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# RESEARCH WORK PLAN 2008-09

## Lord Howe Island Marine Park



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## Lord Howe Island Marine Park

### Introduction

Lord Howe Island is a narrow volcanic strip surrounded by several small islets that is located approximately 600 km off the New South Wales (NSW) north coast and 700 km north-east of Sydney. The Lord Howe Island Marine Park (LHIMP) consists primarily of a shallow marine plateau atop an eroded seamount that varies in depth from intertidal to about 50 m at the plateau's edge, from where depths plunge abruptly to over 2000 m. The marine environment is internationally significant and features the world's southern-most coral reef. In 1982, Lord Howe Island and the surrounding waters were declared a World Heritage Area, the first in NSW.

The LHIMP extends 3 nautical miles out to sea from the mean high water mark and covers an area of approximately 48 000 hectares. The state marine park stretches north around the Admiralty Islands and south-east around Balls Pyramid and South East Rock. The NSW Government gazetted the Lord Howe Island State Marine Park in February 1999, and the LHIMP Zoning and Operational Plan came into effect in December 2004.

The Lord Howe Island Marine Park (Commonwealth Waters) covers the waters between 3 and 12 nautical miles around Lord Howe Island and Balls Pyramid and is estimated to be 300,510 hectares. The Commonwealth Marine Park was proclaimed in June 2000 to compliment the Island's World Heritage status and the management plan was gazetted in September 2002 and expires in September 2009.

The marine environment of the Lord Howe Island Marine Park is very distinctive, compared to the NSW coast and continental shelf and contains a unique mix of tropical, subtropical and temperate species. It supports a large number of species not found elsewhere in NSW and is characterised by a variety of unique habitats. These include the only barrier coral reef and lagoon system in NSW, basalt cliff rocky shores, subtidal coral and algal reefs, sandy beaches, subtidal soft substrates, foraminifer meadows, seamount slopes and the open ocean. The 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.

The zoning plan for the LHIMP protects representative areas of these habitats in sanctuary and habitat protection zones in order to ensure their conservation. Many of the habitats of LHIMP are poorly studied, with much to be learned about their biodiversity and ecological function.

Research is a key component in the development of zoning arrangements within the LHIMP. Monitoring and research provide information to make informed management decisions for the conservation and sustainable use of the park mandated by the *Marine Parks Act 1997*. Marine Parks Authority research and monitoring programs are guided by a strategic research framework and a strategic research plan. This provides a vision and structure for the development of research and monitoring programs that contribute to a 'whole-of-government' approach to the sustainable management of marine resources in NSW.

The strategic framework includes two overarching priorities for research and monitoring. These are the need to:

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1. Identify and select the location and nature of marine parks and their zones
  2. Monitor and evaluate the effectiveness of marine park zoning and related management arrangements

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. 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.

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 2008-09 Research Work Plan 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 or supported by the Marine Parks Authority and does not include research conducted within the Marine Park that is funded solely from other sources, although these are listed at the end of the document. The Marine Parks Authority actively works with other government agencies and universities to identify priority projects and seek external funding for research. This plan applies to the Lord Howe Island Marine Park, both Commonwealth and NSW Waters. Additional projects may be added to the plan during the year as further resources become available.

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## Mapping of seabed habitats around Lord Howe Island

### Background

The primary goal of the Marine Parks in NSW is to establish a comprehensive, adequate and representative (CAR) system to protect marine biodiversity and maintain ecological processes. As detailed spatial information on the distribution of marine biota is limited, seabed habitats are increasingly being used as effective surrogates for biological diversity, provided they are appropriately validated and all representative habitats are included. Remote sensing techniques for mapping of seabed habitats are now recognised as a cost-effective method of diversity assessment for marine park planning, and an important component of the overall research required to identify the distribution and structure of marine ecosystems and habitats.

There is little information on the broadscale distribution of intertidal and nearshore habitats within Lord Howe Island Marine Park (LHIMP). While some species and assemblage data is available for marine mammals, threatened birds and fishes, overall there is little data available on the distribution of subtidal habitats and their associated biota. The exception is within the lagoon area and selected shallow reefs where recent work has been examining the biodiversity associated with this habitat type. Such information is important to provide a more comprehensive assessment of marine biodiversity in the region.

