National Environmental Research Program

TROPICAL ECOSYSTEMS hub

NERP Tropical Ecosystems Hub Conference 2013

Poster Abstracts

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

Poster Abstracts

Great Barrier Reef

Historical and Current Condition of the Great Barrier Reef

Project 1.1 Monitoring status and trends of coral reefs of the GBR

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Australian Institute of Marine Science

The series of large cyclones that have passed through the GBR in recent years caused substantial loss of coral cover, notably from reefs in the southern GBR. Recent surveys show uneven rates of reef recovery among regions in terms of total coral cover and densities of coral recruits, with densities of coral recruits being high on Capricorn-Bunker reefs and on Pompey reefs and less so on the Swains and Whitsunday reefs.

Project 1.2 Linking Indigenous and scientific knowledge of inshore dolphins and dugongs within the northern Great Barrier Reef to evaluate their conservation status

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This collaborative research project between James Cook University (JCU) and Traditional Owner groups from the northern Great Barrier Reef (GBR) addresses a fundamental gap in the scientific knowledge of the occurrence and distribution of inshore dolphins and dugongs in this region. Our research approach integrates Indigenous and western scientific knowledge of four focal species; Australian Snubfin dolphin (Orcaella heinsohni), Indo-Pacific humpback dolphin (Sousa chinensis), inshore bottlenose dolphin (Tursiops aduncus), and the dugong (Dugong dugon). Scientists consider that these dolphin species occur in small isolated populations across northern Australia but the locations of these populations is poorly known. While aerial surveys have been used for extensive regional assessments of dugong distribution and relative abundance, there are significant gaps in local-scale information. Within the northern GBR, coastal development and other human activities pose increasing pressure on the conservation and management of dolphins and dugongs. These species are Matters of National Environmental Significance that trigger development referrals to the Commonwealth Government.

JCU recognizes and respects the cultural significance of marine mammals to the Traditional Owners of the Great Barrier Reef, as well as their expert knowledge and connection to sea country. We

conducted Knowledge Sharing Mapping workshops with Traditional Owners and Indigenous Ranger groups from the Girringun Aboriginal Corporation (GAC) where dolphin and dugong sighting information (past and present) and habitat associations were recorded.

The six salt water Traditional Owner groups of GAC (Djiru, Gulnay, Girrimay, Bandjin, Warragamay and Nywaigi), who encompass the coastal region between Rollingstone and Mission Beach within the GBR Marine Park, were the first to develop an accredited TUMRA (Traditional Use of Marine Resources Agreement). The sea country knowledge shared by Indigenous participants during this mapping process is being used to identify locations for scientific surveys involving Traditional Owners and Indigenous ranger groups as active participants. Indigenous ranger groups within the northern GBR such as the Girringun Rangers, have a burgeoning capacity and increasing opportunities to collect data on their priority marine species. Information collected from this project contributes to sea country planning and management (including TUMRA and Indigenous Protected Areas), a national assessment of the status of the Australian snubfin and Indo-Pacific humpback dolphins and will inform the assessment of coastal developments.

Project 1.3: Historical changes on the GBR: Looking to the past to unravel the future

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While long-term monitoring has demonstrated that more than half (50.7%) of the Great Barrier Reef's (GBR) initial coral cover has been lost over the past 27 years, we have little understanding of how reefs existed and responded to disturbance prior to this time period. The aim of this large, multidisciplinary project is to better understand the dynamics of reef ecosystems over long time scales (i.e. before European settlement c. 1850) by reconstructing ecological and environmental changes from reef matrix cores and massive coral colonies, respectively. Here we demonstrate contrasting histories of reef development over the past several thousand years for two inshore regions. In the Palm Islands (central GBR), the onset of decline of the ecologically important coral genera Acropora can be traced back to the early 20th century. Yet Acropora has remained dominant in the Keppel Islands for the past 6 ka, despite being repeatedly impacted by flood events. These results provide important baseline information to reef managers so that the current status of inshore reefs can be appropriately assessed. Similar techniques are currently being applied to other regions, including the Wet Tropics and far-northern GBR, to provide a broad-scale understanding of the history of the reef.

Cumulative Impacts on Benthic Biodiversity

Project 5.1 Coral Cover and Diversity of the Great Barrier Reef

Glenn De'ath, Katharina Fabricius

Australian Institute of Marine Science

The reefs of the GBR have experienced a major decline in coral cover from 28.0% to 13.8% (0.53% yr-1) from 1985-2012. This is shown to be due to tropical cyclones, coral predation by crown-of-thorns starfish (COTS), and coral bleaching that accounted for 48%, 42% and 10% of the losses and amount to 3.38% yr-1 mortality. The relatively pristine northern region showed no overall decline. The estimated rate of increase in coral cover in the absence of cyclones, COTS and bleaching was 2.85% yr-1, demonstrating substantial capacity for recovery of reefs.

Although total coral cover is a useful measure of reef health, it does not reflect the complexity of reef communities. Diversity is a key concept for understanding such communities and how they are changing in response to these pressures. The theory of ecological diversity has for many years been problematic and bedevilled by a multitude of definitions and the inability to relate spatial and temporal change of diversity to complex environmental drivers. The Multinomial Diversity Model (MDM; De'ath 2012) is a solution to this problem. It is based on a parametric formulation of entropy and diversity and a novel link between entropy and the log-likelihood of the multinomial model. In initial analyses, we apply the MDM to coral cover data of 73 taxa (AIMS LTMP) and show how diversity varies over time in six zones of the GBR.

In the final year of this project the MDM toolbox will be applied to several GBR biotic data sets and a comprehensive report on the current state of diversity on the GBR. It will show how the GBR has evolved in space and time due to the effects of tropical cyclones, coral predation by crown-of-thorns starfish, and coral bleaching.

Project: 5.2 Experimental and field investigations of combined water quality and climate effects on corals and other reef organisms

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Increasing temperatures, ocean acidification (OA) and decreasing water quality from terrestrial runoff are likely to significantly alter ocean and coastal ecosystems over the next few decades. These issues are commonly considered as individual pressures on tropical systems, but their interactions are as yet poorly understood and likely to be more damaging than each pressure in isolation. Increased ocean temperatures negatively affect symbiotic relationships (e.g. causing coral bleaching) and atmospheric CO_2 pollution is reducing the ability of tropical marine organisms to calcify. The research in project 5.2 uses integrated laboratory and field experimental studies to assess causal relationships between the interactions of water quality, ocean warming and ocean acidification and the responses of key coral reef organisms. In the first 18 months of this project, a number of medium-term (2-8 weeks) experiments have been conducted to investigate the interactive effects of two combined factors, for example: i) OA and temperature, ii) OA and salinity, iii) OA and turbidity/light, iv) Temperature and elevated nutrients/increased suspended sediment.

