

Cape Byron Marine Park



RESEARCH WORK PLAN 2009-10

Cape Byron Marine Park

INTRODUCTION

The Cape Byron Marine Park covers approximately 220 km², extending from Brunswick Heads in the north to Lennox Head in the south. It includes the seabed and extends seaward from the mean high water mark to the 3 nautical mile limit of state waters. The tidal waters of the Brunswick River and its tributaries as well as Belongil and Tallow creeks are also within the marine park. Cape Byron Marine Park was declared in November 2002 and the current zoning plan commenced in 2005.

The marine and estuarine environments in the Marine Park are biologically diverse and contain a range of subtropical and temperate species. Within the Marine Park these species are found in a variety of ecosystems and habitats, including estuaries, coastal creeks, intertidal rocky shores, island fringing and subtidal reefs, seagrass beds, exposed and sheltered sandy beaches and subtidal soft substrates. A range of resident and migratory marine species rely on specific habitats for breeding, feeding and protection.

Marine life includes many species of dolphins, fish, seabirds and marine plants along with threatened species such as little terns, grey nurse sharks and sea turtles. Humpback whales travel through the marine park on their annual migration, making the area an important site for long-term monitoring of whale populations.

The Marine Park 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. Sites of cultural significance to Indigenous people include Julian Rocks, Cocked Hat Rocks, Cape Byron and beaches around Broken Head. Tourism is a major industry within the region, with many activities occurring within the Marine Park, particularly swimming, surfing and diving.

Monitoring and research provide information to make informed management decisions for the conservation and sustainable use of the park in accordance with the provisions of 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:

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.

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 2009-10 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 by the Marine Parks Authority and does not include research conducted within the Marine Park that is funded from other sources. The Marine Parks Authority actively works with other government agencies and universities to identify priority projects and seek external funding for research. Additional projects may be added to the plan during the year as further resources become available.

Monitoring the frequency of coral disease and survivorship at heavily-dived and rarely-dived sites adjacent to Julian Rocks, northern New South Wales

Background

Impacts from recreational SCUBA diving on subtropical reef ecosystems are largely unknown, but the likely impact of divers on corals at Julian Rocks in Cape Byron Marine Park is an issue of concern for management. There are incidences of coral diseases and unexplained mortalities around Julian Rocks which appears to be concentrated around the two most heavily-dived areas (the northern Nursery and Hugo's Trench) and in the vicinity of most moorings. Currently, species of particular interest for disease studies are the meandroid brain coral *Goniastrea australensis*, the common branching coral *Acropora solitaryensis* and two species of Turbinaria. Most of the diseased corals at Julian Rocks are *Goniastrea australensis*, although a major bleaching event in 2002 principally affected the branching coral *Pocillopora damicornis*, although other species showed minor bleaching in 2006.

While important, monitoring changes in benthic assemblages by examining percent cover of different benthic categories only provides part of the picture. Important factors that cause change include stress response, competition, predation, growth and reproduction within individual categories (corals, sponges, algae and other groups). In heterogeneous benthic assemblages, monitoring stress response or change in some conspicuous benthic categories using random transect or quadrant methods is problematic. Patchy distribution and limited cover of corals and sponges would require excessively large numbers of replicate transects or quadrats to detect very small (but potentially biologically significant) changes. Therefore, individual stress response, survivorship, disease or predation is to be examined by monitoring individuals or colonies.

Objectives

- Survey selected coral and/or sponge colonies assemblages to examine colonies/individuals for physical damage, predation, bleaching, disease (or recovery from previous events)
- Examine recruitment rates, frequency of disease, damage and dieback and survivorship rates in heavily dived and rarely-dived sites.

