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# RESEARCH WORK PLAN 2009-10

## Batemans Marine Park



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### INTRODUCTION

The Batemans Marine Park (BMP) is located on the south coast of NSW from the most northerly point of Murramarang Beach near Bawley Point to the southern side of Wallaga Lake entrance at Murunna Point. The marine park extends from the offshore limit of NSW State coastal waters to mean high water mark within all rivers, estuaries, bays, lagoons and inlets, and saline and brackish coastal lakes (excluding Nargal Lake) and covers around 850 km<sup>2</sup> of estuarine and marine ecosystems. Batemans Marine Park was established in April 2006 and the zoning plan commenced in June 2007.

One outstanding feature of the Batemans Marine Park is the large expanses of rocky reefs that support a diverse array of fish, invertebrates and algae. Mapping has revealed that in many places rocky reef extends as continuous habitat across the inner and mid continental shelf, a feature apparently unique to the NSW south coast region. There are also numerous islands (including the Tollgates, Brush and Montague) that provide breeding areas for many seabird species and populations of the endangered grey nurse shark, pelagic fish, seals and penguins.

The park also contains highly significant coastal lakes and lagoons, including Durras, Brunderee, Tarourga and Brou Lake, many of which have been recommended for protection. Such lakes provided important areas for seagrass habitat with its associated high diversity of fauna. The Clyde River and Batemans Bay areas also have significant estuarine habitats including areas of mangrove and saltmarsh.

The coastal land surrounding the marine park is the traditional country of the Yuin people and contains many sites of historic and cultural significance. The Yuin people have a long association with the south coast which continues today, with a tradition of cultural resource use. The Marine Park area is of social, cultural and economic importance to the region and caters for a wide range of user groups. It is a particularly popular area for holidaying, recreational and charter fishing, diving and boating. There is also a wide range of commercial fishing activities and aquaculture (principally oyster farming) within several of the rivers and lakes.

Monitoring and research provide information to make informed management decisions at the BMP 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:

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.

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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 or supported by the Marine Parks Authority and does not include research conducted within the Marine Park that is funded solely 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.

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# Mapping and classification of continental shelf seabed habitats in the Batemans Marine Park

## 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 defined within a hierarchical classification structure 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 have developed considerably in the past decade and 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.

To meet the primary objectives under the *Marine Parks Act* all major benthic 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 Batemans Shelf Bioregion, with only small areas of rocky reef mapped from existing aerial photographs and hydrographic charts, none of which have been ground-truthed. There is even less information available on the structure and distribution of subtidal soft-sediment habitats. Given the recent findings in other NSW marine bioregions of significant areas of subtidal reefs, it is also likely that such habitats exist within the Batemans Shelf bioregion.

An initial assessment of the available broad-scale bathymetry indicates extensive reef habitat along sections of the coast north of Batemans Bay and around Montague Island, Brush Island and Tollgate Islands. There is a clear need to assess the distribution and extent of subtidal habitats within the Batemans Marine Park to assist the zoning process to ensure habitats are adequately represented within highly protected areas. Much of this will be conducted through the use of acoustic swath mapping that provides detailed information on bathymetry and seabed texture and hardness. More mapping is scheduled for 2009.

## Objectives

- Determine the distribution and extent of seabed habitats in selected areas of the continental shelf within the Batemans 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

## Methods

Extensive field surveys will be conducted with the DECC's GeoSwath bathymetric sidescan throughout the marine park area. The location of the survey areas consists of a combination of fixed transects providing full coverage and targeted tracks, the spacing of which will be determined by assessment of habitat distribution from knowledge of geomorphology, bathymetry, hierarchical level of classification required and available survey time. In most cases this will allow identification of the offshore extent of reef habitats in order to complement the existing nearshore reef spatial layers that were defined thru assessment of aerial photographs.

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Depth data will be used to produce contour layers and a Digital Elevation Model (DEM) for use in the GIS analysis. Depth measurements taken from the sounder will be used to construct a contour layer corrected to Mean Sea Level after the depths have been corrected for tidal variation. These images will be used to examine reef roughness, slope and depth. Habitat categories determined from the sidescan backscatter will be defined within a hierarchical classification scheme for subtidal seabed habitats that are based on either abiotic or biotic structuring variables, or a combination of the two. The resulting habitat map will be draped over the DEM to provide a visual 3D representation of the substrate surface. A submersible digital colour video camera will be deployed to confirm habitat boundaries and obtain information on sessile biota. The resulting maps will be a combination of raster layers of bathymetry and rugosity, and vector layers of defined habitat categories.