Organisms investigated included several coral species, calcifying algae, seagrasses, foraminifera and echinoderms. In most cases, the combination of local and global stressors showed additive effects. A new model of the relationship between nutrient availability and thermal tolerance in corals was formulated and published. In the second half of the project, further experiments will allow to formulate conceptual frameworks for most of the other organisms of their responses to combined environmental pressures. However, it is already apparent that improving marine water quality would convey increased resilience to climate change for most of the organisms investigated.

Project 5.3: Vulnerability of seagrass meadows of the GBR to water quality impacts

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Seagrass meadows have an important ecological role in the GBR. Many estuarine, coastal and reef animals, including species of fisheries importance, use seagrass meadows as habitat. Dugongs and turtles feed directly on seagrasses and changes to seagrass health have direct consequences for these fauna. Seagrass meadows also form a buffer between the catchment and the reef as they trap sediments and absorb nutrients. Seagrasses in the GBR have been in decline over the past few years. This occurred because water quality had deteriorated due to above average runoff from modified catchments. We developed a novel approach to model exposure of seagrasses to flood plumes using remote sensing imagery. This approach has identified that the impact of flood plumes on seagrass is strongly linked to the type of plume waters and the duration of exposure. Seagrass meadows with the highest exposure to flood plumes have reached the lowest abundance in recent years. Water quality is complex and there are a number of ways in which it can impact upon seagrass health. We are systematically testing these possibilities. We found that coastal seagrasses have broad salinity tolerance, with seagrass death occurring only at salinities <9ppt after 10 weeks exposure. These results indicate that low salinity was probably not the cause of recent seagrass loss. However, we analysed in-situ monitoring data, which showed strong correlation between low light (turbid water) and seagrass loss, so we are testing the impacts of low light even further. Using experimental approaches, we tested the effects of low light conditions and elevated nutrients on seagrass health to simulate flood plumes. Analysis of this is still in progress but is showing that seagrasses exhibit early-warning signs of water quality stress. Outcomes from this project feed directly into the Reef Rescue Marine Monitoring Program, assisting with the interpretation of monitoring data and in the development of indicators.

Movements and Habitat Use by Marine Apex Predators

Project 6.1 Worlds apart? Connectivity between marine predator communities

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Many coastal, and especially reef based species are considered to be highly site attached with limited movement from home locations. This is also true for predatory marine fish, including sharks, despite research to indicate the potentially broad movements of some species. A limited understanding of the broad-scale movements of predators and the overall implications for habitat connectivity and management of marine resources are evident. This project examines the long-term movement patterns of marine predators to define their use of space in relation to habitat type, location and marine park zonation. Preliminary results indicate that although some portions of populations are more resident than others, movement between reefs is not uncommon. Further, movement between inshore and offshore regions is also apparent in both teleost and elasmobranch species. Finally, broad-scale alongshore movements are also occurring. These movement patterns indicate potential problems for mobile species that are moving in and out of protective zones, encountering a number of commercial fishing fleets, and also crossing jurisdictional boundaries. Future management of mobile populations will require consideration of these previously unconsidered aspects of movement.

Project 6.2 The role of nursery areas in the management and conservation of inshore sharks

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Shark nursery areas, where the young are born and live, are widely used by shark species. Within the GBRWHA coastal embayments are the most commonly used nursery areas, being inhabited by more than a dozen species. This research project investigates how the use of bays in the central GBR varies both spatially and temporally, and what factors drive this variation. To date, surveys using gillnets and longlines in five embayments have identified 19 species of shark. Of these at least seven use these areas as nurseries, with others occurring more regularly as adults or later stage juveniles. There are significant differences in shark communities between bays, and differences in the species using bays as nurseries. Zoning differences, levels of freshwater input, geomorphology and environmental parameters are being investigated as potential drivers of this observed variation. Theoretical work, and data from other locations, suggests that shark species may derive benefits from using multiple nursery areas through a "portfolio" effect, where changes in individual nurseries result in dampened variation over time. Ultimately this project will help improve the management and conservation of inshore sharks of the GBRWHA through understanding the benefits of nursery areas and portfolio effects.

Project 6.3 Critical foraging areas for seabirds of the Great Barrier Reef

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Previously, we have shown that both El Niño activity and sea-surface temperature variation significantly influence seabird breeding success on the GBR. These findings highlight the potential

vulnerability of seabirds to predicted climate change impacts under all future climate scenarios. As a first step in assessing magnitude of these potential impacts we are identifying and mapping the principal foraging locations of seabirds breeding at significant GBR colonies.

Current data are preliminary but confirm that many important foraging sites are outside of the management zone of the GBRMP and that foraging activity overlaps significantly with known commercial fishing activity. For wedge-tailed shearwaters adults are restricted to using near-colony foraging grounds for chick provisioning. Foraging success at these sites is primarily linked to local ocean dynamics. Adults on longer self-provisioning trips routinely travel to distant foraging grounds in the Coral Sea and Tasmantid Seamount Region. These 'at-distance' locations are characterized by specific meso-scale oceanographic features such as frontal systems and eddies, or by steep bathymetric change. Both near-colony and at-distance foraging locations can vary among-seasons, but within-seasons specific locations are often consistently reused by multiple individuals.

In addition tracks encompassing the 7-8 month winter migration period (May to October) have been obtained for wedge-tailed shearwaters. These tracks identify wedge-tailed shearwaters of the GBR as trans-equatorial migrants that overwinter in Micronesia, in a region known globally for its commercial tuna catch rates. This finding raises significant further conservation concerns for this GBR breeding species.

Effectiveness of Spatial Management on the Great Barrier Reef

Project 8.1 Monitoring the ecological effects of the Great Barrier Reef Zoning Plan on mid- and outer shelf reefs

Hugh Sweatman, Alistair Cheal, Mike Emslie, Kerryn Johns, Michelle Jonker, Ian Miller, Kate Osborne

Australian Institute of Marine Science

The zoning plan for the GBR Marine Park that was implemented in 2004 aims to conserve biodiversity, but the most direct effects were to regulate fishing. AIMS has surveyed a series of mid-shelf and offshore reefs that are matched by size and distance from shore, but differ in access for fishing. The most recent surveys in 2012 showed that exclusion of fishers correlated with a small increase in numbers of coral trout and a larger increase in biomass (as protected reefs support bigger fish). There are also strong regional effects because coral trout densities are much higher in the southern GBR.