Methods

Given the low and patchy cover of corals at Julian Rocks the survey methods used to date (random line intercept transects, either diver counts or video) are not sensitive enough to detect incidence of disease or damage in potentially sensitive benthos of the magnitude required. As such, permanent belt transects are being used in which the location of all coral colonies and other potentially sensitive groups can be mapped, the size of each colony will be accurately determined and any evidence of physical damage or disease noted. The length, width and number of the transects will be determined by pilot work, but transects would need to be large enough to include more than 15 individual coral colonies of selected species per transect. The number of replicate transects per site will be limited by the size of relatively homogeneous habitat and by logistical constraints of being able to map organisms within a short time frame. It is expected that 3-4 replicate transects of 10 to 15 metres in length and 2 to 4 metres wide would be established in each habitat type (boulder field and/or high relief) for heavily-dived sites and rarely-dived sites.

Contacts

Mr Simon Hartley/Dr Danny Bucher/
Assoc. Prof. Peter Harrison -

Southern Cross University

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

Ecologically Sustainable Use

- Assessment of usage, impacts and threats of anthropogenic activity on habitats

Mapping biodiversity in and around the Cape Byron Marine Park. To what extent are the protected zones of the marine park representative of the range of local benthic communities?

Background

The Cape Byron Marine Park was established in November 2002 and the zoning plan came into effect in May 2006. The protection zones of the park ('Sanctuary' and 'Habitat-protection') are by definition intended to include examples of each community type, thereby providing sufficient representative habitat for the full range of biodiversity in the region. To facilitate this, prior to the zoning for the park a side-scan sonar survey of the park's seabed was conducted. Several habitat types were broadly defined either on the basis of arbitrary physical parameters (e.g. depth and sediment hardness/texture) or on the presence or absence of visually dominant taxa (e.g. the kelp *Ecklonia*). There was no further classification of soft-sediment habitats based on the presence of dominant benthic communities. Overall, knowledge of the composition and distribution of soft-sediment fauna of Cape Byron Marine Park is poor, and this is the predominant habitat of the park.

On hard substratum in Cape Byron Marine Park, significant differences in invertebrate and fish assemblages have been described between geographically close reefs of similar depth with similar coverage of *Ecklonia*, and between sediment infaunal assemblages in deep coarse sands. Significant differences were also found in fish assemblages on reefs of different topography at similar depths around Julian Rocks. Before the present zoning plan can be effectively reviewed more detail is needed on the distribution of benthic communities within and surrounding the marine park. Some sections of Cape Byron Marine Park that were previously open to fishing such as trap and line, spanner crabbing and prawn trawling have been closed under the zoning plan. Although the sensitivity of this study is not designed to detect fishing effects (or rather the effects of protection *from* fishing), such differences may be evident if suitable sample units are chosen.

Objectives

- to examine the soft-sediment invertebrate communities within Cape Byron Marine Park to depths of 80 m using a combination of established and novel sampling methods to sample a range of benthic species
- describe and map the extent of the different faunal community types
- evaluate the sensitivity of these communities to anthropogenic disturbance

Methods

The region will be divided into 6 latitudinal regions each with three cross-shelf regions. The boundaries of each region will be chosen such that the regions are of approximately equal size taking into account natural boundaries (e.g. the rapid transition from fine to coarse sand between 30-45m) or boundaries of human usage such as the edges of fishing exclusions. The surveys will be repeated in winter and summer to incorporate seasonal changes in assemblages.

This project focuses on fish and invertebrates of sedimentary habitats in all depths and on invertebrates of reef habitats in greater than 30m of water. Reef and sediment habitats (when present) in each cell will be sampled by timed roving Remote Operated Vehicle (ROV) searches, baited underwater video, baited invertebrate scavenger traps, and small cage dredge and pipe dredge.

Contacts

Mr Simon Hartley/Dr Danny Bucher/
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Southern Cross University

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

Assessment of Marine Park Zoning

- Examine the optimum design of marine parks

Habitat knowledge

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

Assessment of demersal sharks and rays in Cape Byron Marine Park using baited remote underwater video

Background

Seabed habitats within the Cape Byron Marine Park are dominated by soft-sediment habitats, primarily fine sand inshore and coarse sand offshore. While the habitat type dominates CBMP, the demersal fauna that it contains has not been examined in detail, particularly the larger demersal species such as sharks and rays. There is a clear need to monitor the effectiveness of marine park zoning within Cape Byron Marine Park, and the establishment of baseline information on the composition and abundance of demersal fauna on soft-sediment habitats is one component of this evaluation. To assess the effectiveness of the zoning arrangements in providing a representative selection of biological diversity, a BRUV's program is being conducted over soft-sediment habitat.

