

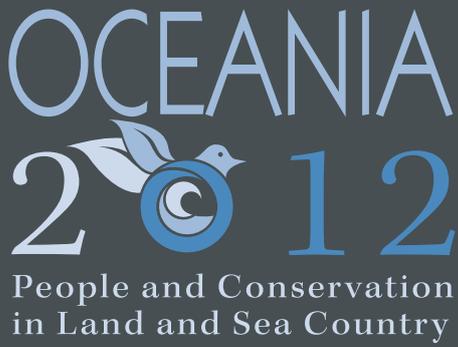
Society for Conservation Biology

OCEANIA

2012

People and Conservation
in Land and Sea Country





[Session details](#)

Contained in this document you will find details of the various sessions presented during the conference. While every care has been taken to present accurate times and venues please be aware that these are subject to change and we advise you to refer to the printed schedule of events in your welcome pack for more up to date information.

Friday 21st September

Mal Nairn Lecture Theatre 08.30-10.30

08:30-09:00 Welcome to Country and opening remarks

09:00-10:30 Plenary Session

Bill Gammage

Australian National University

Bill Gammage is adjunct professor of history in the Humanities Research Centre, Australian National University, Canberra. He grew up in Wagga, NSW, and has taught at universities in Canberra, Port Moresby and Adelaide. His book on Australian soldiers in the Great War, "The Broken Years", was published in 1974; an illustrated edition is still in print. He was historical adviser to Peter Weir's film "Gallipoli" and among other books has written on Narrandera Shire NSW and the 1938-39 Hagen-Sepik Patrol in New Guinea. His 2011 book, "The Biggest Estate on Earth: How Aborigines made Australia", argues that at the time of contact Aborigines carefully distributed plant and animals to make them abundant, convenient and predictable.

Fire in 1788

In 1788 Aboriginal fire was characterised by detailed local expertise enforced and reinforced by a continent-wide religious philosophy which valued fire as an ally and respected its abilities. Differences in climate, terrain, soils and vegetation generated distinct local management practices, but everywhere the various purposes and benefits of managing fire were much the same. Across so vast an area, this was a momentous achievement. Probably it was also unique. In 1788 its like was not evident on the other continents, or in neighbouring Oceania. Why not? Comparing how farmers burn with how hunter-gatherers burn offers clues, but raises questions about why some people became farmers and others did not. The relation between fire and Australia's plants and animals suggest ways to explore these questions.

Bob Pressey FAA

Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University

Professor Bob Pressey is the program leader for Program 6: Conservation Planning for a Sustainable Future in the Australian Research Council Centre of Excellence for Coral Reef Studies at James Cook University. He is recognised internationally for establishing the field of systematic conservation planning and continues to be one of its leading innovators. His main scientific contributions are: new concepts and techniques that have increased the effectiveness of conservation planning across the world; a long series of intellectual advances that have progressively defined best-practice; conceptual and technical innovations related to the dynamics of biodiversity and human activities; and ground-breaking, intuitive software tools. Bob's research interests include planning for biodiversity processes in the context of human-caused dynamics, integrated planning for coastal catchments and nearshore marine waters, integration of conservation action with economics, interactive decision-support software and effective engagement between scientists and practitioners.

The mismeasure of conservation

Conservation is the means by which society seeks to preserve natural assets and safeguard biodiversity against threats to its persistence. Conservation reserves are the cornerstones of the global conservation strategy, but reserves in Australia and around the world have a serious failing: they are concentrated in areas that are remote or otherwise with little value for subsistence or commercial uses. Therefore, they tend to occur where threats to biodiversity are low while losses of biodiversity continue unabated elsewhere. Importantly, this failing is hidden by common measures of conservation progress that emphasize the number and extent of reserves rather than how much loss of biodiversity their establishment has avoided. Means and ends have been confused, presenting immense risks to biodiversity. Measuring avoided loss is tractable now. Analogous conceptual and technical challenges are being overcome for carbon accounting. The main barriers to measuring avoided loss, and making reservation (and any other spatial conservation interventions) more effective are institutional and political. Bringing sensible measures of progress into policy and practice will require not only good science but active, persuasive argument to accelerate the uptake of this science.

Morning Tea Break

10:30-11:00am

Mal Nairn Lecture Theatre 11.00-13.00

Symposium: Socio-economic aspects of threatened species conservation in Oceania

Organizer: Judit Szabo, Charles Darwin University

We are currently experiencing a human-mediated extinction crisis. Threatened species conservation is more than just biology - addressing social, economic and institutional aspects can strengthen conservation strategies. Government funding for threatened species conservation in most countries is inadequate and the role of conservation is ever more dependent on participation by the broader community and experts working across a range of disciplines. Reviewing past conservation spending and the success of actions can guide future investments for maximum effectiveness and efficiency. We explore this topic via bird conservation in Australia and other case studies. Presentations in this symposium will be of interest to policy makers and conservation managers from countries facing similar institutional, economic and social challenges.

11:00-11:15 Threatened species conservation – the need for a holistic approach

GARNETT, S.T.¹

¹Charles Darwin University, Darwin NT 0909

Much of the work on threatened species tends to be concentrated around understating the biological constraints on their survival. However rarely are these the only issues that need to be solved. Governance, leadership, funding and social support are among a range of other issues that need to be managed if threatened species conservation is to be successful, especially in the long term, as is evident from the other talks in this symposium. Ultimately the values of threatened species need to be institutionalised like other heritage rather than be subject to the whims of project funding. In this presentation I will draw together the main threads of the symposium as the basis of a monitoring framework that will spell out what needs to be tracked to ensure that we not only ameliorate threats to threatened species but also ensure that they are valued as assets to our society.

11:15-11:30 From attitudes to action: how understanding public values can increase the success of threatened bird conservation

AINSWORTH, GB¹, Aslin, HJ¹, Garnett, ST¹, Weston, MA², Zander, KK¹

¹Charles Darwin University, Darwin, Northern Territory, Australia 0909

²Deakin University, Victoria, Australia

Since European settlement 234 Australian bird taxa have become Extinct, are threatened with extinction or are Near Threatened. Habitat loss due to human development is the major cause and addressing this conservation challenge is as much a social matter as it is ecological. Yet government funding in Australia remains inadequate and the role of conservation is ever more dependent on participation by the broader community. Community attitudes and behaviours are driven by a wide range of values e.g: aesthetic, utilitarian, scientific and anthropomorphic. Using socio-psychological techniques based on Kellert, Campbell and Smith my research aims to understand which of the values held by Australian society for threatened birds drive conservation action. In 2011 I surveyed 3,000 members of the Australian public about their attitudes towards birds. Results will demonstrate a range of values that support threatened bird conservation including a willingness to pay; however, participation in conservation activities is low. By better understanding public values we can develop more targeted communication strategies and more relevant opportunities for participation in threatened bird conservation projects. The results and conclusions of this research will be of interest to policy makers and conservation managers from countries facing similar ecological, economic and social challenges.

11:30-11:45 The role of social science research in conserving Australia's threatened birds

ASLIN, HJ.¹

¹Charles Darwin University, Darwin, NT 0909, Australia

Many disciplines have a role in addressing the human-mediated extinction crisis. More specifically, this paper asks 'How can social science research help to conserve Australia's threatened birds?' In Australia to date, social research contributions to species' conservation have not been extensive, and conservation's human aspects are often 'backgrounded' in comparison with biological and ecological aspects. Also, because of the nature of the Australian research system, research efforts, in this area as well as others, are driven largely by individual researchers' interests and motivations, often rely on short-term research funding, lack longer-term institutional support, and there is limited monitoring of research effectiveness. Research is often relatively ad hoc and its practical outcomes unknown. By reviewing frameworks developed to analyse how social research can be applied to natural resource management, and applying them to conserving Australia's threatened birds, the paper identifies key applications of social research warranting further attention. These include developing a systematic set of social research priorities, and monitoring and evaluating research in terms of conservation outcomes. Together with an understanding of relevant paradigms and methods, and of previous research and its findings, this is part of working towards an effective social research agenda for conserving Australia's threatened birds.