Project 8.2 Do green zones work? Assessing the ecological effects of management zoning on inshore reefs of the Great Barrier Reef Marine Park

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Networks of no-take marine reserves (green zones) are increasingly being established with the goals of restoring and conserving biodiversity, boosting populations of exploited fishes and increasing the sustainability of fishery catches. Numerous studies have documented significant increases in the abundance, body size and reproductive potential of exploited species within adequately protected reserves. There is also increasing evidence that networks of reserves can provide fishery benefits via spillover and recruitment subsidies to surrounding areas. There is little evidence however, that reserves provide protection against broad-scale acute disturbances such as coral bleaching events, cyclones or flood plumes. The Great Barrier Reef Marine Park (GBRMP) encompasses the World's largest coral reef ecosystem and multiple-use management zoning, including an extensive network of no-take reserves, is the cornerstone of marine park management. Here we provide an overview of recent findings from a long-term monitoring program that is assessing the ecological effects of management zoning on inshore reefs of the GBRMP. We demonstrate significant and persistent increases in populations of key fishery target species such as coral trout (Plectropomus spp.) within well-protected reserves. However, there are clear regional differences in the magnitude of reserve effects on target fish species, and these differences can be directly linked to non-compliance (poaching) and/or habitat degradation from climatic disturbances. This project provides significant insight into the long-term effects of reserves on the persistence of exploited fish populations, fish and benthic community structure, and ecosystem health and resilience.

Project 8.3 Closing the generation gap: secrets of larval fish dispersal on coral reefs

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One of the enduring mysteries in marine biology is the fate of individuals during their brief pelagic larval stage. The link between parents and their offspring has remained a secret because of the seemingly impossible task of tagging tiny eggs or larvae. The lack of concrete data on dispersal has fuelled controversies over how marine populations are regulated, and how marine populations should be managed, both for conserving species and sustaining fisheries. With a large team effort we have measured where larvae go by using DNA to detect parent-offspring relationships. We began with some of the smallest of reef fishes (clownfish), but have since expanded our work to include some of the largest (coral trout, groupers). The unfolding story for all species is a tale of two extremes - from offspring that find their way home, to others that cross >100km of open water to find a home away from home. We hypothesize that this 2-tailed dispersal strategy promotes population resilience, as natal homing contributes to local persistence, while long-distance dispersal contributes to population recovery. Networks of marine reserves can achieve both conservation and sustainable fishing objectives, as reserve populations will retain some of their progeny, while others will be spread to areas open to fishing and to other reserves. We argue for pluralism in the management of coral reef fishes, because although they are confronted with many problems, their innate dispersal abilities offer a range of solutions.

Decision Support Systems for GBR Managers

Project 9.1 Dynamic Vulnerability and Resilience Maps for the Great Barrier Reef

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We present the first predictive coral vulnerability and resilience maps for the Great Barrier Reef (GBR). The maps are based on functional integration of a set of environmental information layers for ocean warming and acidification, water quality, cyclones and Crown-of-Thorns starfish predation. At the core of the framework is a dynamic community model for corals, macroalgae and other benthic groups, using the suite of environmental layers as input parameters. The model is calibrated using coral growth and recovery data from the AIMS Long-Term Monitoring Program, and is modelled for 1200 reef sites across the entire GBR. Vulnerability is calculated as the net loss of coral cover over the management time frame (e.g. 5, 10 or 20 years), and resilience is calculated as the capacity of the system to return to pre-disturbance states within that timeframe. In essence, the spatial vulnerability and resilience model framework consists of a set of animations of environmental behaviour feeding dynamically into the spatial ecosystem model, which produces a map of vulnerability and a map of resilience as outputs. Because environmental layers are probabilistic (i.e. they consist of probabilities of for example a warming event occurring and a probability of the event's severity), animations are generated a thousand times (as Monte Carlo analyses). The end-product of these analyses are four maps: predicted vulnerability and resilience, and their associated uncertainties. The key strength of the model is the forecasting of reef vulnerability and resilience under complex climate change and local/regional scale stress scenarios. Here, the team is collaborating with several world-leading groups to produce state-of the-art environmental layers to inform the model: Hadley Centre UK (ocean warming), CSIRO (Brando, water quality), Stanford University (ocean acidification, Long and Caldeira) and MIT (cyclone risk maps, Emanuel). Further, the team is developing a spatial decision interface to enable managers to identify areas of high versus low reef resilience, and to assist effective reef planning and spatial prioritization under climate change, and under cumulative stressors resulting from coastal development and land-use practises.

Project 9.2 Design and implementation of management strategy evaluation for the Great Barrier Reef Inshore (MSE-GBR)

Project leader: Dr Cathy Dichmont (CSIRO)

Project Team: CSIRO, Great Barrier Reef Marine Mark Authority, Department of Agriculture, Fisheries and Forestry, Department of Environment and Heritage Protection, Department of Science, Information Technology, Innovation and the Arts, James Cook University

This project is developing a Management Strategy Evaluation (MSE) framework to build a real understanding of the key human uses and drivers of change in the inshore Great Barrier Reef (GBR).

It will also inform GBR stakeholders of the likely consequences, costs and benefits of particular management decisions that aim to minimise the impacts on biodiversity, particularly from inshore multi-species fisheries.

Local stakeholders are helping drive the project to qualitatively integrate our understanding of the key drivers of change in the GBR inshore ecosystem and human uses.

Following a period of extensive consultation with the two chosen case studies – Mackay and the Burdekin – the project aims to:

- Develop qualitative models to understand key interactions in the region, and underlying processes and drivers
- Identify social, ecological, economic and governance objectives of stakeholders for the inshore Great Barrier Reef region
- Identify alternative strategies for the management of the inshore region, using a stakeholder driven approach
- Assess the impacts of the management strategies against objectives using a semi-quantitative approach
- Develop management options (with end users) aimed at biodiversity outcomes, focusing on inshore multi-species fisheries management.

Project 9.3 A decision-making tool for prioritising management actions on islands in the southern Great Barrier Reef

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Managers of the Great Barrier Reef's (GBR's) 1100 islands and cays face difficult decisions when it comes to investing in conservation management. The islands contain a wide variety of natural, cultural and presentation values, that face multiple and dynamic threats, that have to be managed within a fixed budget, using actions with varying levels of effectiveness and with different costs. To assist in prioritising management of the islands, a transparent yet flexible decision-support tool is being developed. Using spatial data, programming using quantitative objectives, and a user-friendly software interface, managers will be able to update information on values, threats, budgets or completed management actions to identify and revise management priorities.

To develop and test the decision-support tool, the method is being applied to several hundred islands and cays in the southern Great Barrier Reef. Existing data on features, threats, objectives and management actions are being collated from published and unpublished sources. As with most (environmental) datasets, there are gaps in knowledge in space, time and accuracy. Sensitivity analysis will be applied to the selected islands, for which a near-complete dataset will be available, to identify the influence of data gaps on apparent priorities for management. The results of this analysis will guide which data gaps to fill for other islands through expert elicitation. The decision-

support tool will be able to create a list of the top management priorities within a given budget, or estimate the budget needed to achieve a set of management objectives.