To meet the primary objectives under the *Marine Parks Act* all major seabed habitats within a marine park should be represented within higher protected areas (sanctuary and habitat protection zones). There is currently limited knowledge of deep subtidal habitats (i.e. >10 m depth) within the LHIMP, with only small areas of reef mapped from existing aerial photographs, and even less information available on the structure and distribution of subtidal soft-sediment habitats. There is a clear need to assess the distribution and extent of subtidal habitats within the LHIMP. Much of this will be conducted using acoustic swath mapping that provides detailed information on bathymetry and seabed texture and hardness.

### Objectives

- Determine the distribution and extent of seabed habitats in selected areas of the continental shelf within the Lord Howe Island Marine Park
- Collect detailed bathymetry and towed video data to allow ground-truthing of acoustics
- Produce a range of spatial layers of seabed habitats defined within a hierarchical habitat classification system

### Contacts

Dr Peter Davies  
Dr Alan Jordan

NSW Department of Environment and Climate Change  
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**

- Identify unique & sensitive marine habitats and communities
- Examine the optimum design of marine parks

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## Attitudinal Survey - Lord Howe Island Marine Park

### Background

The Lord Howe Island Marine Park is due to commence a review of its zoning plan in 2009, and the establishment of attitudinal information is critical information required to assist this process. The values that people have in relation to the Marine Park vary between individuals and are difficult to quantify. To fully consider values it is important to consider attitude and perceptions in combination with actual patterns of use.

A Visitor Survey for Lord Howe Island was undertaken for LHIMP in 2006 and provides overall information relating to the socio-economic information of visitors to Lord Howe Island (LHI). This study surveyed domestic and international visitors to LHI between January 2007 and late April 2007, with 376 surveys being completed. The survey was primarily intended to collect socio-economic information which could be used in planning and management of the NSW Lord Howe Island Marine Park (LHIMP). The survey also collected information on expenditure made by visitors to LHI, which demonstrates the economic benefits to the local community of the Marine Park and the LHI natural environment.

The survey showed that respondents highly valued their visit to the Marine Park and other natural areas on the island, with swimming, snorkelling and walking on the beach the most popular marine related activities, and walking and cycling round the island for sightseeing the most popular land-based activities. The reports made recommendations for future surveys but did not directly address attitudes and community values of the Marine Park.

Attitudinal surveys are an important input into the Marine Park zoning plan review process. The main target audiences for the proposed LHIMP Attitudinal Survey are: local residents (one of main user groups), islanders (those living on and off the island), commercial operators, local business owners, managers and staff, marine park users and island visitors.

### Objectives

- Determine the level of support and understanding for the overall conservation of LHIMP
- Evaluate the importance of various reasons for protecting LHIMP
- Determine relevant issues relating to the Marine Park with respect to the upcoming zoning plan review.

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

#### **Ecologically sustainable use**

- Assessment of usage, impacts and threats of anthropogenic activity

#### **Socio-economic influences**

- Social & economic value of MPA's

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## Fishing catch data and population response to fishing pressure

### **Background**

Recreational charter line fishing licensees are required through a condition of marine parks permits to return records of the number and size of each individual of each species of fish caught each day from the Lord Howe Island Marine Park (LHIMP) at the end of every three months. Permit holders are also required to report how much time was spent fishing at each location, and catch and size composition of kept and released fish. The Park is divided into a total of 6 locations, and approximately 40 different species of fish are regularly taken. All fishing is undertaken using recreational line fishing methods, although no records are kept to discriminate between the different techniques employed within the method (e.g. jigging, trolling, bait fishing, fly fishing).

### **Objective**

- To determine levels of fishing mortality and the direct and indirect effects on population structure in order to determine sustainable levels of use of certain fish species.