11:45-12:00 A review of the institutional framework across the management of Australia's threatened birds

HOLMES, T¹

¹University of Queensland, Brisbane, QLD 4072

In the last ten years 5.5% of Australia's extant bird species have been uplisted, i.e. gone to a category of increased risk of extinction, and 1.4% has been downlisted. Substantial amounts have been spent on attempting to keep them from becoming extinct. Currently 17% of species require conservation action. In this study I investigate the effectiveness of the institutional framework across the management of Australia's threatened birds. This was done by undertaking content analysis of legislation, policies and plans and analysis of semi-structured interviews with key players. The institutional framework for the management of threatened birds has evolved to be highly complex involving multiple scales and many participants and has expanded its capacity for monitoring, research and implementation of actions, and involved an increasing number of participants. The non-government sector has taken the lead on several aspects of management and the national and state governments have enhanced their processes for managing threatened species. Other findings include: institutional mismatches; planning and prioritising processes and data management of different jurisdictions vary in quality; diverse perspectives among those involved in the management of threatened birds; influence of social elements of conservation management highlighting the need to focus on organisational skills to improve decision-making.

12:00-12:15 The State of Threatened Species Prioritisation in Australia

AUERBACH, N¹, Possingham, H¹, Holmes, T¹, Watson, J, Joseph, L, Szabo, JK²

¹University of Queensland, Brisbane, QLD 4072

²Charles Darwin University, Darwin, NT 0909, Australia

Conservation requirements for threatened species in Australia are not fully met. This is due, in part, to scarce resource allocations, an issue of societal values and political will, but improvements can be made in strategic planning. With inadequate funding for addressing the needs of all threatened species, most receive little or no aid for management action implementation. For example, some subspecies, such as the Spotted Quail-thrush (Mt Lofty Ranges), have disappeared with no management allocations. Our objective was to assess current state and federal threatened species planning approaches in Australia, based upon seven criteria of strategic importance. We evaluated strengths and weaknesses in the planning strategies, and determined that the Project Prioritisation Protocol planning framework, which incorporates cost and feasibility of management actions, meets most of the strategic criteria. Improvement would be made by linking the planning process to funding sources. We conclude a similar strategic national prioritisation process would reduce duplication of effort and improve efficiency. Through identification of national goals for threatened species, the states and federal government could move toward a planning process that is consistent, transparent, and repeatable, building the case for targeted funding to improve the conservation status of Australia's threatened species.

12:15-12:30 Which actions are most likely to be effective for threatened species conservation?

SZABO, JK.¹ and Garnett, ST.¹

¹Charles Darwin University, Darwin, NT 0909, Australia

In 2010 Australia had 211 threatened or near threatened bird taxa, and most of which coping with stresses of environmental change on their own, with little or no input from environmental managers. Using planning documents over the last two decades we identified actions recommended and undertaken for each taxon, their cost and effectiveness. The necessary and performed actions depend on the nature and severity of threats each taxon faces. These threats are location and taxon specific – e.g. introduced alien invasive species for island taxa and fisheries by-catch for seabirds. Some threats are easier and cheaper to mitigate than others. Early interventions tended to be underfunded, short-term and they failed to secure long term gains. Effective monitoring was lacking at most sites. However, there have been some stand-out success stories, such as those of the Gould's Petrel and the Lord Howe Woodhen. Major challenges continue – some can be remedied by eradication of exotic predators, reversing losses suffered over a century ago, but initial investment must be high. Strategic planning and high levels of investment are essential – scrimping on costs leads to a waste of money.

12:30-12:45 Conservation of Unique Fauna on Small Inhabited Islands: Biology & Beyond

BRODIE, G¹, Bogitini, L¹, Stevens, F¹ and Barker, G²

¹Department of Biology, University of the South Pacific, Suva, Fiji Islands

²Landcare Research, New Zealand

Non-marine molluscs are globally and regionally one of our most threatened faunal groups. Yet information about them is to date missing from many Pacific Island national biodiversity strategy action plans. Fiji for example has a very large and diverse number of native land snail species (> 200) with an endemism level of nearly 80%. In this study we collated very scattered information and reviewed the conservation status of Fiji's land snail fauna, we then began conducting much needed field surveys to priority areas, targeting priority species. The availability of information to allow easy species identification was a limiting factor. Our reviews and surveys found evidence of many endemic species in need of conservation action. There were significant threats to unique fauna from invasive species as well as continuing human-induced habitat degradation. We found relatively little knowledge of snails was held by land owners and community members but that there was significant interest from small local NGO's and some government departments. People were generally more interested in introduced or invasive snail species because they could relate more readily to how these species impact on humans. The concept of conserving biodiversity for its intrinsic ecosystem or biodiversity value was challenging to communicate. To be successful we will need to work harder at bringing indigenous land owners and their leaders on board with conservation efforts at a habitat level. However, even then, the chances of success are debatable as many of the major threats are difficult to address and many developing-country small-island communities in Oceania are dealing with more obvious socio-economic issues.

12:45-1:00 DISCUSSION

Open Session: Conservation Genetics**11:00-11:15 Population viability of highly inbred black robins**WEISER, E¹, Grueber, C¹, Kennedy, E² and Jamieson, I¹¹Department of Zoology, University of Otago, Dunedin, New Zealand²Canterbury Conservancy, Department of Conservation, Christchurch, New Zealand

The Chatham Island black robin, one of New Zealand's iconic bird species, has recovered from a single-pair bottleneck in 1979-1982 to around 230 adults today. The species currently exists in three small subpopulations on two geographically and genetically isolated islands. All individuals are highly inbred. Some inbreeding depression has been observed, raising concerns about the long-term viability of the species. We are using Vortex to assess population viability over the next 50 years. Preliminary results suggest that inbreeding depression has a small effect on population growth rates and extinction probability but may not substantially affect population viability. However, one of the three subpopulations is expected to become extinct within 20 years due to low survival and reproductive rates suspected to result from poor habitat quality. We will present our final results in the context of implications for management of this critically endangered species, including the potential value of efforts to reduce inbreeding within each subpopulation.

11:15-11:30 Limited mitochondrial and microsatellite variation within the black rhinoceros (*Diceros bicornis minor*) of KwaZulu Natal, South Africa and consequences for metapopulation managementANDERSON-LEDERER, RM¹, Linklater, WL^{1,2} and Ritchie, PA¹¹Centre for Biodiversity and Restoration Ecology, School of Biological Sciences, Victoria University of Wellington, PO Box 600, Wellington, 6041, New Zealand²Centre for African Conservation Ecology, Department of Zoology, Nelson Mandela Metropolitan University, PO Box 77000, Port Elizabeth Eastern Cape 6031, South Africa

Genetic variation and structure give practical information on a population's condition, connectivity and demographic history that are necessary when creating effective management plans. We compared sequences of the mitochondrial DNA (mtDNA) control region (n=101) and 10 microsatellite markers (n=127) for three subspecies of black rhino: *D. b. minor*, *D. b. michaeli* and *D. b. bicornis*. A single unique haplotype was found within the 65 *D. b. minor* samples from Kwa-Zulu-Natal as well as low microsatellite variability compared with *D. b. minor* populations in Zimbabwe and the other subspecies. Here we considered the implications of our findings for translocations, reintroduction and supplementation as well as the long-term management of the remnant populations of *D. b. minor* in South Africa.

11:30-11:45 Resolving founder relationships in the genetically depauperate population of Kakapo (*Strigops habroptilus*) using mitochondrial DNA and microsatellite markers
BERGNER, L¹, Jamieson, I¹, Eason, D², Moorhouse, R², Vercoe, D² and Robertson, B¹

¹Department of Zoology, University of Otago, PO Box 56, Dunedin, NZ

²National Kakapo Team, Department of Conservation, Private Bag 5, Nelson, NZ

The Kakapo is a critically endangered endemic parrot of New Zealand that recently experienced a bottleneck of 50 founder individuals. The current population exhibits high hatching failure and other signs of inbreeding depression, and genetic studies have indicated that the population is inbred. Therefore, quantifying and maintaining existing genetic diversity is a high priority for management. In this study, DNA sequence for the mitochondrial DNA (mtDNA) control region, combined with 25 kakapo-specific microsatellite markers, were used to resolve founder relationships in the Kakapo pedigree. We compared mtDNA haplotypes of founder individuals with the output of COLONY, a program for assigning relationships based on microsatellite data. Haplotype data were used to confirm putative full-sibling relationships and establish a cut-off probability for full-sibship. We constructed the Kakapo pedigree with the combined microsatellite and mtDNA sequence data using the program PMx. The improved pedigree will be used by the New Zealand Department of Conservation to manage the Kakapo population genetically through artificial insemination and planned matings.