On this poster, we will describe the results of the data collation, method development, difficulties encountered, plans for sensitivity analysis, and the design of expert elicitation.

Project 9.4 Coastal development in the Great Barrier Reef coastal zone: Using scenarios for conservation planning

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The Great Barrier Reef (GBR) and its lagoon are classified as a World Heritage Area (GBRWHA) and are protected by the Great Barrier Reef Marine Park (GBRMP). Hence, most of the marine part of the coastal zone is consistently managed, but most of this legislation does not cover the extensive terrestrial regions that influence the GBR. The terrestrial, freshwater and estuarine fringe of the GBR hosts nurseries and feeding grounds for animal species of the GBR and has been subject to intensive development. Coastal development has led to degradation or loss of coastal ecosystems, increased run-off, and reduced water quality. The key development activities in the GBR coastal zone are ports, intensive agriculture, urban development, and tourism. All these activities are set to expand and intensify. Conservation planning determines the best spatial use of limited conservation resources to minimise the loss of valued aspects of the natural world. Conservation planning is faced with a significant challenge with coastal development because the future extent and intensity of development is difficult to predict. Hence, future threats to ecosystems and species are uncertain. Our research project uses spatially explicit scenario planning to identify plausible futures to 2035 for the GBR coastal zone. The project is using ArcGIS and IDRISI software to model land changes corresponding to each of eight scenarios, using spatial data on land use, infrastructure, tourism, land suitability, ecosystems, models of sea level rise, and available coastal and port development plans for the next 20 years. The resulting spatially explicit scenarios allow for comprehensive conservation planning with better understanding of where threats to ecosystems and species will most likely occur, what conservation goals should be developed, and how conservation resources would be best distributed.

Socio-economic value of GBR goods and services

Project 10.1 How are the people of the Great Barrier Reef doing?

Nadine Marshall[1], Erin Bohensky[1], Matt Curnock[1], Jeremy Goldberg[1], Margaret Gooch[1], Ally Lankester[1], Petina Pert[1], Lea Scherl[2], Samantha Stone-Jovicich[1], Renae Tobin[1]

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Knowing how people of the Great Barrier Reef (GBR) are interacting with the Reef is an essential component of effective Marine Park management. The "SELTMP" is the first Social and Economic Long term Monitoring Program set up in the GBR region to provide annual snapshots of the human

dimension. It aims to include up-to-date descriptions of Traditional Owners, the marine tourism industry, the commercial fishing industry, recreational users and coastal communities as well as ports and shipping, catchment and mining industries. The aim of the SELTMP is to assist policy makers and leaders to make decisions that not only enhance conservation goals, but also maximize the wellbeing of the region. For example, social and economic data presented in the SELTMP may assist managers to understand the capacity that Reef-dependent people have to undergo change as well as adapt. This may be as important for effective Reef management as are the efforts to build resilience of GBR ecosystems. Our approach has been to engage with industry, government and community to identify and prioritise data needs, synthesize existing datasets and identify data gaps. We have also structured our data collection needs based around the Millennium Ecosystem Assessment and ecosystem services frameworks, which were then modified for our purposes. Here, we introduce the SELTMP for 2011 ("SELTMP 2011") as a "proof of concept" that will be further refined for 2012 and again in 2013. We welcome all comments and suggestions.

Project 10.1 Development of a long term social and economic monitoring programme (SELTMP)

Petina L Pert, Erin Bohensky, Matt Curnock, Jeremy Goldberg, Margaret Gooch, Nadine Marshall, Renae Tobin

CSIRO Ecosystem Sciences, Townsville

The Great Barrier Reef Marine Park was the world's first declared large-scale marine protected area. The park is a multiple-use resource and supports key activities such as commercial fishing, tourism, recreational fishing, shipping and traditional use. It is estimated that the Great Barrier Reef contributes $5.8 billion annually to the Australian economy. Since the establishment of the Great Barrier Reef Marine Park in 1975, a variety of social and economic research has been conducted to support planning and management. Nevertheless, much of this research is yet to be linked to broader frameworks for understanding human dimensions of resource-use and marine park management problems and decision making. Through the multi-year National Environmental Research Program (NERP), CSIRO and James Cook University are addressing this gap by examining a number of indicators and developing a long term social and economic monitoring programme for coastal communities, catchment industries, marine tourism, commercial fishing, aquaculture, recreation, traditional owners and shipping sectors in the Great Barrier Reef. Using a spatial approach we are able to characterise the spatial and temporal heterogeneity of human uses and analyse how these uses relate to the complex human and natural systems in which they are embedded. This study can positively contribute to marine spatial planning, management and long term monitoring designed to achieve ecological, economic, and social objectives.

Project 10.2 On the relative 'value' of market and non-market goods and services provided by the GBRWHA – preliminary findings from NERP project 10.2

Natalie Stoeckl

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Many of the GBR's ecosystem services are not bought or sold in the marketplace, so do not have a price. But absence of price does not mean absence of value, so this project investigates people's perceptions of the importance of and state of various ecosystem services, asking: How important are various ecosystem services to different people? How satisfied are people with the current state of various ecosystem services and how would they feel if some were degraded? Are people willing to pay money to help improve the state of some services?

Using data collected from a survey of more than 1700 tourists to and 1000 residents of the GBR Catchment area, this poster presents some preliminary (largely descriptive) analyses of responses to questions like those. Both residents and tourists rate many non-market ecosystem services (e.g. healthy reef fish, healthy coral reefs) as being more 'important' than other market-based services (e.g. the incomes and jobs associated with industry or high-quality accommodation). Residents believe that more frequent oil spills, more pollution, or increased turbidity could have a more significant (negative) impact on their overall quality of life than higher local prices; Tourists had similar reactions. The (stated) mean amount which respondents were willing to donate to a fund designed to improve water quality was higher than the amount they were willing to pay to help protect top predators or reduce the risk of fishing accidents, but many respondents are not willing to contribute anything at all.

Torres Strait

Natural Resources of the Torres Strait Land and Sea

Project 2.1 Communicating knowledge across cultural boundaries

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Over the past 10 years there has been an increased investment, both in time and capacity, towards applied research of turtles and dugong in Torres Strait. The research projects have largely been managed and coordinated through various combinations of Indigenous communities, Torres Strait Regional Authority, the Queensland Government and University groups. With multiple "players" involved effective communication of the research process (from conception to completion) is paramount, but challenging to achieve. In our presentations we use our turtle and dugong conservation project in north Queensland as (1) an example of cooperative arrangements and process that can easily be incorporated into project or project plans to improve communication success and (2) the value of adaptive field-based research. Through the development of our research project it has become clear that communication models for researchers and stakeholders need to be "two-way" and incorporate many communication tools. Equally important, the communication tools should be co-developed and sufficient time needs to be allocated to these aspects of the project. Overall we show that incorporating communication pathways as well as monitoring and evaluation strategies are effective tools for researchers to use to demonstrate research impact and can aid research groups participants to maximise the value of research in terms of managing natural resources in sea country.