### **Contacts**

Dr Doug Ferrell                      NSW Department of Primary Industries  
Mr Ian Kerr                              NSW Marine Parks Authority

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

#### **Ecologically sustainable use**

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

#### **Socio-economic influences**

- Social & economic value of MPA's

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## Exotic Marine Pest Monitoring

### Background

The LHIMP has been a rich maritime history regularly visited by ocean going vessels since its discovery in 1788, and is still a popular stop over for international yachts, cruise ships and naval vessels. The Lord Howe Island Port currently receives regular shipping from Yamba in NSW and approximately 90-130 recreational yachts of wide-ranging domestic and international origins. A marine pest survey using standardised survey protocols was undertaken in February 2006. The survey identified 19 cryptogenic species (i.e. unclear if the species is native or introduced), and when amalgamated with literature reviews, 54 cryptogenic species were identified, of which 50 were confirmed as being found in the islands marine habitats. The report found the waters of LHIMP to be virtually “pest species-free”, with LHI being possibly the only Australian port in this condition.

Marine pest invasion is widely recognised as one of the most significant threats to marine ecosystem integrity. Due to the nature of regular shipping visiting the island and the relatively enclosed nature of the lagoon, there is a high potential to severely compromise the values for which the island was listed as a World Heritage and Marine Park. Invasive pests carried by visiting vessels are a direct and immediate threat to the integrity of the Lord Howe Island Group World Heritage values. The monitoring program will aim to raise community awareness and provide for early detection and response for any future invasion.

### Objectives

- To develop monitoring and response protocols for the early detection and treatment of invasions
- To survey, assess and report on the identity, distribution and population density of invasive marine species in high risk areas and representative habitats
- To increase the local community awareness of the potential impacts and identification of exotic marine pests.

The introduced marine pest survey design and methodology will be consistent with the relevant protocols outlined in the 'National Monitoring Manual' produced by the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF).

Qualitative diver assessments, photo stills and quadrat scrapings (of jetty pylons/moorings if required); including beach wrack and intertidal searches will be undertaken on an annual basis. Since the public can play a key role in detecting introduced pests (due to their familiarity with local species and habitats), local diver operators and LHIB staff will be trained in the detection of marine pest species and can assist with inspection of moorings and other high risk areas. Visual waterline and underwater assessments of visiting yachts will be undertaken in liaison/conjunction with LHI Maritime Port Operations and will involve visual hull observations and possibly involve the use of underwater pole camera (funding dependent).

### Contacts

Mr Ian Kerr

NSW Marine Park Authority

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

**Specific impacts**

- Identify and monitor the distribution and impacts of marine pests
- Impacts of marine structures

**Biodiversity and ecological processes**

- Examine habitat condition
- Identify processes that threaten biodiversity

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## Assessment of baseline biodiversity survey data for Lord Howe Island Marine Park

### Background

A recent survey of marine pests was conducted within LHIMP using standard port survey protocols. As these methodologies do not collect quantitative data on native species that allows direct comparisons of biodiversity among sites and between Lord Howe Island and other locations, additional biodiversity surveying methods were conducted independent of the marine pest survey. While there are pre-existing monitoring sites for coral and algal species at Lord Howe Island, the value of the biodiversity survey techniques are that they provide quantitative data on the biodiversity of fish and mobile macro-invertebrates as well as sessile species, using techniques identical to those applied in other Australian marine parks. Therefore, repetition of these surveys over time will enable a quantitative assessment of changes in biodiversity of a wide range of community types, and an assessment of these changes in the context of changes documented in marine parks elsewhere in Australia.

The protection of marine biodiversity is a key objective of the Marine Parks Authority and LHIMP is seen as an area of high biodiversity containing a unique mix of tropical, subtropical and temperate species, including the most southerly coral reef in the world. There is limited information on a wide range of marine taxa at LHI, particularly at a large number of sites and habitat types. The collection of such data will allow a detailed assessment of diversity, and there is a need to fully analyse and report on these surveys. In addition, analysis of data on the distribution and density of fish, invertebrates and algae over various habitat types in the LHIMP is required to establish baselines for time series monitoring of population densities as they respond to zoning protection.