11:45-12:00 Population genetics in conservation dependent fisheries: stock structure in the deep-sea conservation dependent orange roughy (*Hoplostethus atlanticus*)

GONÇALVES DA SILVA, A¹, Barendse, W², Kijas, J², Barris, W², McWilliam, S², Bunch, R², McCulloch, R², Harrison, B², Hoelzel, AR³ and England, PR¹

¹CSIRO Marine and Atmospheric Research, GPO Box 1538, Hobart, TAS, 7000, Australia

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³School of Biological and Biomedical Sciences, Durham University, South Rd., Durham, DH1 3LE, UK

Uncertainty about fish stocks can have severe impacts on fisheries management. In particular, stock depletion at one location may have unknown impact in other areas. Our goal was to describe the stock structure of orange roughy using 5,600 nuclear genetic markers. The genomic scale of our sampling allowed high resolution to distinguish even subtle structure resulting from relatively high gene flow. At the scale spanning from the western side of the Great Australian Bight (GAB) to seamounts off the coast of Chile, we found very little genetic differentiation at neutral loci (mean $F_{ST} = 0.0007$). Yet, we were able to confidently distinguish between Chile and Oceania. At outlier loci, which are loci that show signs of natural selection, we observed differentiation between sites in the GAB, Tasman Sea and south of NZ from all other sites. The results suggest that there may be regions in Oceania that have different local environment, and thus may warrant separate stock status under management programmes. Thus, even though we are unable to distinguish stocks at extensive spatial scales at neutral loci, we put forth evidence suggesting separate stocks based on differential local selective pressures. Additional research is required to determine exactly what are these pressures.

**12:00-12:15 A range-wide conservation genetic study of Little Penguins (*E. minor*):
Augmenting population genetics at neutral loci with the immunogenetic MHC**

VOGEL, S, Sinclair, J and Sherwin W

Evolution and Ecology Research Centre, School of Biological, Earth and Environmental Sciences, University of New South Wales, Kensington, 2052, Australia

Little Penguins are the smallest penguin species and the only one breeding in Australia. Populations have been reported to decline in numerous locations, mainly due to human impacts such as urbanisation, introduction of feral predators and climate change. We will describe viability and delineate relevant conservation units of these native animals in NSW using demographic and population genetic studies. In addition to using neutral genetic markers, we present the first study investigating non-neutral genetic diversity in Little Penguins. Sequencing of an immunogenetic locus of the major histocompatibility complex (MHC) showed high allelic diversity at the functionally relevant peptide binding groove of the MHC molecule in Little Penguins from WA. A range-wide population genetic study including microsatellite genotyping, sequencing mitochondrial DNA and the novel immunogenetic marker will be conducted. For that, we will sample wild populations, where care must be taken to minimise disturbance and impacts on animals and ecosystems. We therefore trialled non-invasive techniques for both genetic sample collection and demographic estimates. Moulting feathers proved to be an unreliable source of DNA, whereas plucked feathers could be a viable alternative to blood sampling of penguins. For estimating survival and population sizes, burrow occupancy and beach counts could replace mark-recapture approaches.

12:15-12:30 The relative importance of reproduction and survival for population viability: a case study of two dolphin populations

MANLIK, O¹, McDonald, J^{1,2}, Mann, J^{1,3}, Smith, H⁴, Bejder, L⁴, Kr'tzen, M⁵, Connor, R⁶, Heithaus, M⁷ and Sherwin, W¹

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²School of Biological Sciences, University of Queensland, Queensland, Australia

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⁴Cetacean Research Unit, Centre for Fish and Fisheries and Aquatic Ecosystem Research, Murdoch University, South Street, Murdoch 6150, Western Australia, Australia

⁵Anthropological Institute, University of Zurich, Winterthurerstrasse 190, 8057 Zurich, Switzerland.

⁶Biology Department, UMASS-Dartmouth, MA 02747, USA

⁷Department of Biological Science, Marine Biology program, Florida International University, FL 33181, USA

Given limited resources and time for conservation actions, it is crucial to focus wildlife management recommendations on vital rates that have the greatest effect on population viability. It has been proposed that in slow-growing animal populations adult survival has a greater influence on population growth than reproduction. Here we evaluate the relative importance of reproduction and survival for the viability of two dolphin populations in Shark Bay and Bunbury, Australia. Whereas the Shark Bay population appears to be stable, the Bunbury population is forecast to decline. In line with other studies, when altering vital rates by equal proportions, adult survival had the greatest effect on population trajectories. However, using alternative analytical approaches, reproduction appears to be much more important. Perturbations based on observed natural variation indicate that population dynamics are by far most influenced by reproduction. Moreover, the difference in viability of the two populations is best explained by differences in reproduction. The projected decline of the Bunbury population can be reversed by boosting reproduction, but not by increasing adult survival. These results highlight the importance of reproduction—even in slow growing populations—and the need to assess the effect of natural variation of vital rates on population viability.

12:30-12:45 Coral Reproductive Biology - Individuality in a Colonial System

Hagedorn, M^{1,2}, Carter, V^{1,2}, Henley, M³, van Oppen, MJH⁴, Heyward, A⁵, MacFarlane, D⁶, SPINDLER, R⁷

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³Invertebrate Exhibit, Smithsonian National Zoological Park, Washington, USA 20008

⁴Australian Institute of Marine Science, Townsville, Australia

⁵Australian Institute of Marine Science, Ocean Institute, Perth, Australia

⁶Chemistry Department, Monash University, Clayton, Australia

⁷Taronga Conservation Society Australia, Research and Conservation, PO Box 20, Mosman, NSW, 2088

Reproductive health of coral is essential to conservation efforts yet gamete biology remains largely unstudied. Uniformity of reproductive output within coral species is assumed, and particularly within a single colony. During recent annual spawning events, a detailed examination of two Acroporid species revealed that sperm motility differed among individuals and even within individual colonies across time and polyp position. Analysis of individual egg-sperm bundles (N= 15/colony) from seven different colonies demonstrated that sperm motility varied from bundle-to-bundle, and gradually increased and then decreased over 2 to 4 hours post release. In individual bundles, sperm number did not vary with egg number, initial or highest sperm motility ($P > 0.05$). Bundles with 5 to 10 and 11 to 15 eggs had lower sperm motility than bundles with 16 to 20 ($P < 0.05$) eggs. This information and an examination of sperm motility patterns has provided a firm baseline for the assessment of coral reproductive health. This information was also employed to optimize freezing techniques and facilitated the formation of the first CryoReserve for the Great Barrier Reef. In total over 700 billion sperm and 20 billion embryonic cells were cryopreserved for future use in research and conservation.

12:45-1:00 Population variability and the viability of a remnant population of a threatened frog

PICKETT, EJ.¹, Stockwell, MP., Bower, DS., Garnham, JI., Pollard, CJ., Clulow J and Mahony MJ.

¹School of Environmental and Life Science, University of Newcastle, Newcastle NSW Australia

A lack of detailed knowledge in population variability has hindered the capacity for informed conservation decisions. The use of long-term data for population viability analysis (PVA) has been increasingly used to understand temporal fluctuations in population size and to detect declines. However, the use of long-term data to produce PVA models for amphibians is rare despite the vulnerability of many species to extinction. We conducted long-term mark recapture on one population of a threatened frog and short-term mark recapture on a further two populations to determine the temporal and spatial variability of vital demographic rates. Using these vital rates, we constructed a matrix population viability model incorporating parametric uncertainty and temporal variability in R. Female survival had the greatest impact on predictions of population persistence, but growth rate of individuals to maturity, which is naturally variable on a spatial scale, also increased population persistence. Increasing fecundity (juveniles per female) increased population persistence, but had less power. This was also seen in the projected use of captive breeding to enhance the populations as an increase in population persistence required large effort. PVA modelling has enabled comparison of scenarios to prioritise research and management efforts for these populations.