Project 2.2 Wetland Habitats of the Torres Strait Islands

Damien Burrows, Norm Duke, Jock Mackenzie

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Whilst the marine (seagrass and coral reef) ecosystems of Torres Strait are fairly well known, the wetland ecosystems on the islands (mangroves, salt marsh and freshwaters) are almost unknown (or at least unrecorded). For most islands, there is no documentation of what wetland types are present, and what their biota, condition and status are. Whilst freshwater wetlands are rarer, most Torres Strait islands have extensive mangrove margins and several islands (eg, Saibai, Boigu) are predominantly made up of intertidal swamps. Establishing the baseline of wetland status and condition is important, especially as many islands are low lying and the predictions of sea level rise and increased storm surge frequency mean that mangroves and coastal wetlands may be among the most threatened ecological communities in Torres Strait. Shoreline communities also buffer coastlines against waves and provide erosion protection. It is thus important that these habitats remain intact and to understand the role they play in providing such protective services.

Torres Strait islanders have a long and intimate knowledge of their wetland habitats, reflected in their traditions, culture and long-standing reliance on the basic benefits and resources provided, like food fishes, wood construction products and medicinal aids. This project builds on this understanding, where scientists benefit from working in partnership with traditional owners to fully describe and document new and existing knowledge of wetland habitats.

Our project aims to visit approximately 20 of the major islands, conducting on-ground, helicopter and boat-based surveys of the wetlands and their biota. Already many new species records have been documented on all islands visited to date. Much data is being collected via digital video following standardised protocols that we are also using in other regions. This is an effective medium for demonstrating habitat condition, especially for traditional communities. It also provides a permanent and reviewable archive of habitat status. Our fieldwork is conducted with land and sea rangers who accompany us during this work, thus increasing their capacity in wetland management.

Beyond providing a snapshot of the wetlands and a baseline against which future changes can be assessed, we aim to provide recommendations for better wetland management and planning, and to promote community dialogue on their values and management.

Project 2.3 Monitoring status and trends of coral reefs of the GBR

Ray Berkelmans, Hugh Sweatman, Scott Bainbridge, Scarla Weeks

Australian Institute of Marine Science, Townsville

Coral reefs of the Torres Strait (TS) are at the northern tip and part of the GBR province. Despite its ecological connection to the GBR and its clear importance to TS communities, comparatively little work has been done on these reefs. As elsewhere, climate change, crown of thorns starfish, disease, storms, and pollution from river runoff and shipping are threatening the ecological integrity

of TS reefs. This project seeks to establish a monitoring program to enable resource managers to keep abreast of key indicators of coral health and to train local rangers to undertake ongoing monitoring.

The project has so far delivered on:

- Establishing a network of in-situ temperature loggers to monitor anomalously warm temperatures
- Developing locally specific bleaching thresholds for the TS
- Installing a real-time weather station which will be used to provide early warning of coral bleaching
- Providing a monthly synopsis of ocean and atmosphere conditions to key stakeholders
- Conducting a review of past coral reef surveys
- Undertaking biodiversity surveys of key reefs
- Undertaking baseline monitoring of selected coral communities and large reef fishes
- Training local rangers in monitoring techniques and maintaining the temperature monitoring program.

The results of biodiversity and first monitoring surveys are currently being analysed.

Resilient Torres Strait Communities

Project 11.1 Building resilient communities for Torres Strait futures

James Butler

CSIRO Ecosystem Sciences, Brisbane

Globally, change is happening at a faster and more unpredictable rate. Climate change, economic growth and human populations are all likely to result in significant and unexpected impacts on local communities, both positive and negative. This requires pro-active planning so that communities and their livelihoods can be ready for such change. Torres Strait communities are particularly vulnerable to future change, being remote, low islands bordering two rapidly growing economies, Papua New Guinea and Indonesia. This project aims to explore potential future development pathways for the Torres Strait, and develop adaptation strategies for local communities and their natural resources which will prepare them for future uncertainties. Working with the TSRA, government and community stakeholders, the project uses participatory processes to analyse future scenarios for the Torres Strait, their potential impacts on ecosystem services and livelihoods, and strategies which can build communities' resilience to potential shocks and undesirable change. The process encourages social learning amongst stakeholders, therefore aiming to build their adaptive capacity. Issues explored include population growth and resource extraction in Western Province, PNG, climate change impacts on ecosystems and cultural change. The project forms the basis of the TSRA's community adaptation planning process, which is beginning in 2013.

Project 11.2 Determining disease dynamics across the Torres Strait and improved approaches for disease detection and management

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The Torres Strait has long been recognised as a biological bridge to mainland Australia. Currently, there is real concern over its vulnerability to emerging infectious diseases and its potential to facilitate disease movement to the mainland. One of the difficulties with the detection of infectious disease in remote areas is that traditional sampling methods are either too expensive or not appropriate. Across four islands in the Torres Strait (Saibai, Boigu, Badu & Moa), we are exploring a novel method of sampling mosquitoes with a passive trap baited with yeast generating CO_2.

Fieldwork to capture mosquitoes near and far from human communities has been completed during the wet season on Saibai, Boigu, Badu and Moa (Kubin). Preliminary results show that mosquito captures are higher in the natural habitats far from humans on Saibai and Boigu, but more mosquitoes were captured near humans on Badu. Once the mosquito identification work is complete we will have a greater idea of disease risk.

Rainforests

Condition and Trends of North Queensland Rainforests

Project 3.1 Rainforest Biodiversity

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Centre for Tropical Biodiversity & Climate Change
James Cook University, Townsville

This project consists of four subprojects examining rainforest biodiversity in the Wet Tropics:

- Monitoring
- Climate change vulnerability and adaptation
- Drivers of biodiversity pattern and process
- Status of the environment and future projections.