### **Contacts**

Dr Peter Davies - NSW Department of Environment, Climate Change and Water

Dr Alan Jordan – NSW Department of Environment, Climate Change and Water

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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## **Benthic fish assemblages on deep water reefs within the Batemans Marine Park**

### **Background**

Recent swath habitat mapping within Batemans Marine Park has identified extensive rocky reef on the continental shelf which, in some places, extends from inshore waters to the eastern edge of the marine park. In this region, these habitats have been poorly studied with information restricted to physical features such as depth and profile. While seabed habitats are frequently used as a surrogate for spatial patterns in marine biodiversity, there is little information on the fish diversity and composition associated with rocky reefs in depths >20 m within the Batemans Marine Park. These deep reef areas are commonly used by recreational and commercial fishers, with many targeted species being closely associated with reef habitat. The inclusion of many areas within BMP where deep reef is included within Sanctuary Zones provides an opportunity to test hypotheses about long-term spatial and temporal changes in species and size composition of fish, sharks and rays under each of the management strategies in BMP

Baited Remote Underwater Video (BRUV), a relatively unobtrusive method for observation was employed to census fish assemblages on deep reefs within Batemans Marine Park. BRUV has been done in 2007 (before the zoning plan was implemented) and in 2008 (immediately after implementation) with the experimental design being modified in 2008 to be hierarchical with zones (4), locations within zones and sites within locations. Approximately 78 and 96 species of fish were sampled in 2007 and 2008, respectively. Univariate and multivariate analyses did not detect differences in species richness or relative abundance among zones in either year, however, there were significant differences among locations within zones. Univariate analyses detected more snapper in sanctuary zones in 2008, but no differences were found for the other two recreationally targeted species examined (silver trevally, *Pseudocaranx dentex* and yellowtail scad, *Trachurus novaezelandiae*). There were no differences in labrids or monacanthids in sanctuary and non-sanctuary zones, but highly significant differences ( $p < 0.001$ ) among locations within these zones. The lack of differences among zones are not surprising given that these initial times of sampling are “before” data with which to assess future changes. Spatial variation among locations does suggest, however, that the current zoning plan encompasses a broad and representative range of fish diversities and assemblages. We anticipate that changes in fish assemblages will become more apparent in following years.

### **Objectives**

- The aim of this project was to test the hypothesis that there are differences in fish assemblages (diversity, abundance and size frequency) between sanctuary, general use and habitat protection zones and areas outside the park on deep subtidal rocky-reef and that these differences will increase over time

### **Methods**

From 2009 onwards the BRUV experimental design will be modified to include areas outside the park (design as for UVC) and conducted in winter to take advantage of inshore migration of snapper in this season.

### **Contacts**

Dr Melinda Coleman - NSW Marine Parks Authority

Dr Andy Davis - University of Wollongong

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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
- Abundance of key species of fish and invertebrates
- Effects of fishing on reef community structure and function

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# Monitoring shallow subtidal reef assemblages in Batemans Marine Park using stakeholder groups

## Background

This project monitors little-studied shallow (< 5m depth) subtidal communities in the Batemans Marine Park by utilising volunteers from a local marine conservation organisation. An appropriate and scientifically sound sampling protocol has been developed and volunteers have been trained. The data collected tests hypotheses to determine whether different management strategies act to change abundances and diversity of species of fish and macro invertebrates in the Batemans Marine Park. In addition, this study will also determined whether there are any indirect changes to shallow subtidal community structure via trophic cascades. That is, whether a decrease in fishing pressure and subsequent increase in abundances of top predators (predatory fish and macro-invertebrates) influences the cover of macro algal communities due to decreased abundances of grazers (e.g. urchins). Data are collected 3 times annually (to assess seasonal changes) and in 3 zone types (sanctuary, non-sanctuary and outside of park) to assess changes among management strategies. Including areas outside of the park allow consideration of shifting fishing effort.

Data has been collected 3 times over the first year of management strategies being initiated and represent baseline data with which to compare long-term temporal changes in fish and invertebrates and cover of macroalgae. We found that community groups were extremely useful in sampling shallow subtidal areas and should be utilized in the continuation of this monitoring. There was considerable effort involved in optimizing methods for use by untrained and sometimes inexperienced volunteers, as well as educating volunteers in basic scientific principles of experimental design and data collection. Nevertheless, this represents a once off commitment that ensures the scientific rigor of the sampling program while still making participation by a wide range of people possible. There was no difference in the composition and abundance of entire assemblages or in abundances of individual species of fish, invertebrates and algae between shallow-subtidal sanctuary and non-sanctuary zones. There was, however, a significantly greater abundance of small, sub-legal abalone (*Haliotis rubra*) in sanctuary zones and this pattern was consistent among times. Despite low abundances, there was also a trend for adult, legal-sized abalone to only be found in sanctuary zones (in 2 of 3 sanctuary zone sites).