While a range of sharks and rays are expected to be surveyed, the sampling locations were selected primarily to examine the distribution of the white-spotted guitarfish (*Rhynchobatus australiae*). This is a demersal ray-like shark known to inhabit the waters of the inner shelf of northern east Australia, and in 2003 was placed on the IUCN Red List as Vulnerable due to known large and rapid reductions in its total population of greater than 30%, with indications of continued declines. Very little is known of the population status or ecology of the species but they are can be found close to shore in Cape Byron Marine Park intermittently in winter and seem to aggregate in groups on sand and adjacent reefs. The location of aggregation sites for *R. australiae* is poorly know as they do not appear to be on regularly dived shallow reefs,

Of all the large cartilaginous fishes in CBMP *R. australiae* stands out as the most vulnerable to a wide variety of fishing gear. Mature *R. australiae* inhabit sandy areas and are vulnerable to being taken in demersal prawn trawl nets and gillnets as bycatch. It is susceptible to being speared, hooked by recreational and commercial fishers and is known to take baits from droplines and demersal longlines of commercial shark fishers. In this regard it is very likely that the species is at greater risk than other sharks and rays to fishing pressures. Given the varying levels of fishing pressure between Sanctuary Zones and adjacent areas there is a need to establish baseline information on species such as *R. australiae*.

Objectives

- To determine the composition and relative abundance of demersal Chondrichthyans including Rhynchobatids, Rhinobatids, Urolophids and Dasyatids in Cape Byron Marine Park Sanctuary Zones and areas open to harvesting
- To investigate the distribution of *R. australiae* and their aggregation sites in near-shore waters of Cape Byron Marine Park and adjacent areas to assess the level of protection provided by Sanctuary Zones to the species.

Methods

Fish fauna are to be surveyed visually using BRUV sets deployed for 30 min over sand. The sampling design will firstly consist of a comparison of shallow-water sanctuary zone and non sanctuary Chondrichthyan populations. It is proposed to deploy 8 replicate BRUVs at each location and conduct sampling four-monthly (ie. on three occasions). Further surveys of the distribution of *R. australiae* in shallow and deep habitats will also be assessed, with a total of three replicates for each location in each season.

Contacts

Andrew Page - 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
- Investigate the effectiveness of marine parks in increasing propagation, identifying areas of sources or sinks, extent of spillovers
- Abundance of key species of fish

Diver impact on health and survival of key benthic organisms and iconic fish species at Julian Rocks, Cape Byron Marine Park

Background

There is growing evidence that SCUBA diving can result in potentially unsustainable physical damage at sites of high diving intensity. To date the majority of research has been conducted in the tropics on coral reefs and focus on either potential diver impact by the number of contacts divers have made with a reef, or broad surveys of coral exposed to different levels of diver visitation.

Julian Rocks, within the Cape Byron Marine Park, is among the most intensively-dived sites for which published figures are available. There are some concerns about this level of activity as some coral reef sites with lower diving intensity showed significant changes in coral cover and health. At present, permanent plots in which coral colonies are mapped to monitor and contrast coral demographics in frequently-dived and rarely-dived sites are monitored. This project will complement that work by approaching the issue of diver impact from the other end of the process – the frequency of contact, the severity of damage and the subsequent fate of individual colonies. The two projects, when complete, will enable the intensity and type of diving behaviour to be linked to any benthic community changes.