We present our latest results showing that there have been observable shifts and declines of a number of upland vertebrate mammals and birds that are worryingly in accord with the impacts predicted under the more severe projections of future climate driven impacts. Species are showing a slight, but detectable, shift upwards in elevation with declines at the bottom edge of their range and either increases or decline at the upper edge depending on their elevational distribution. Power analyses of the data suggest that to monitor and detect a 10% change in abundance of common species over a 10 year period we need to monitor the sites at least twice per year. We will present ongoing work examining the importance of buffered microhabitats and microclimate

gradients in ameliorating impacts on biodiversity. Future predictions of climate change impacts on vertebrates have been refined following our vulnerability framework (Williams & Shoo et al. 2008) and utilizing the latest modeling approaches, climate projections and the IPCC 5th Assessment Report scenarios. Predictions refine our previous projections but have not significantly changed the previous qualitative results. |That is, latest projections indicate that approximately one third of the vertebrate species will be severely threatened, one third will be vulnerable and one third will not change or increase. Preliminary systematic conservation planning for the region using Zonation and a combination of both vertebrate and freshwater biodiversity data has been completed and the results will be presented. We provide an update on analyses examining the efficient spatial and temporal selection of corridors and landscape design for maximizing resilience under climate change. We will synthesise these results in the context of pathways to adaptation for the region using our recently published decision framework (Shoo et al. 2013).

Project 3.2 What is at risk? Identifying rainforest refugia and hotspots of plant genetic diversity in the Wet Tropics and Cape York Peninsula

Darren Crayn[1,2],Craig Costion[1], Kaylene Bransgrove[1,3], Sandra Abell-Davis[1,3], Lalita Simpson[1,2,3], Katharina Schulte[1,2], Dan Metcalfe[4], Maurizio Rossetto[5], Andy Lowe[6], Steve Williams[2,3]

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[6]State Herbarium of South Australia, Department of Environment and Natural Resources

Australia's tropical rainforests of far north Queensland are globally renowned for preserving one of the most complete and continuous records of the evolutionary history of Earth's biota, and harbour much of the remaining Gondwanan flora that was once widespread across the continent. Much remains to be discovered however, about the distribution of this evolutionary history within the region, particularly for plants and fungi. Where are the refugia and hotspots of phylogenetic diversity (concentrations of evolutionarily distinct species)? How is genetic diversity within species, a strong predictor of resilience to environmental threats, distributed across the landscape?

In this multifaceted project we are mapping diversity across a range of scales - species, populations and genes - of selected plants and fungi of the Wet Tropics and Cape York. A current focus is on species potentially at most risk: mountaintop specialists whose cool, wet habitat is projected to be severely impacted under a warming climate. This research is enhancing the scientific basis for conservation priority-setting and planning for future environmental change.

Project 3.3 Targeted surveys for endangered rainforest frogs and other herpetofauna in peripheral areas of the Wet Tropics and Eungella, and assessment of frog population recovery from disease

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Ten frog species disappeared from the upland rainforests of the Wet Tropics and Eungella during outbreaks of an amphibian chytrid fungus (Batrachochytrium dendrobatidis) in the late 1980s and early 1990s. Five of these species occurred only in the uplands and were presumed extinct because no individuals were subsequently found despite intensive searches. The exciting recent development is that we rediscovered one of these 'extinct' species, the Armoured Mistfrog (Litoria lorica) in high elevation dry sclerophyll forest very close to rainforest sites it vanished from. Equally exciting is that this population coexists with chytrid fungus, suggesting that at some sites these species can persist with the pathogen. This rediscovery strongly suggests that other missing frogs may well still be out there (including Litoria nyakalensis, Taudactylus acutirostris, Taudactylus rheophilus and even the Northern Gastric Brooding Frog Rheobatrachus vitellinus). Further, it has allowed us to target very particular sites – dry forests bordering rainforest – that have rarely been surveyed for these species. Coincidentally, these ecotonal and peripheral habitat areas are poorly surveyed for vertebrates more generally, because most of the work in these regions has focused on rainforests. A number of frog species declined from the uplands of these areas but persisted in the lowlands. Our surveys suggest that some of these species are starting to reappear at historic upland rainforest sites. It is very important to know the degree to which this is occurring and whether it represents population recovery for species such as Litoria nannotis, Litoria rheocola and Nyctimiste dayi. We have now completed many surveys in the Wet Tropics and Eungella regions as part of our NERP project and I will present a summary of the results of these, management implications, and future plans.

Project 3.4 Monitoring of Key Vertebrate species

David Westcott

CSIRO Sustainable Systems

Effective biodiversity management assumes an ability to monitor trends in the status of key assets, including the ecological processes that support biodiversity, ecological communities, species and populations. Not only is monitoring information fundamental to on-ground management but it is recognised under our own legislation and planning and under international agreements to which we are a party. Despite this there is surprisingly little direct information available on the status and trends of biodiversity in Australia and instead we are often reliant on indirect measures such as extent of vegetation cover or area of protected habitat to provide us as indicators. The reason for this is that direct monitoring of biodiversity can be expensive and time consuming and these costs demand that the investment is justified both in terms of the value of the asset and the lack of alternative management approaches. In the Wet Tropics Region two of our most iconic vertebrate species, the southern cassowary and the spectacled flying-fox, fall into this category. Both species are listed under the EPBC Act and both are the focus of significant community concern. However, neither species is amenable to standard monitoring approaches necessitating the development of species specific methods. Drivers and problems are outlined for monitoring of these two species, and methods that have been developed are discussed followed by overview of results to date.

Threats to Rainforest Health

Project 7.1 Fire and rainforests

Dan Metcalfe

CSIRO Ecosystem Sciences, Brisbane

Fire is a significant environmental driver of change across most of Australia, yet we know little of the effects of fire on tropical rainforest communities. Tropical rainforests used to cover almost all of Australia, but today only account for about 2% of the land mass, so how does that tiny remnant respond to the fire at its margins? Current approaches to managing fires which threaten rainforest are driven by concerns over infrastructure protection, public perception, research into fire impacts in other countries, and by the availability of trained staff to deal with such threats. We are compiling research data to support development of management strategies; these data will illustrate both the positive and negative effects of fire in rainforests, and will provide a distinct Australian contextual understanding of the problems faced by managers and decision makers.

Project 7.2 Identifying and managing emerging weed threats in the Wet Tropics

Helen Murphy

CSIRO Ecosystem Sciences, Tropical Forest Research Centre, Atherton

Climate change will enhance the capacity of non-native species to establish, spread and transform ecosystems, and tropical regions may be especially at risk. Therefore, current approaches to identifying and managing weed risks need to be revised in line with projected climate change across northern Australia. Management strategies will need to consider the potential future distributions of the suite of invasive species already present in the region as well as the potential distributions of species which may establish in the region as climatic conditions become more suitable. Part of the challenge of adapting to climate change will be incorporating proactive management of the threat of newly emerging weeds into existing invasive species management frameworks within the region.