Symposium: Poverty, climate & ecological sustainability – Spatial marine conservation planning and human development in the Oceania region

Organizer: Karen Edyvane, Charles Darwin University

The Oceania Region encompasses a region of global marine biodiversity significance, including the Indo-Malay epicentre of global marine biodiversity or Coral Triangle region and also, the near-pristine seascapes and biodiversity of northern Australia. The region also includes coastal Indigenous communities with strong cultural links to sea country, including systems of customary beliefs, practices and sea tenure – resulting in high levels of both, resource and cultural, dependency on coastal and marine resources. Against this background, the Oceania Region is also characterised by major food security, climate change, coastal population pressure and human development challenges, including the prevalence of Small Island Developing States (or SIDs). In this context, modern systematic marine conservation planning in the Oceania Region, particularly Marine Protected Area network planning, face major challenges, including the need to (1) ‘scale-up’ local planning actions to larger scale network planning; (2) incorporate social-cultural and human development objectives into planning, in addition to biodiversity values and benefits; (3) develop appropriate governance mechanisms which address Indigenous rights and aspirations; and (4) integrate resilience mechanisms and other systems approaches in planning within the human development framework. Such multi-scale, trans-disciplinary and integrated approaches and tools to conservation planning are critical to understand and develop governance approaches that address the synergies and trade-offs between poverty reduction, adaptation strategies and ecological sustainability.

11:00-11:15 Marine spatial planning in the Coral Triangle and Oceania: learning to deal with multiple objectives and scales

PRESSEY, RL.¹, Weeks, R¹, Mills, M², Horigue, VC.¹ and Hamel, MA.¹

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²Global Change Institute, University of Queensland, St Lucia, Queensland, 4072, Australia, morena.mills@uq.edu.au

Marine spatial planning for the inshore marine waters of the Coral Triangle and Oceania presents researchers, managers and policy makers with two related problems: reconciling multiple objectives (related to biodiversity conservation, resilience to climate change, and support for livelihoods); and bridging the gap between regional-scale spatial design and local-scale spatial management actions. While developed-country planning tools offer some promise, the social, economic and political context of inshore waters in most countries in Australia’s neighbourhood require the application of planning tools to be reconsidered for effective marine conservation. Key factors underlying the need for marine spatial planning to be reconsidered are: finely subdivided tenure and management responsibility of inshore waters; a high level of direct dependence by coastal communities on marine resources; and very limited occupational mobility if harvesting marine resources is restricted. We summarise progress toward bridging the gap between the respective advantages and limitations of regional spatial designs and local management actions, presently representing mostly independent spheres of activity. We also outline progress toward understanding how the tradeoffs between multiple objectives can be understood and managed when limited portions of inshore waters can be closed to fishing and other extraction.

11:15-11:30 Compromises between international habitat conservation guidelines and small-scale fisheries in Pacific island countries

HAMEL, MA^{1,2*}, Andrefouet, S¹ and Pressey, RL²

¹Institut de Recherche pour le Développement, Centre de Nouméa, B.P. A5, 98848, Nouméa, New-Caledonia.

²ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD 4811 Australia.

* present address

In Wallis, Alofi and Futuna, three small islands in the central Pacific Ocean characterized by different reef geomorphologies, an indicative conservation plan based on international habitat guidelines was prepared with two objectives that could not be achieved simultaneously: 1) representing 20% of the extent of each coral reef habitat while 2) keeping all subsistence fishing grounds open for extraction. Our analyses revealed the large extent to which compromises between these objectives are needed. Due to the small size of these islands, and the dependence of local communities on coral reef resources, the fishery objective significantly limited the extent of most habitats available for conservation. For all three islands, the conservation objective will only be achieved if the fishery objective is partially achieved and *vice versa*. The problem is enhanced if the conservation plan uses smaller conservation units and more complex habitat typologies. Our results indicate that international conservation guidelines should be carefully adapted to small Pacific islands and that incentives to reduce available fishing grounds will probably be needed.

11:30-11:45 Ecological, legal, cultural and human development challenges and regional trans-boundary conservation planning in the Arafura and Timor Seas

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³Lourenco Borges Fontes, Ministry of Agriculture and Fisheries, Timor Leste

The waters of the tropical and semi-enclosed Arafura and Timor Seas (ATS) are shared by Indonesia, Timor-Leste, Papua New Guinea (PNG) and Australia. As a 'semi-enclosed sea', the 1982 United Nations Convention on the Law of the Sea (UNCLOS) places a responsibility and an obligation on countries bordering enclosed and semi-enclosed seas to cooperate in resource management, the protection of the marine environment and marine scientific research (Article 123). The shared waters of ATS region lie at the intersection of two major Large Marine Ecosystems (LMEs): The Indonesian Sea (IS) and the Northern Australian Shelf (NAS) and is a part of the Coral Triangle which is considered to house the world's highest marine biodiversity. Within these semi-enclosed seas, shallow, continental shelves, semi-enclosed gulfs, and also, sea level changes, have resulted in pronounced, ecological connectivity (ie. oceanographic processes, shared fish stocks and biodiversity, strong land-sea interactions), diverse seascapes, extensive coastal wetlands and shallow water ecosystems and globally-significant populations of marine species (especially megafauna). The ATS region is also characterised by high productivity that sustains both, small- and large-scale fisheries (including several high-value, 'shared', trans-boundary fish stocks) that provide livelihoods for millions of people in the region, and coastal communities with high levels of both, resource and cultural, dependency on coastal and marine resources. With this dependence and importance of the living (and non-living) resources of the ATS, the sustainability and effective trans-boundary, regional management of these 'shared seas', remains a critical priority for the littoral nations bordering this region. Significantly, the data-poor ATS region is also recognized as containing the most pristine and some of the most highly threatened coastal and marine ecosystems in the world – facing critical challenges from major trans-boundary threats and management issues, such as food insecurity, poverty

alleviation, climate change, illegal and unregulated fishing, increasing resource use and impacts (marine pollution, habitat degradation, loss of protected species, biosecurity) and indigenous rights and interests. These trans-boundary issues are compounded by vastly differing socio-economies, culture, institutional capacities, governance and levels of human and economic development among the littoral nations of the ATS. These factors underscore the urgent need for trans-boundary, regional management of the ATS. In this paper we apply the Millennium Ecosystem Assessment framework to define coastal and marine ecosystem goods and services (EGS) and assets in the ATS, their importance to human well-being, and assess their status and trends in ecological condition (identifying key drivers of ecosystem change) and outline current spatial marine conservation and MPA planning programs, challenges and priorities (national and trans-boundary) and the application of marine EBM and EGS approach to conserving and sustaining the linked social-ecological systems of the ATS.

11:45-12:00 Integrating fisheries, biodiversity, and climate change objectives into marine protected area network design in the Coral Triangle

GREEN, A¹, ²White, A, ³Fernandes, L, ⁴Maypa, A and ⁵Tanzer, J

¹The Nature Conservancy, Brisbane, Australia

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Overfishing, degradation and loss of key habitats due to local and global threats are undermining food security, livelihoods and long term sustainability of coral reefs and associated ecosystems in the Coral Triangle. In 2009, the six Coral Triangle countries launched the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) to reduce these threats to marine resources, and protect the ecosystem services they provide. If well designed and effectively managed, marine protected areas can contribute to the CTI-CFF goals by achieving multiple objectives regarding fisheries management, biodiversity protection and climate change adaptation. Here we describe how we developed biophysical principles for designing marine protected area networks to contribute to achieving all three objectives simultaneously by providing guidance on: minimizing threats, what to include in MPAs (proportion of each habitat, number of examples of each habitat, and critical areas), and the configuration, location, boundaries and duration of these areas. We also describe how these principles can and are being used to assist governments, non-government organizations and communities in designing marine protected area networks at regional (Coral Triangle Marine Protected Area System), national and subnational scales throughout the Coral Triangle.