Objectives

- To document the pattern and intensity of diving activity.
- To record the physical interaction of divers with the benthos.
- To correlate the frequency of diver contact with the fate of individual corals, sponges, ascidians and other conspicuous sessile organisms.
- To correlate diver frequency with relation to iconic fish species behaviour modification e.g. *Epinephelus* sp. and *Carcharias taurus*.

Methods

A sample of at least 400 recreational SCUBA divers will be followed by researchers. The frequency of contacts with the bottom will be recorded over a 10 minute interval of the dive (0-10min, 10-20 min, or 20-30min after descent). Significant contact (i.e. that leaves visible damage), will be documented and the damaged organism (e.g. coral, sponge, ascidian) will then be monitored on a fortnightly basis using U/W digital photographs, to determine the long-term outcome of contact (e.g. recovery or demise). After each dive each diver will be interviewed to provide background information on training, experience and awareness of the number of damaging contacts they made.

Contacts

Mr Simon Hartley - Southern Cross University

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 on habitats

Ongoing monitoring of interactions between kayaks and dolphins at Cape Byron

Background

The waters around Cape Byron host both resident and transient dolphins of at least three species of coastal dolphins (*Tursiops aduncus*, *T. truncatus* and *Delphinus delphis*) and at least three species of baleen whales (humpback, right and brydes whales). It is the intention of commercial sea kayak tours that operate around Cape Byron that interactions between groups of clients and dolphins will occur. Research to date indicates the importance of the Watego's/Little Watego's area and waters 500 m offshore are "critical regions" of core habitat. In this context the actual and potential implications of these interactions with dolphin populations requires consideration and management.

The National Parks and Wildlife Amendment (Marine Mammals) Regulation 2006 specifies requirements for vessel operation and various approach distances and operating limitations in the vicinity of marine mammals. These requirements are mirrored in the Australian National Guidelines for Whale and Dolphin Watching 2005 (the Guidelines). Neither the Guidelines nor the Regulation refer to kayaks or their regulation specifically. Both refer to "vessels" collectively and as such the provisions apply to kayaks. There is potential for commercial tour activity to result in interactions that cause changes to the behaviour of dolphins under some circumstances, and such impacts may become unsustainable resulting in degradation of some areas of the marine park as dolphin habitat i.e. due to the frequency and nature of disturbance.

Objectives

- To determine the effectiveness of marine park permit special conditions in conjunction with existing statutory requirements in minimising disturbance to dolphins in the core habitat area attributable to commercial sea kayak tours, and to provide recommendations in the event significant amendment to either is required.
- Monitor the habitat use of resident dolphins and the interactions with kayak tours utilising existing and new data

Methods

To achieve the objectives, the research will integrate land-based and kayak-based surveys in addition to questionnaires for commercial operators. Land-based surveys will be undertaken to assess the levels of compliance of commercial kayak tour operators, monitor the habitat use of dolphins and assess the influence of kayak encounters on the behaviour of dolphins. Land-based surveys will be conducted from the Cape Byron Lighthouse for between 0700 and 1300hrs during intensive two-four week seasonal survey periods between September 2009 & September 2010. The composition, location and behaviour of each group of dolphins sighted will be manually recorded. The activity and location of commercial kayak tours will also be recorded.

Kayak-based surveys will be used to assess the residency patterns of mother-calf groups. Land-based observers and kayak-based observers will communicate using hand-held VHF radios. When a group of dolphins is sighted, the kayak will begin a 'focal follow' for up to 1hr. During group focal follows the behaviour and dorsal fins of individuals will be recorded and individual dolphins identified and matched against a Dolphin ID Access Database.

A questionnaire for the current commercial kayak tour operators will examine the practicalities of operating tours under the special conditions of permits and also the current regulations. The

kayak operators will also be asked to log all sightings and encounters with dolphins, the duration of each tour and the number of kayaks participating in each tour.

Contacts

Elizabeth Hawkins - Southern Cross University

Assoc. Prof. Peter Harrison - Southern Cross University

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

Ecologically Sustainable Use

- Interactions with marine mammals
- Abundance of key species