These preliminary results are encouraging and suggest that juvenile abalone are surviving and growing in areas where adults were previously targeted. Nevertheless, since this study represents only 1 time of sampling, caution must be taken in attributing these result to the implementation of sanctuary zones. The hypothesis that abalone are increasing in abundance in sanctuary zones will be more rigorously tested with further temporal replication. Similarly, the lack of major differences in fish, and invertebrate assemblages between sanctuary and non-sanctuary zones is not surprising since changes in abundance and size of organisms are likely to take some time to respond to management strategies. The continuation of this project has been guaranteed via funding from Caring for Our Country Community Coastcare (grant awarded in 2008).

## Objectives

- To test the hypothesis that there are differences in the diversity, abundance and size frequency of targeted fish and macro-invertebrates and cover of macroalgae among shallow subtidal areas where different management strategies have been implemented and that these differences will increase over time

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- To assess the reliability and usefulness of data collected by community groups

### **Methods**

To test these hypotheses this research will survey nine replicate sites at each of three times annually, beginning in January 2008. Three sites will be located within sanctuary zones, three sites outside sanctuary zones and three sites outside the marine park. At each site and time, 30m transects ( $n = 3$ ) will be haphazardly laid on subtidal reef between 2 and 5m depth. On each transect, volunteers from the Nature Coast Marine Group (along with at least 1 “trained” person per transect) will count the abundance and size frequency of all fish, invertebrate and algal species. Data from each time of sampling were checked for quality control, collated, entered into a spreadsheet and analysed using a variety of appropriate univariate and multivariate statistics.

### **Project Contacts**

Dr Melinda Coleman - 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
- Assess the spatial and temporal patterns of assemblages

#### **Ecologically Sustainable Use**

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

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# **Pilot studies to unconfound the influence of seal foraging on fish at Montague Island**

## **Background**

A common consequence of the implementation of sanctuary or no-take zones worldwide is an increase in the abundance and size of targeted fish species with decreased fishing pressure. This prediction becomes problematic, however, in areas that support locally high abundances of organisms in higher trophic levels. Unless the effects of these higher order predators are accounted for, changes in abundances of fish among areas with different management strategies cannot be properly interpreted.

Montague Island in the Batemans Marine Park is home to large colonies of Australian and New Zealand Fur Seals which are known to forage around the island as well as adjacent mainland reefs and are likely to have significant impacts on the size frequency and abundances of fish assemblages. Although the implementation of sanctuary zones on Montague Island may act to increase abundances of fish, predation by seals may obscure these changes. To rigorously determine whether changes (or lack thereof) in fish assemblages on Montague Island are associated with the implementation of Sanctuary zones or foraging by seals, experiments need to be designed to unconfound these factors. This study will test whether there are spatial and temporal changes in the size, abundance and species composition of fish among zones with different management strategies on the reefs of Montague Island (where seals are abundant), compared to the magnitude of changes occurring between zones on the mainland (where seals are less abundant).

## **Objectives**

- To test the hypothesis that there are spatial and temporal changes in the size, abundance and species composition of fish among zones with different management strategies on the reefs of Montague Island (where seals are abundant), compared to the magnitude of changes occurring between zones on the mainland (where seals are less abundant).

## **Methods**

This pilot study will involve existing deepwater BRUV techniques to determine the influence of seals on fish assemblages inhabiting the reefs of Montague Island. Relative changes between zones that have different management strategies will be compared to those observed on the mainland where seals are less abundant or absent. In each of the 2 sanctuary zones and 2 habitat protection zones (east Vs west of the island), 2 “sites” will be selected where we will have 4 replicate “drops” of the BRUV. Data already collected as part of the larger scale BRUV project will be used to compare the magnitude and direction of differences between sanctuary and habitat protection zones on Montague (where seals are abundant) to areas on the mainland (where seals are less abundant). This project will be supplemented by NPWS data on interannual, seasonal and spatial changes in seal abundances on Montague Island. A PADI Project Aware grant was awarded to Batemans Marine Park in 2009 to fund this pilot project.