12:00-12:15 Dhimurru Aboriginal Corporation; Mapping Indigenous Knowledge to Better Manage the Marine Environment

MARIKA, M¹, ROEGER, S¹, DRYSDALE, V¹, Williams, N¹, Dethmers, K and Daniel, L¹
¹Dhimurru Aboriginal Corporation, Arnhem Road, Nhulunbuy NT 0810

Indigenous Australians have become increasingly involved in declaring and managing areas over their traditional land and sea areas. In Australia, indigenous-managed conservation areas, known as Indigenous Protected Areas (or IPAs), are officially recognised by the Australian Government and have been primarily terrestrial. Recently, the Dhimurru Aboriginal Corporation has commenced a systematic marine conservation planning project for the conservation of cultural values and biodiversity in the marine areas surrounding the Dhimurru IPA. In this unique process, traditional knowledge is incorporated in the planning and zoning of the marine estates in North East Arnhem Land, using the software package Marxan. Marine cultural information was collected and collated in a series of consultations with Traditional Owners (TOs) and custodians, plus biological and biophysical data was extracted from a range of existing dataset. Dhimurru rangers were introduced to systematic conservation planning during a 2-day workshop, and listed a series of conservation goals and threats. Preliminary results from the Marxan analyses revealed a series of planning scenarios with different configurations for areas with high and low conservation priority, with the high conservation priority areas usually centered around the areas of high cultural significance. This is one of the first projects in Australia attempting Marxan with Culture, whereby largely subjective and often intangible cultural meanings are rendered into quantified values using numbers and rankings. This combination of both cultural knowledge and western science has been used to initiate the systematic marine conservation planning of sea country surrounding the Dhimurru IPA. Further conservation planning work will concentrate on the compilation of more spatially explicit and culturally important biodiversity data.

12:15-12:30 Coastal climate change, human population change and livelihoods in Papua New Guinea

Butler, J¹, SKEWES, T¹, Bohensky, E¹, Lyne, V¹, Rochester, W¹ and Wise, R¹
¹CSIRO Sustainable Ecosystems

Communities of the Oceania Region are vulnerable to population growth and climate change due to their disadvantaged socio-economic status and high dependency on local marine resources. Sustainable development requires an adequate understanding of the condition and trends of these resources. Scant or sub-optimal data, future uncertainty and a need for concepts to be easily accessible and understood by stakeholders combine to necessitate the development of simple and robust methods. Here we present a 4-step semi-quantitative approach to providing sound advice for management and adaptation planning. It is based on modelling the interaction between system drivers and ecological assets, the relationship between ecosystem asset condition and ecosystem services, and the contribution of those services to human well-being. Model inputs and outputs are presented in participatory planning workshops. Results are presented for Milne Bay, PNG. Modelling of a 'business as usual' future indicated that by 2030 the provision of ecosystem services and human well-being is likely to decline, primarily driven by population growth and, especially after 2030, by climate change. Adaptation strategies identified by Milne Bay stakeholders are presented and discussed with reference to the sustainable development of the region.

12:30-12:45 A decision framework for prioritizing multiple management actions for long-lived, migratory endangered species, applied in a data-poor context

FUENTES, MMPB¹ and Pressey RL¹

¹ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, Australia

North Queensland and the Torres Strait region have globally significant populations of sea turtles that have spiritual and social importance to Australia's indigenous peoples and value to the tourist industry. The resilience to climate change of these populations is already severely compromised by dramatic reductions in population sizes due to impacts such as bycatch, direct take, boat strike, and pollution. Depletion increases the vulnerability of populations to additional threats and lowers their ability to adapt to and recover from climate change.

Therefore, managers face the challenge of addressing the direct effects of climate change, as well as ongoing threats that sea turtles face throughout their geographic range. For logistical, financial and political reasons, natural resource agencies cannot address all of these drivers or “threats” simultaneously; priorities must be established. Most management agencies have developed simplistic threat-ranking procedures to identify priorities, but most of these assume a static environment, ignore synergies and interactions between different drivers, and lack a proper assessment of the costs of management actions. Consequently, there is an urgent need for a systematic decision-theory framework that accounts for the benefits and costs of actions while incorporating the complex effects of climate change. Here we describe a novel systematic decision framework to the management of flatback turtles in the Gulf of Carpentaria and Torres Strait that incorporates the whole multitude of threats they experience as well as the benefit of emphasizing strategies to different life stages. The framework uses a budget constraint and maximizes the likelihood of management actions being successfully applied and accepted by local communities. The structured approach undertaken here can be applied to guide prioritization of other species in similar contexts.

12:45-1:00 DISCUSSION

Mal Nairn Lecture Theatre 14.00 – 15.30

Symposium: Spatial connectivity and the management of threatened marine vertebrates

Organizers: Kiki Dethmers, Peter Kyne and Mark Hamann

Long-distance migration is a characteristic trait of many large marine species, including cetaceans, dugongs, elasmobranchs, seaturtles and seabirds. It is driven by ecological and biogeographical processes, such as the spatial and temporal distribution of resources and habitats, seasonal variation in temperature and currents and reproductive needs.

Understanding the spatial connectivity across the distribution of marine vertebrate species is crucial for understanding the potential impact of threats (e.g. from anthropogenic sources of mortality or climate change) with more precision, thereby enhancing successful management. Effective management is challenged by the transboundary movement of migratory species, highlighting the need for collaborative effort across Oceania and more broadly. In this regard, migratory species link regions and nations, often demanding cross-cultural management. The Oceania region is rich in diversity and cultural heritage and Indigenous people of the region have strong customary links to the marine environment and marine species. Throughout the region stories, songs, and art are testament to the strength of both the socio-cultural connection many peoples have with marine vertebrates and of their cultural management protocols. With the introduction of tools such as satellite tags, the ways marine vertebrates can strengthen links between communities are being highlighted to both local groups and western scientists. This symposium will present a range of projects that focus on a wide diversity of threatened marine vertebrate species, their ecology, their management and the specific tools, approaches and challenges associated with conservation of the taxa. Presentations will offer perspectives from across the region and from across different cultures.

This symposium is sponsored by the National Environmental Research Program (NERP) Marine Biodiversity hub.

2:00-2:30 Management applications of close-kin genetics: spatial population structure, abundance, and survival

BRAVINGTON, M¹ and Grewe, P¹

¹CSIRO Wealth from Oceans Marine Laboratory, Castray Esplanade, Hobart 7001 Australia

Close-Kin Genetics (CKG) is a new and powerful way to assess status and design management for a range of threatened and/or commercially exploited species. It starts from "DNA profiling" to identify close relatives, then applies mark-recapture principles to the number of relatives found, and their patterns in space and time. One application addresses what is often the single most important need-to-know for effective management: the spatial extent of "independent demographic units" in relation to threatening processes. Conventional population genetics struggles to answer this when the migration rate is fast enough to blur genetic difference, but still too slow to matter demographically--- a common scenario in marine settings. However, low divergence is no problem for CKG, and the results pertain to single-generation timescales of immediate relevance to management. As well as population structure, CKG can provide estimates of absolute (not effective) adult population size and survival rates, sometimes without even sampling adults. The talk will provide examples from whales, seabirds, and two large ongoing studies: Southern Bluefin Tuna, a major commercial species with abundance as the focus; and Freshwater Sawfish, a threatened by-catch species where we are estimating abundance, survival, and population structure, using juvenile samples only.

2:30-2:45 The connectivity of dugong populations: a case for regional co-management

MARSH, H¹

¹ School of Earth & Environmental Sciences, James Cook University, Townsville, Australia

The dugong is a species of conservation concern that is of high cultural value to both Indigenous and non-Indigenous Australians. The most significant management actions are those that increase the survival of adult animals. Even though dugongs are seagrass community specialists, both genetic and tracking data indicate that dugong populations function over spatial scales of up to several hundred kilometers. Individual dugongs make variable movements ranging from commuting movements to macro-scale movements of up to several hundred kilometers in a few days. The Indigenous hunters that target dugongs and the fishers that catch them incidentally in nets also operate at individualistic spatial scales. Regional co-management of the activities of both hunters and fishers at scales that are ecologically relevant to dugongs should be encouraged as essential components of dugong management. The management plans of individual Indigenous communities should be coordinated across spatial scales that are both culturally and ecologically relevant. Fishers need to be enabled to operate at local scales so that their local knowledge can contribute to reducing the risk of dugongs accidentally drowning in nets.