We have used bioclimatic modelling and climate matching methodologies to identify:

- High-risk source areas for future invasive species based on matched climates with Wet Tropics predicted future climate scenarios
- Species that are currently not widespread in the region but which pose an increased risk of establishment and spread under future climate scenarios
- Strategic, proactive management approaches which have the potential to greatly reduce future weed impacts and the future cost of weed management.

Project 7.3 Climate change and the impacts of extreme climatic events on Australia's Wet Tropics biodiversity

Justin Welbergen

Centre for Tropical Biodiversity & Climate Change, School of Marine & Tropical Biology
James Cook University, Townsville

While anticipated changes in the means of the world's climate will have numerous effects on a range of environmental, social, and economic sectors, many significant impacts of climate change will emerge through shifts in the intensity and the frequency of extreme weather and climate events, including heat waves, flooding rains, and cyclones. Such extreme events represent the way in which our communities, animals and plants will strongly experience climate change. Extreme temperature events are of special concern to biodiversity conservation, not only because of their direct impacts on organismal health but also because of their effects on the frequency and intensity of droughts and wildfires. However, despite the clear importance of temperature extremes for our understanding of climate change impacts, little is known about their effects on biodiversity. Our project investigates the exposure and the sensitivity of the Wet Tropics vertebrates to extreme temperature events. Integration of our information on exposure and sensitivity will then enable us to quantify the vulnerability of Wet Tropics biota to extreme climatic events, and to map the historical and future impacts of these events on biodiversity in the Wet Tropics Bioregion. Although our focus is on temperature extremes, we will use the analytical and conceptual advances gained from this project to form the basis of a generalised framework for assessing the impacts of extreme weather and climate events on natural systems across Australia and elsewhere.

Managing for Resilient Rainforests

Project 12.1 Indigenous co-management of rainforest diversity

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[7]Mandingalbay Yidinji Aboriginal Corporation
[8]Australian Conservation Foundation
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[10]Central Wet Tropics Institute for Country and Culture
[11]Mamu Traditional Owner
[12]Rainforest Aboriginal Peoples' Alliance

Australia's wet tropics region encompasses 20 traditional estates of Rainforest Aboriginal peoples. They have been actively working for 20+ years at various levels in asserting Traditional Owner (TO) relationships and rights to manage their country. Land management arrangements are multi-tiered, involving lease and freehold owners and several State, local and Federal government authorities. More recently, the outstanding significance of Rainforest Aboriginal peoples' cultural values associated with the wet tropics was recognized through national heritage listing in 2012.

Our project, which includes a co-research team between Rainforest Aboriginal peoples, scientists and managers, has identified different pathways connecting cultures and knowledge through co-management. For equitable engagement to occur five components have been described:

- Principles (e.g. self-determined level of involvement)
- Relationships (e.g. good ones enable Indigenous roles)
- Mechanisms (e.g. plans)
- Power (e.g right to exercise native title)
- Regimes for joint governance (e.g. legislation, policy).

Our institutional analysis identified that significant barriers exist to equitable engagement. Queensland human rights institutions do not include the protection for cultural, social and economic rights that currently exist internationally. Raising human rights standards appears important to generate equitable engagement of culture and knowledge through co-management.

Project 12.2 Active vs passive options for re-establishing rainforest on post-agricultural land

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Progress towards rainforest restoration can be achieved through different pathways which vary in their intensity of intervention, timescale, and cost. High-diversity tree planting has been widely used in the Wet Tropics, where research has demonstrated promising short-term results of "best practice" restoration plantings for recovering biodiversity and biomass. However, the costs of tree planting over large areas can be prohibitively high, and the longer-term biodiversity development within these plantings remains uncertain. Accordingly, there is a need to explore alternative restoration techniques that require lower input of labour and resources, and to understand why these succeed or fail in relation to various goals. We are investigating how fast unassisted (ie, low-cost) natural regrowth can produce ecological outcomes, how these compare with the outcomes of tree-planting, what factors limit or accelerate the development of regrowth, and whether there is potential for low-intensity intervention to kickstart regrowth in retired pasture. The longer-term aim is to identify a menu of approaches that differ in type and cost of intervention, speed and quality of outcome, and environmental situations or goals to which each approach is either well- or poorly-suited. This will help landowners and planners to make effective decisions based on risks, costs and benefits, about how to restore rainforest wherever needed across the landscape.

Project 12.3 Relative social and economic values of residents and tourists in the Wet Tropics World Heritage Area (WTWHA)

Michelle Esparon, Natalie Stoeckl

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The Wet Tropics World Heritage Area (WTWHA) is famous for its wildlife, biodiversity and natural beauty. However, very little is known about the 'value' of these attributes, partly because it is quite challenging to quantify them. Recognizing that the absence of price does not mean absence of value, this project – which started in July 2012 – seeks to improve our understanding of the

importance of these non-market values to residents and tourists. It complements NERP Project 10.2 which is investigating non-market values in the Great Barrier Reef World Heritage Area (a separate poster provides preliminary findings from that work).

Given the many attributes of the WTWHA and the fact that it is impossible to measure all, a workshop was organized with some key stakeholders of the region to identify and prioritise a) key attributes for assessment and b) development 'changes' that may erode on those values. Of the attributes identified for assessment thus far, forest health, landscape, iconic species, culture, accessibility, quality of access, water quality, and employment opportunities were deemed most important. The most significant management issues identified for consideration related to the: protection of native animals and plants (while allowing access); maintenance of undeveloped scenic beauty; and improvement in water quality/clarity. Further engagement with Indigenous stakeholders is underway. This information is helping to inform the design of two questionnaires that will be distributed to residents of and tourists to the WTWHA during 2013/14. When complete, the project will provide insights into the priorities and attitudes of residents and tourists (as they relate to the WTWHA), thus generating information that will be useful to the tourism industry, the WTMA and other key policy makers.

Project 12.4 A Governance Analysis of Australia's System of Greenhouse Gas Abatement Through Landscape-Scale NRM

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Healthy governance systems are key to delivering effective outcomes in any broad domain of natural resource management (NRM). One of Australia's newest (and still emerging) NRM domains in is our national framework for greenhouse gas abatement (GGA) as delivered through a wide range of management practices in the Australian land and sea scape. This domain resides within the nation's broader NRM policy framework and it is primarily progressed through the Australian government's Clean Energy Package (CEP), and more particularly, its Carbon Farming Initiative (CFI). This paper explores key areas of governance risk within the governance system underpinning this new and emerging domain. We then map some of the potential reform or continuous improvement pathways required (from national to paddock scale) with the view to securing improved landscape outcomes over time through GGA activities.

Knowledge Brokering and Communications

Project 13.1 e-Atlas – Discover, learn, investigate and download environmental research data

Eric Lawrey

Australian Institute of Marine Science

With the e-Atlas you can discover, learn, investigate and download environmental research and reference data for the Great Barrier Reef, its catchments, the Wet Tropics and the Torres Strait regions.

