderee National Park

Dr Tim Lynch

NSW Marine Parks Authority

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

#### Ecologically Sustainable Use

- Abundance of key species of mammals
- Interactions with marine mammals

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## The utility of Marine Protected Areas in estuarine intertidal soft-sediment assemblages

### Background

The aim of this research is to determine the effect of human foraging (bait suction pumping and trampling) on estuarine tidal flat macrofauna. Three main questions are being addressed. First, at what scales do intertidal mudflat fauna assemblages vary? Second, using a Beyond Before-After-Control-Impact approach do “no-take” sanctuary zoning effect biodiversity indices and third what are the effects of non-human predators. Macrofaunal invertebrate assemblages from three tidal-flat habitats (including the JBMP sanctuary zone at Currumbene Creek) are being compared. A hierarchical, nested sampling design is being used, which incorporated three spatial scales i.e., plots (<20 m apart), sites (20-500 m) and locations (estuaries) (10-15 km). Distributions of species assemblage types were maintained at sites throughout the three years of the study. Species variation was greatest at the site level, indicating that whole mudflats need to be conserved if the majority of biological diversity is to be contained in the reserve.

This provides strong evidence to support the existence of different sub-habitats, at scales of 100's m, within a habitat generally considered biologically homogeneous. Importantly, of the 80 taxa identified over three years, two bivalves, *Eumarcia fumigata* and *Soletellina alba* showed a significant increase in numbers following closure of the Currumbene mudflat to harvest. Most of the other taxa demonstrated minor fluctuations that could not be distinguished from natural variation. One important factor to consider specific to this habitat, is that many of the species have evolved to tolerate high levels of natural sediment disturbance by fish predation. It may be possible that the effects of human exclusion in certain habitats may be specific to non-target species, a consequence of secondary impacts such as trampling or disturbance of predators.

### Objectives

- To determine the effect of human foraging (bait suction pumping and trampling) on estuarine tidal flat macrofauna.

### Project Contacts

Ms Pia Winberg	University of Wollongong
Ms Fran Clements	NSW Marine Parks Authority
Dr Tim Lynch	NSW Marine Parks Authority

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

#### **Biodiversity and Ecological Processes**

- Examine habitat condition
- Conduct biodiversity assessments of selected taxa

#### **Ecologically Sustainable Use**

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



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- Abundance of key species of fish

## Free-ranging Bottlenose Dolphins (*Tursiops aduncus*) in Southeastern Australia: effects on behaviour of Naval training

### Background

Naval training is a source of anthropogenic disturbance to coastal cetaceans. Yet information is scarce on the nature of interactions between Navies and common tooth whales such as the bottlenose dolphin. While anecdotal evidence suggest dolphins may change their surface behaviour in response to certain training activities, there is limited research about how they respond acoustically, despite the importance of sound to cetaceans.

The projects main aim is to monitor the acoustic and surface behaviour of the JBMP population of *T. aduncus* during naval training to assess the effects of anthropogenic disturbance on the dolphins vocal and non-vocal behaviour. Information collected is part of the EPBC Act requirements of Naval training Experiments are also being conducted to of the two populations of dolphins.

### Objectives

- To investigate the effects of human-induced disturbance

### Project Contacts

Dr Michelle Lemon

Defence Science and Technology Organisation

Dr Tim Lynch

NSW Marine Parks Authority

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

### Ecologically Sustainable Use

- Interactions with marine mammals

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## Benthic Fish Assemblages on Deep Patch Reefs

### Background

A variety of habitats have been afforded sanctuary zone status in the Jervis Bay Marine Park. These locations were chosen in consultation with the local community to represent a range of habitats. Some habitats, however, such as medium to deep water patch reefs were not given sanctuary status, mostly due to opposition from anglers. Therefore, there is reason to believe that these reefs provide preferred habitat for adult fish targeted by anglers.

A number of baited underwater video (BUV) have been built to investigate the differences in fish assemblages between nearshore reefs and patch reefs in medium to deep water (i.e. >15 m). The advantage of using baited underwater video is it allows a visual census for extended periods of time, which would not be possible by snorkel or SCUBA. In addition, BUV is not extractive, which makes it an excellent tool for sampling protected areas.

A variety of other research questions will be investigated during this project. For instance, BUV's usually use pilchard baits. Other types of bait, such as abalone offal and sea urchin will be trialed to determine if time to fish, maximum number of fish and fish diversity differ between bait types. A third question will look at the proximity to the reef of over-sand movements by predators such as the snapper (*Chrysophrys auratus*). Finally the behaviour of fish towards BUV will be assessed.

### Objectives

- To determine if species or population structures of species differ between deep patch and coastal reefs
- To trail different baits for BUV to examine effects on relative abundance and diversity
- To determine the reef association of snapper

### Project Contacts

Mr James Wraith

University of Wollongong

Dr Tim Lynch

NSW Marine Parks Authority

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

#### **Biodiversity and Ecological Processes**

- Determine the habitat requirements of fishes through their life-cycle

#### **Ecologically Sustainable Use**

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