2:45-3:00 Green turtle post-nesting migration from flipper and satellite tagging: potential to establish sub-regional management units

Bell, LAJ¹, SIOTA, C¹ and Anderson, P¹

¹Secretariat of the Pacific Regional Environment Programme (SPREP), PO Box 240, Apia, Samoa

The migratory nature of marine turtles, foraging in one area (country) and nesting in another, makes conservation effort of stocks difficult. Based on site-based monitoring, genetic analyses, mark-recapture studies and telemetry, Wallace *et al* (2010) established “management units as a solution in organizing marine turtles into units of protection above the level of nesting populations, but below the level of species”.

Analysis of movement data of green turtles tagged at nesting sites, and recaptured at foraging areas, as well post-nesting migration from satellite tag movement maps, show potential of this information to establish sub-regional green turtle population management units. Although data confirms that turtles migrate through-out the region, and that turtles nesting in a particular site forage in more than one other country/territory, there are strong patterns linking certain nesting areas and foraging grounds. Marine turtle flipper tag recaptures and migration maps from satellite tagging show that green turtles that nest in the western Pacific Islands, forage mainly in Asia; those nesting in the central Pacific, forage mainly within the central area; and those nesting in East Pacific Islands, forage mainly in Fiji. These patterns can be used to establish sub-regional management units to improve protection of turtle stocks.

3:00-3:15 The importance of understanding spatial connectivity for the conservation management of manta rays

TOWNSEND, K¹, Jaine, F¹, Couturier, L¹, Vanderline, N¹, Bennett, M¹, Richardson, A¹ and Weeks, S¹

¹Project Manta, The University of Queensland, St. Lucia, QLD, 4072

The manta rays are the world's largest ray species, reaching a wing span of up to 7m across. They are a long lived, slow growing species with low reproductive rates and their populations are susceptible to impacts such as bycatch, boat strike, entanglement in marine debris, and direct fisheries. The consequence of these impacts is the decline of some populations around the world, including Mexico, Africa and Indonesia. In 2012, both *Manta birostris* and *Manta alfredi* were listed as Vulnerable to extinction on the IUCN Red List of Threatened Species. While recent tracking work has shown significant site fidelity and predictability of occurrence; it has also highlighted that both species can migrate great distances (>600km) and are closely associated with oceanographic features such as frontal zones. They regularly forage for plankton over very large spatial scales (100's of km), which is at a scale that is outside of existing MPA networks, and they regularly cross state and international boundaries. This wide ranging movement pattern across multiple legal jurisdictions, plus the site fidelity at specific locations, presents conservation management challenges that are not unlike many other marine species (e.g. sea turtles and whale sharks). Current static and disconnected MPAs provide limited protection for these wide ranging species. The pros and cons of the recently suggested "dynamic protected areas" (Graham et al, 2012) that overlay the strongly associated frontal regions are discussed.

3:15-3:30 Ecological risk management – incorporating scientific research into fisheries management – the AFMA experience

RYAN, P¹

¹Australian Fisheries Management Authority

The Australian Fisheries Management Authority (AFMA) has adapted its management approach to incorporate a risk assessment / risk management framework. The implementation of an Ecological Risk Management (ERM) framework is a key initiative driving the implementation of the ecological component of Ecologically Sustainable Development (ESD) in Commonwealth managed fisheries. The framework details a process for assessing and progressively addressing the impacts that fisheries' activities have on five aspects of the marine ecosystem: target species, byproduct and discard species, protected species, habitats and communities. A progression of risk assessments have now been completed for all major Commonwealth managed fisheries. The risk assessment methodologies developed by the CSIRO are hierarchical in their approach and are an efficient means of screening out low risk activities and focusing increasing attention on those activities assessed as having a greater environmental impact on Australia's fisheries. The result of these risk assessments is a priority list identifying the key ecological areas in each fishery that require management attention. Ecological risk management strategies have now been developed to address the priority lists identified for each fishery. AFMA is responding to identified risks through a number of initiatives. To date it has not been clear how or if they integrate together. AFMA is currently developing a comprehensive description of its overall fisheries management package as the basis for assessment of its environmental performance. This framework draws each major initiative together in one consistent framework to provide stakeholders with clarity on their integration. The key initiatives to be highlighted include:

- ecological risk assessments and ecological risk management;
- harvest strategy policy,
- fishery stock assessments;
- the 2005 Ministerial Direction to AFMA,
- the Environment Protection and Biodiversity Conservation Act 1999 and its assessment processes; and
- the Commonwealth Bycatch Policy and more recent AFMA Guidelines on reducing bycatch.

The final product of this process will be a comprehensive summary of AFMA's fisheries management system that can be accredited under Australia's environmental legislation. A relevant example of the application of the ERM framework to mammal interactions is the Australian Sea Lion Management Strategy.

Symposium: REDD+: integrating biodiversity conservation into climate change mitigation

Organizer: Mike Lawes

Climate change mitigation and biodiversity conservation are intrinsically linked but rarely considered together, despite the original intention at the Rio Earth Summit in 1992 that adopted both the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity as an integrated package. Negotiations leading to the Kyoto Protocol forfeited using forests and ecosystems generally for climate mitigation, decoupling biodiversity from carbon pollution reduction and climate change. Reducing emissions from deforestation and degradation (REDD) emerged in 2005 at the Bali Conference of Parties, to account for at least one forest ecosystem service. To date the voluntary carbon market has largely shaped markets in forests and ecosystem services. REDD+, formally defined only in 2010 at the Cancun Conference of Parties to broadly include conservation and sustainable management, potentially provides an unprecedented opportunity for biodiversity conservation to be included in climate change remediation. How is this playing out in our region?

2:00-2:15 The potential of Blue Carbon as keystone habitats in climate change mitigation and adaptationCAMERON, C¹¹Research Institute for the Environment and Livelihoods, Charles Darwin University, Darwin NT 0909

Coastal and marine ecosystems have been demonstrated to be extremely effective and efficient in the sequestration and storage of atmospheric carbon, and thus could play a key role in climate change mitigation and adaptation. Blue Carbon, the carbon sequestered by living organisms throughout the world's ocean and coastal environments, is stored in the form of living biomass and extensive sedimentary deposits (i.e. the burial of organic matter in sediment) typically associated with mangroves, salt marshes and seagrass beds as they accrete vertically. Because the sediment beneath these habitats is typically anoxic (i.e. low oxygen), organic carbon is not broken down and released by microbes as typically occurs in terrestrial biomes. While comprising only 0.05% of the amount of above ground biomass of terrestrial plants, they store and sequester overall a comparable amount of total organic carbon per year as terrestrial ecosystems. Thus, projects to improve the condition and function of such habitats have the potential to operate as extremely efficient carbon sinks both on short and long-term time-scales. The additional ecosystem service benefits and biodiversity importance of Blue Carbon habitats are highly significant, which means that projects focused on mangrove rehabilitation as a means of sequestering and storing carbon may also have substantive co-benefits. This presentation firstly outlines the emergent role of Blue Carbon within international climate change mitigation and adaptation discourse, along with the additional biodiversity and ecosystem service values such habitats provide. This is followed by a brief outline of a potential program of work under development to establish Blue Carbon demonstration sites in Indonesia.

2:15-2:30 The Integration of Biodiversity and Climate Change: A contextual assessment of the Carbon Farming Initiative

VAN OOSTERZEE, P¹

¹Biocarbon Pty Ltd and Research Institute for the Environment and Livelihoods, Charles Darwin University, Darwin NT 0909

The Carbon Farming Initiative (CFI) allows the creation of tradable Australian Carbon Credit Units (ACCUs) broadly from the ecosystem sector via project-level baseline and credit activities. The project development process is complex and costly, and uptake is likely to be low. Biodiversity considerations are not integrated into the CFI but, rather, are dealt with indirectly through safeguard measures that avoid perverse incentives and unintended harm. I show how international politics and policy have influenced the design of the CFI with its potential to proliferate complex and narrow methodologies, and counter-productive approaches to integrity standards such as permanence. Despite the pressing need to integrate biodiversity and climate change considerations as equally important challenges, their integration remains poorly articulated. A crucial outcome for biodiversity and climate change is for the CFI to thrive. I suggest that to do that we need to move past the shackles of Kyoto toward landscape approaches that allow ecosystem-based activities to opt-into the Clean Energy Act and out of the voluntary carbon market, and by using standardized approaches such as regional baselines and risk-based assessments.