## **Contacts**

Dr Melinda Coleman

NSW Marine Parks Authority

Dr Brendan Kelaher

NSW Marine Parks Authority

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

**Biodiversity and Ecological Processes**

- Examine multispecies linkages and mechanisms determining rocky reef assemblage structure and dynamics
- Species level interactions – predators, prey, competitors, especially between key species

**Ecologically Sustainable Use**

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

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# **Monitoring changes in estuarine seagrass habitats in Batemans Marine Park**

## **Background**

Estuarine habitats are exhibiting marked changes in community structure and function as a result of multiple anthropogenic stressors, superimposed on natural change. Of particular concern are human impacts on ecologically important seagrass habitats. Seagrasses are critically important to estuarine systems because they greatly enhance local primary production and biodiversity, stabilize sediment, and provide a nursery habitat for many economically-important crustaceans and fish. Despite their high conservation status, seagrass beds are declining worldwide, as well as in Australian waters.

Seagrass habitats are well represented in Batemans Marine Park and changes with the implementation of different management strategies are likely. Decreased fishing pressure on commercially and recreationally targeted organisms such as fish and crustaceans may significantly influence community dynamics of seagrass habitats via trophic cascades. Similarly, decreased human disturbance within sanctuary zones e.g. fewer instances of direct physical disturbance from activities such as boat and anchor scaring and trampling from prawners, are likely to change the spatial extent and patch dynamics of seagrass beds. Over long time-scales, changes brought about by local environmental planning, differential coastal development and climate change may seriously alter health and aerial extent of seagrass beds. This project will monitor spatial and temporal changes in seagrass beds within different zones of BMP. Specifically, we will test the hypothesis that there are differences in seagrass species composition, density and percentage cover, morphology and epiphyte load as well as changes in the occurrence and size of anchor/propeller scarring among zones and these differences will increase over time. We will also monitor long-term changes within and among zones to assess effects of potential press (e.g. climate change) and pulse (e.g. developments, spills) impacts.

## **Objectives**

- To test the hypothesis that there are long term spatial and temporal changes in the species composition, morphology, density, epiphyte load and damage (e.g. from propeller scarring) to seagrass habitats in estuaries and ICOLLs within Batemans Marine Park with different management strategies as well as to areas outside the park

## **Methods**

This project will be done in 2 phases. First, seagrass species composition, density and percentage cover, morphology and epiphyte load will be sampled in replicate sanctuary and non-sanctuary ICOLLs within BMP as well as outside the park (to account for shifting effort). This sampling began in summer 2008/2009 and will be monitored annually. Sites were chosen to correspond to those monitored and mapped by DPI as part of the statewide MER program. Second, the occurrence and size of anchor/propeller scarring will be sampled in replicate sanctuary and non-sanctuary areas within larger estuaries (Clyde and Wagonga). To gain a more accurate measure of seagrass condition among these fundamentally different ICOLLs and estuaries, we propose to purchase a PAM fluorometer to measure photosynthesis sometime in the coming years.

## **Contacts**

Dr Melinda Coleman - NSW Marine Parks Authority

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

**Biodiversity and Ecological Processes**

- Assess the spatial and temporal patterns of assemblages
- Examine habitat condition

**Ecologically Sustainable Use**

- Examine the optimum design of marine parks
- Abundance of key species of fish and invertebrates

**Specific Impacts**

- Impacts of vessel moorings on seagrass beds

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## **Ecological performance: assessing and understanding ecological changes in highly disturbed estuaries**

### **Background**

Estuaries are considered to be the most impacted of all marine habitats (Edgar et al. 2000; Roy et al. 2001; Kennish 2002) and more than 50% of Australian estuaries are disturbed by anthropogenic activities to some degree (Arundel and Mount 2007). Most estuaries are subject to a combination of stressors from industry, agriculture and urbanisation and the effects of these stressors are predicted to interact. Industry and urban development are often concentrated around estuaries which results in contaminated wastes such as suspended solids, heavy metals, organochlorines, terrestrial runoff, sewage effluent and antifoulants entering the water body (Scanes and Scanes 1995). These inputs from industrialisation and urbanisation have often dramatically altered the physico-chemical conditions of estuaries such as their temperature, salinity, turbidity and chemical composition. These alterations extend the range of natural variation in physico-chemical variables and they represent stressors on the ecology of these systems. Additionally, human activities will sometimes add distinct new stressors (e.g. highly synthesised novel chemical contaminants). The effects of multiple human stressors are generally predicted to be synergistic (i.e. multiplicative). Nonetheless, there has only been limited experimental work examining interactions between stressors (McLusky et al. 1986; Johnston et al. 2008). In order to manage these important and threatened environments we need to identify the strongest drivers of human impact and the ways in which these drivers interact.