### Objectives

- To monitor the intertidal and shallow subtidal biodiversity of reef habitats throughout the LHIMP

### Project Contacts

Assoc. Prof. Graham Edgar

Aquenal Pty Ltd

Dr Joe Valentine

Aquenal Pty Ltd

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
- Assess the spatial and temporal patterns of assemblages

#### **Ecologically Sustainable Use**

- Abundance of key species of fish and invertebrates

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## The life-history and ecology of Bluefish (*Girella cyanea*) at Lord Howe Island

### Background

Knowledge of the ecology of a population is crucial for the informed management and conservation, although effective management of fish is especially difficult and near-impossible since many species are considered data deficient. Few studies have focused on species in the family Girellidae in situ, or examined aspects of their ecology such as reproduction, life history or age. *Girella cyanea* is one of sixteen species belonging to the genus, and is considered to be data deficient.

Historically an important fish species for residents of Lord Howe Island, the continued popularity of angling on the island indicates a need for targeted research on the basic ecology and biology of the species. Despite its importance to the residents of Lord Howe Island, no comprehensive study has been attempted for the species, its life history parameters are very poorly understood, and there are no formal data on the reproductive ecology and/or ontogeny for the species. Furthermore, there are few data on the ecology of the genus.

Data being used to surmise the biology (e.g. feeding, life history, ecology) of the genus in Australia and New Zealand have often been based on one or a few studies carried out on related taxa on the other side of the world (e.g. *G. nigricans*). Moreover, there are currently no formal monitoring efforts in place, with only fishing catch rates and incidental observations during other research used to assess the status of the species. This research project aims to investigate the population biology, structure and ecology of the Lord Howe Island population of *G. cyanea*.

### Objectives

- To provide quantitative baseline data on the nearshore distribution, abundance and population composition of *G. cyanea* at Lord Howe Island
- To determine basic life-history parameters of age, growth, size-at maturity and temporal patterns of spawning
- To describe the level of connectivity between habitats for different life stages of *G. cyanea* as a basis for effective management at key life stages.

### Contacts

Ms Melanie Lewis

University of Technology Sydney

Prof. David Booth

University of Technology Sydney

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

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

- Examine species connectivity at multiple scales

#### **Ecologically Sustainable Use**

- Determine age, growth, reproductive biology of selected fish species
- Abundance of key species of fish

## Current External Research

Below is a table of the current projects that are currently underway within Lord Howe Island Marine Park that are funded solely from external sources, although they may contain some amount of in-kind support from the NSW Marine Parks Authority.

| <b>Project</b>  | <b>Researcher/s</b>                              | <b>Agency / Institution</b>                    |
|---|--|--|
| Multibeam echosounder data from Lord Howe Island Marine Park  | Dr Brendan Brooke, Prof Colin Woodroffe          | Geoscience Australia/Uni of Wollongong         |
| Monitoring of Marine Water Quality LHIMP  | Duncan Rayward, Sallyann Gudge                   | LHI Board/ NSW MPA                             |
| Global warming and potential changes in long-distance migration of reef-building corals: A comprehensive genetic survey of high-latitude corals | Annika Noreen (PhD student)                      | Southern Cross University, NSW                 |
| Zooxanthellar diversity and the potential susceptibility of Lord Howe Island corals to climate change   | Laura Wicks (PhD Student)                        | Victoria University of Wellington, NZ          |
| Understanding larval dispersal and the interconnected wave and wave driven circulation at Lord Howe Island                                      | Dr Kerry Black, Dr Steve Swearer, Graeme Symonds | ASR Ltd and Melbourne University               |
| Long-distance dispersal and local retention of larvae as mechanisms of recruitment in an island population of coral reef fish                   | Dr Heather Patterson, Dr Steve Swearer           | Department of Zoology, University of Melbourne |
| Conserving Lord Howe Island's unique marine biodiversity through community-based monitoring   | Jean-Paul Hobbs                                  | James Cook University, Qld                     |
| Morphology and chronostratigraphy of fossil reefs around Lord Howe Island   | Prof. Collin Woodroffe                           | University of Wollongong< NSW                  |
| Life History and Population Study of East Australian Garfish ( <i>Hyporhamphus australis</i> )  | Dr Doug Ferrell                                  | NSW Department of Primary Industries           |
| Genetic comparison of Australian and NZ salmon ( <i>Arripis</i> spp)  |  | Murdoch University, WA                         |