2:30-2:45 Assessing carbon stocks across land cover types in the YUS Conservation Area, Papua New Guinea: implications for REDD+

VENTER, M, Dieleman, W, Gillieson, D, Ramachandra, A and Bird, MI

Center for Tropical Environmental and Sustainability Science, James Cook University, Cairns QLD 4878

Two basic interventions exist for REDD+; the first is reducing emissions from forest loss, the second is the sequestration of atmospheric carbon (C) into forest biomass. Both interventions require adequate measurement of the C stored in forest. Most of the remaining uncertainty in estimates of tropical forest C stocks results from an inadequate understanding of how stocks vary spatially and the environmental factors that drive this variation, caused mainly by the paucity of on-the-ground measurements. We evaluate the influence of topography and elevation and other environmental factors on C stocks in primary forests along a 3000m elevation gradient in PNG. Above-ground-biomass and soil organic carbon in 9 elevation categories ranged from 228 ± 59 to 381 ± 72 $\text{MgC} \cdot \text{ha}^{-1}$ with a mean of 306 ± 78 $\text{MgC} \cdot \text{ha}^{-1}$, higher than previous estimates reported for PNG. Landscape scale variability in forest C stocks was considerable and elevation had the strongest effect on C stocks. We also measured C stocks in four anthropogenic land-uses bordering the primary forest. Although anthropogenic landscapes stored much less carbon than primary forest, our results suggest that intervention within these landscapes could yield greater climate mitigation benefits than avoided deforestation because of current low deforestation rates in the area.

2:45-3:00 Assessing spatial priorities for carbon forestry and biodiversity conservation
CARWARDINE, J¹, Watts, M², Polglase, P¹, Hawkins, C¹, Reeson, A¹, Possingham, H² and Martin, T¹

¹CSIRO

²University of Queensland

A carbon economy provides incentives for reforestation to reduce net carbon emissions. Carbon forestry has the potential to benefit biodiversity, but the extent of these benefits depends on the locations of and approaches to carbon reforestation. Here we demonstrate a continental-scale approach for assessing the spatial trade-offs and opportunities for carbon sequestration and biodiversity conservation through reforestation. Using Australia as a case study, we compare profitable areas for carbon forestry under a carbon price of \$20/ tonne with optimal areas for meeting a biodiversity goal of restoring ecosystems to 30% of their original extent. Our analysis shows that biodiversity benefits accumulate as more areas are planted for carbon forestry, but that many biodiversity goals will be unmet under a forestry landscape designed for carbon alone. A biodiversity fund has the potential to shift carbon forestry landscapes to meet biodiversity restoration goals. An integrated planning approach enables the design of a carbon forestry landscape that meets combined carbon and biodiversity goals more efficiently.

3:00-3:30 DISCUSSION

Open Session: Community Conservation**2:00-2:15 Community Monitoring in Tree Kangaroo Conservation in PNG**KROCKENBERGER, A¹, Ziembicki, M and Porolak, G¹School of Marine and Tropical Biology, Centre for Tropical Sustainability Science, James Cook University, Cairns

In 2009, the YUS Conservation Area became the first area ever to be gazetted under PNG's 1978 Conservation area legislation. This gazettal codified over a decade of consultation and conservation work by the Seattle-based Tree Kangaroo Conservation Program (TKCP) with traditional landowners in the YUS local government area, on the Huon Peninsula, Morobe Province. The PNG 1978 Conservation Area Act requires that a gazetted conservation area be managed in accordance with a management plan agreed by landowners and all areas of government. Since 2010 we have worked with local landowners and the TKCP to establish an on-going monitoring program designed to inform that nascent management plan. We will discuss our establishment of a YUS Community Ranger program (funded in perpetuity by a conservation trust) and the ecological monitoring program those rangers work within. We will consider the strengths and certain limitations of the program, as well as some of the initial results of that program, that have allowed us to determine the distribution and relative abundance of 3 species of macropodid, cassowaries and a suite of possums throughout the YUS landscape with respect to variation in elevation and proximity to villages. These results provide us with an understanding of the ecological drivers of the abundance of medium-sized mammals in this area, as well as baseline to assess the performance of the conservation area's management plan in future.

2:15-2:30 Natural resource harvesting in Ramingining: Making ends meet?HONER, M¹¹The Research Institute for the Environment and Livelihoods, Charles Darwin University, Darwin NT 0909, Australia

Ramingining Yolngu people exploit a rich biodiversity whilst confronting competing challenges. Here, we present findings on how these households rely on natural resources for food, income and to meet social and cultural demands as part of an enduring Aboriginal culture. Seasonal surveys were conducted in the Ramingining area with 21 households over a 16 month period (2008-2010). Our results show Ramingining Yolngu now rely less on natural resources than reported by anthropologists in the 1970s and 1980s among the neighbouring Murgin and Gunwinggu people. Natural resource use now complements Yolngu livelihoods for subsistence and commercial use rather than sustains them. A hunting preference for animals rather than gathering plants is evident. Commercial natural resource use is often art production related despite reasonable alternatives. With most community members on welfare payments (like unemployment, parenting and pension allowances, and Community Development Employment), our results indicate that monetary incomes do not meet basic household and social food needs. Yolngu resort to harvesting natural resources for food and art production to make ends meet. Similar natural resource use will probably continue as Ramingining Yolngu strive to meet livelihood needs.

2:30-2:45 The Piku Project: Pig-nosed Turtle (*Carettochelys insculpta*) community led conservation in the Kikori region of Papua New Guinea

EISEMBERG, CC¹, Rose, M², Amepou, Y³ and Georges, A¹

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²Fauna & Flora International, Jupiter House, 4th Floor, Station Road, Cambridge UK;

³The Papua New Guinea Institute of Biological Research, PO BOX 1550, Goroka, EHP, Papua New Guinea.

The Pig-nosed Turtle (*Carettochelys insculpta*) is an evolutionarily distinct species and unusual in many facets of its morphology, ecology and behaviour. In the Kikori region, Gulf Province, Papua New Guinea, the introduction of outboard motors and modern fishing equipment is related to increased capture rates and population declines of *C. insculpta*. Local villagers harvest Pig-nosed Turtle eggs with an efficiency close to 95%. We present the findings and activities developed for Pig-nosed Turtle conservation and management during the “Piku Project” from January to April, 2012. We monitored market and village consumption of eggs, protected major turtle nesting sandbanks (Wau Creek), and raised awareness in communities along the Kikori River. Egg consumption in villages and the market and nest mortality were compared with the 1980-82 and 2007-09 nesting seasons. Nest survival rate from the 2011-12 nesting season was compared with 2008-09 and between protected and non-protected areas. The declining trend observed in village consumption during 2007-09 continues to be present in 2011-12. Although the number of nests inside the protected area that survived to the end of the incubation period was low (n=8), we found no evidence of nest survival outside the protected area.

2:45-3:00 Shared Responsibility for Conservation in Regional Australia

WALLINGTON, T^{1,2}, Robinson, CJ¹ and Taylor, B¹

¹Social and Economic Sciences Program, CSIRO Ecosystem Sciences, Ecosciences Precinct, 41 Boggo Road, Dutton Park QLD 4102

²Adjunct Senior Fellow, Sociology, The University of Queensland

The new regional paradigm for natural resource management (NRM) in Australia signals a significant departure from the traditional model of individual landholder responsibility for land-use decision making. In this community-based approach, regional groups are now responsible for setting the standards by which to judge progress towards sustainability in their region. The rationale is that a community-based approach will be more responsive to local knowledge and priorities; will foster shared ownership of problems based on shared interests; and will therefore foster shared responsibility for implementing proposed solutions. A four-year study of NRM groups in the tropical savanna regions of northern Australia shows that locally relevant targets and pathways to achieve them have been set by communities to suit the social, political and cultural realities and priorities of their region. While program rules require that regional targets contribute to the scientifically determined biophysical standards agreed by central governments, regional processes broadened notions of expertise beyond science, and standards have been re-interpreted and legitimised by holders of local knowledge. This research confirms that shared responsibility relies on due recognition of the shared interests and local knowledge of regional actors, and on the pragmatic legitimisation of ‘universal’ knowledge and priorities.