Identifying the main drivers of impact is key to identifying what management should strive to achieve in order to conserve the remaining biological diversity of these systems (ANZECC 2001; Johnston et al. 2008). This project will use field surveys along with innovative field and laboratory experiments to establish causal links between environmental stressors and biological patterns in estuarine environments subject to different levels of industrial activity and urbanisation.

### **Objectives**

This project will include 2 large and unmodified estuaries in Batemans Marine Park; Batemans Bay in the northern part of the park and Wagonga Inlet in the southern section. We will test the following hypotheses:

- Patterns of diversity and abundance of algae, invertebrates and fish differ greatly between extensively modified, modified and largely unmodified estuaries.
- Anthropogenic stressors correlate with the ecological differences among estuaries.
- There are indicator species which consistently correlate, positively or negatively, to the measured anthropogenic stressors.
- Biomarkers can quickly and cheaply indicate ecological differences among estuaries and stressors.
- There are causal links between stressors and changes at the assemblage, species and biomarker levels.

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## **Contacts**

Dr Emma Johnson – University of NSW

Dr Melinda Coleman - NSW Marine Parks Authority

Dr Brendan Kelaher - NSW Marine Parks Authority

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

### **Biodiversity and Ecological Processes**

- Examine habitat condition

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## Managing coastal lakes to minimise invasion

### Background

Species invasions occur when non-indigenous species are translocated to novel environments and subsequently establish and spread (Sakai et al. 2001). Some non-indigenous species that successfully establish cause economic or environmental harm by reducing biodiversity, impacting sustainable harvesting and aquaculture or causing losses of important ecosystem functions (Vitousek et al. 1996, Mack et al. 2000). Minimization of these impacts is dependent on a comprehensive understanding of factors that influence each stage of the invasion process. Despite this, our knowledge of why the distribution of certain invaders remains relatively localized around the point of introduction, whereas others spread widely, is severely limited. Although factors such as successful reproduction in the novel environment and proximity to suitable habitat are clearly critical to facilitating spread (Sakai et al. 2001), the extent of population expansion of many exotic species cannot be successfully predicted from models only incorporating these factors (e.g. Thresher et al. 2003, Klinger et al. 2006).

The European green crab, *Carcinus maenus* (Linneus 1758), is among those invasive species that have displayed widely divergent patterns of spread following introduction in different parts of the world. For example, a population introduced to San Francisco Bay in the late 1980s had expanded over 1700 kilometers of coastline by the year 2000 (Behrens et al. 2000). In contrast, following introduction to Australia a century ago, the distribution of the same species remains restricted despite locally abundant and reproductively active populations (Thresher et al. 2003, Ah Yong 2005). Although interactions with native species may partially explain why *C. maenus* has failed to establish in many estuaries, the characterization of most NSW estuaries as Intermittently Closed Coastal Lagoons and Lakes (ICOLLS) may alternatively explain this observation. ICOLLS tend to be either predominantly open or predominantly closed to the ocean (Haines et al. 2006). Although many NSW ICOLLS are naturally closed the majority of the time, 72% are now artificially opened by local management agencies when they reach a predefined 'trigger' height. In this study we will contrast the invasibility by European green shore crabs in coastal lakes of BMP and southern NSW (within the current range of *C. maenus*) with different "natural" opening and closing regimes as well as those that are artificially manipulated by local management agencies to provide critical knowledge on how estuarine morphology may influence patterns of invasive species spread and whether common management strategies may facilitate invasion.

### Objectives

This novel research will assist managers in their efforts to control spread of this invasive by ascertaining: (1) whether ICOLLS serve as barriers to the spread of this species and (2) whether the way in which ICOLL entrances are managed may influence their susceptibility to invasion. Much of the project will be done within ICOLLS of Batemans Marine Park. Experimental designs will take advantage of different zone types where possible to test additional hypotheses about ICOLL management strategies and invasibility.

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## **Contacts**

Dr Melanie Bishop – Macquarie University

Dr Melinda Coleman - NSW Marine Parks Authority

Dr Brendan Kelaher - NSW Marine Parks Authority

Dr Tim Glasby – NSW Department of Industry and Investment

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