The e-Atlas is a website and mapping system for presenting environmental research data in an accessible form that promotes greater use of this information. It is also a data management system for preserving and encouraging reuse of this data.

Decades of research have generated a large amount of data and information on the Great Barrier Reef and the terrestrial tropical ecosystems. Until now this information has generally been under-used. The e-Atlas aims to promote collaboration and support the work of management agencies, researchers, reef-based industries and community groups.

From the site, users can discover what research is being done in a given region or on a given topic, then learn more about this research and its outcomes. The data behind the research can be investigated through an interactive mapping system and, where possible, the data itself can be downloaded. The e-Atlas also contains a wide range of reference datasets that complement its research content.

The e-Atlas is the primary data and knowledge repository for 38 NERP Tropical Ecosystems Hub projects, 6 Reef Rescue Marine Monitoring Program projects and historically, the Marine and Tropical Science Research Facility. This research covers a wide range of topics some of which include: seagrass, coral reefs, turtles, dugongs, seabirds, bathymetry, fish abundance, Crown Of Thorns Starfish (COTS), rainforest revegetation, wet tropics species distributions, etc.

The e-Atlas was initially developed in 2008, funded by the Marine and Tropical Science Research Facility and the Australian Institute of Marine Science. The e-Atlas is now supported through funding from the Australian Government's National Environmental Research Program and the Australian Institute of Marine Science.

Water Quality of the Great Barrier Reef and Torres Strait

Project 4.1 Tracking coastal turbidity over time and demonstrating the effects of river discharge events on regional turbidity

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The objective of this recently commenced study is to quantify the relationships between daily variation in coastal water clarity and daily Burdekin River discharge volumes into the GBR, using daily Modis Aqua remote sensing data at 1 km resolution. We used a newly developed index of euphotic depth, and quantified where and by how much the relationship between water clarity, waves and tidal currents has changed throughout the recent wetter and drier years as a function of location (inshore, midshelf and offshore, and with increasing distance to the Burdekin river mouth), bathymetry, river flow rates, and hydrodynamics (waves and tidal currents). Preliminary analyses show a strong relationship between Burdekin discharge volumes and annual and daily values in water clarity in the GBR within the Burdekin sector. Across the ten years, mean annual water clarity was 24% greater in the driest compared to the wettest years (11.7 vs 8.9 m mean euphotic depth).

Within years, water clarity was lowest in February and progressively improved throughout the dry season, reaching highest values around October, and rapidly declining soon after the onset of the river flow. The study suggests that the Burdekin River is a significant factor determining water clarity throughout the Burdekin sector of the GBR.

Project 4.2 Chronic effects of pesticides and their persistence in tropical waters

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Pesticides, and particularly herbicides from agricultural sources have been detected in nearshore sites of the Great Barrier Reef (GBR) all year round. The most commonly detected herbicides inhibit photosynthesis, potentially reducing primary productivity in key marine species. While herbicides are thought to contribute to the stress on nearshore habitats, little is known of their chronic effects on tropical species or their persistence in tropical waters. In this project, two species of seagrass were shown to be sensitive to four PSII herbicides in three-day laboratory exposures. The order of toxicity was Diuron > Hexazinone > Atrazine > Tebuthiuron for both species. The order of toxicity and the sensitivity of seagrass to these herbicides were generally consistent with corals and microalgae. Identifying the concentrations of herbicides that inhibit photosynthesis in seagrass by 10% and 50% has contributed to risk assessment process for the Reef Plan Scientific Consensus Statement on water quality. Understanding the half-lives of these herbicides and the toxicity of their breakdown products in the tropical marine environment is also a critical data-gap required to develop realistic ecological risk models for sensitive coastal communities of the GBR. Two flask experiments have been conducted for 12 months each to measure degradation in up to nine herbicides in seawater at 25°C, 31°C and in the dark and light. Analyses are still underway; however, preliminary data indicates very slow degradation of the herbicides Diuron, Atrazine, Ametryn, Simazine, Hexazinone, Tebuthiuron, 2, 4-D, Metolachlor and Glyphosate in seawater. This long persistence is likely to contribute to the common detection of herbicides in GBR waters.

Project 4.4 Hazard Assessment for water quality threats to Torres Strait marine waters and ecosystems

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The project's aim was to provide an assessment of current and potential water quality issues in the Torres Strait Region. This involved a review of available water quality information for the region, documentation of the status of island sewage treatment and other discharges such as desalination waste on the islands, documentation of the status and scope large scale developments in the region, and review of current and projected shipping activity in the region. While the study has identified a number of relatively minor local pollutant sources that may pose a risk to the ecological

values of the Region, the largest threats are most likely to be associated with the potential risks from the transit of large ships through the Region.

Shipping appears to pose significant potential threats. The shipping route through Torres Strait is already an bottleneck for Australian east coast shipping traffic. With the expansion of ports, especially coal and coal seam gas loading ports, on the Australian east coast in response to proposed large increases in export large increases in shipping traffic up the Queensland coast are predicted. Additional increased shipping through the Torres Strait will also result from the construction of the major port at Daru. Increased shipping will result in greatly increased risk of accidents in the Torres Strait. Currently there is very limited capacity to respond in any meaningful way to a large oil spill in the Strait. The area is remote in Australia with strong winds and currents and a matrix of reefs and islands on which oil could impinge. Any large oil spill would have devastating consequences for the populated islands on which it landed as well as severe environmental consequences.

Large developments in PNG including gas platforms, oil palm expansion and Daru port development may also be significant. Preliminary analysis of proposed developments in western PNG suggest that although large scale development is likely to occur, adverse effects in the Australian part of the Torres Strait are likely to be restricted to the northern islands – Boigu, Saibai, Erub and Stephens. Hydrodynamic modeling and remote sensing analysis show that excursions of water from the Fly River drainage basin predominantly move to the east into the northern Coral Sea and along the PNG coast towards Port Moresby and are uncommon to the west of the river mouth. In addition the currents in this western region are generally from east to west both in the central TS and along the PNG coast. However, construction and operation of a major port at Daru has the potential to lead to excursions of contaminated water along the PNG SW coast and thus to Saibai and Boigu. It is now almost certain the Ok Tedi mine will continue production for at least another 10 years instead of shutting down in 2014. Continuing introduction of toxic metals such as copper into the northern TS via Fly River discharge can only be viewed with concern given the absence of transparent monitoring programs as to the effects of the discharge in the lower Fly River and Torres Strait. While the TSBS showed little influence of Fly River discharge on metal levels in TS, the data are now 20 years old and it would be valuable to repeat the study in a more limited way to assess the changes since the early 1990s.