3:00-3:15 Two-Way Learning: Science and Indigenous Ecological Knowledge of Euryhaline Elasmobranchs in the Roper River, Northern Territory

EVERY, S¹, Kyne, P¹ and Edyvane, KS¹

¹Charles Darwin University, Northern Territory, Australia

Northern Australia is a global stronghold for populations of euryhaline and coastal elasmobranchs, particularly rare, threatened, endangered and protected species, such as sawfishes and river sharks, including *Pristis clavata*, *Pristis microdon*, *Pristis zijsron*, *Anoxypristis cuspidate*, *Glyphis garricki* and *Glyphis glyphis* and also, the Freshwater Whipray *Himantura dalyensis*. These species, along with other sharks and rays are of major cultural, spiritual and totemic significance to the traditional, Indigenous coastal communities in northern Australia. While many of these species continue to be at risk, effective conservation and management is currently limited by an acute lack of data, particularly in the remote gulf rivers and inshore waters of the Northern Territory. Abundance and distribution, and also, improved understanding of biology, connectivity, habitat requirements, population genetic structure and key threats, are essential to inform population status, assessment and trajectories. In the intact, cultural landscapes of northern Australia, Indigenous ecological knowledge (and collaboration with remote Indigenous communities) also has the potential to provide invaluable knowledge and insights into population status, biology, movement and ecology. As part of the recently-funded, NERP Marine Biodiversity Hub, this PhD project will adopt an innovative, cross-cultural approach to improving knowledge and understanding of euryhaline elasmobranchs in the Roper River region, in the remote western Gulf of Carpentaria. Building on previous surveys and research, this project aims to improve understanding of biology, distribution, habitat utilisation and movement, through systematic monitoring, tagging, close-kin genetic analysis and tracking of priority species. The project will also, undertake cultural studies, surveys and interviews to document indigenous ecological knowledge of key species.

3:15-3:30 Pacific Conservation Biology: Building and working with your journal

CALVER, M¹

¹Murdoch University

When *Pacific Conservation Biology* was launched in 1993, foundation editor Craig Moritz aimed to tap the potential of world-class conservation researchers and managers within the Pacific region to solve pressing conservation problems, and to encourage communications across research biologists and administrators in government and non-government organisations. Now, 18 years and four Editors-in-chief later, the journal thrives, publishing Forum Essays, News and Views, book reviews and 25 – 32 research papers over four issues each year. Over the period 1993 – 2007 authors came from Australia (73%), the Americas (12%), New Zealand (8%) other Pacific and Asian countries (4%), Europe (2%) and others (1%). Authors citing *Pacific Conservation Biology* came from Australia and 82 other countries. PCB is recognised as an affiliate journal of the SCB. Published analyses of PCB's profile place it in the category of 'internationally recognised regional journal', with an editorial board and authorship with regional emphasis but attracting international citations. PCB has a web site (<http://pcb.murdoch.edu.au/>) and all issues are available online through the Informit database. Members of the Oceania chapter of the SCB can support PCB by: checking that your university library links to PCB papers in Informit directly from the library catalogue (Australian university libraries should have an Informit subscription), citing PCB papers wherever possible (the PCB website lists titles and abstracts of all papers, Scopus listings for earlier issues are incomplete), supporting requests to review papers, and submitting relevant manuscripts.

Open Session: Indigenous Conservation**2:00-2:15 Evaluation of management tools for an Indigenous traditional fishery**DELISLE, A¹, Stoeckl, N² and Marsh, H³¹School of Earth & Environmental Sciences/School of Business, James Cook University, Townsville, 4811, Australia²School of Business, James Cook University, Townsville, 4811, Australia³School of Earth & Environmental Sciences, James Cook University, Townsville, Australia

Traditional hunting of dugongs and green turtles in the Torres Strait has occurred for 4000 years. The rights of Torres Strait Islanders to hunt these species are recognised in Commonwealth and state laws and an international treaty between Australia and Papua New Guinea. Local stakeholders and government agencies are working together to implement co-management arrangements for the Torres Strait traditional turtle and dugong fisheries that acknowledge the ecological and cultural significance of both species. The remoteness of Torres Strait and the legal rights of the hunters mean that management tools need to be acceptable to the local community, self-monitored and enforced. We evaluated the perceived social, cultural, environmental and financial impacts of several management tools, some of which have already been identified in community management plans. We found that the fishers prefer tools that reinforce the cultural aspects of the traditional fisheries. We conclude that policies aiming to connect cultural aspects to the environment may be more likely to succeed than those that connect financial aspects to the environment in this Indigenous traditional fishery.

2:15-2:30 Traditional ecological knowledge and wildlife utilization in Papua, IndonesiaPATTISELANNO, F¹ and Krockenberger, A¹¹School of Marine and Tropical Biology, James Cook University QLD Australia

The majority of the indigenous people of Papua are dependent on traditional use of plants and animals from tropical forests. Traditional ecological knowledge and practices which have been developed and passed down through generations by cultural transmission for millennia, include practices that directly promote sustainable use of wildlife resources. These practices include selecting hunting of prey, using traditional hunting weapons, assigning hunting tenure and practicing certain taboos related to hunting. Regrettably, other traditional practices are potentially creating a massive loss of wildlife species. Increase in human population and greater access to tropical forests have also created significant impact on wildlife population in tropical forests. Nevertheless the major threats to wildlife populations in the area are those most familiar in other tropical forests: the outright destruction of habitat, habitat alteration and fragmentation. This paper describes a promising program of Majelis Rakyat Papua (MRP) – Papuan Community Assembly supporting socio-cultural empowerment policy through endeavors to enrich local wisdom and values, which has the potential to greatly assist co-management for sustainable customary management in wildlife conservation in Papua.

2:30-2:45 Empowerment of Indigenous land managers through appropriate management of cost recovery contracts

GORMAN, J¹ and Vemuri, S²

¹ Research Institute for the Environment and Livelihoods, CDU

² School of law and Business, CDU

This paper is concerned with the delivery of natural resource management activities by Indigenous people in the Northern Territory. The need for accountability of Federal funding for land management has led to a shift in the model of delivery of Indigenous land management practices from being program to activity based. This presentation highlights risks associated with – (a) conditions of contracts derived from the buyers of these services with little cultural input from the custodial land managers, (b) high transaction costs of engaging with Aboriginal groups and negotiating contracts which potentially may limit the participation of many potential buyers who might wish to invest in Indigenous natural and cultural resource management. We propose a framework to reduce transaction costs and enable to make informed decisions that better promote access to the services that Aboriginal people can perform on their country. The paper highlights need for appropriate training and mentoring to groups providing services in order to make themselves business ready to take control of this method of delivery and ensure ‘suitable’ people are involved in providing these services.

2:45-3:00 The Contribution of Indigenous Wildlife-based Enterprises to Conservation in the Northern Territory

AUSTIN, BJ.¹

¹ Research Institute for Environment and Livelihoods, Charles Darwin University, Darwin, Northern Territory, Australia

It is often purported that the sustainable consumptive use of wildlife has contributed positively to conservation in various places throughout the world. Based on doctoral research that investigated success factors for Indigenous Wildlife-based Enterprises (IWBEs) in northern Australia, this paper questions whether IWBEs contribute to conservation in the region. It is suggested that, up to this point in time, IWBEs have made little direct contribution to conservation on the Indigenous estate in northern Australia. However, they do contribute indirectly as the livelihood income generated from the commercial use of wildlife enhances the ability of people to visit or occupy remote parts of their estate. Given the distribution and density of population in the Northern Territory, this presence is important to conservation efforts as it enhances peoples’ capacity to look after country and protect against threats to biodiversity, such as invasive weeds, feral animals, and wildfires.

3:00-3:15 Prospects for whale shark conservation in eastern Indonesia through Bajo traditional ecological knowledge and community-based monitoring

Karam, J¹ and STACEY, N¹

¹Research Institute for Environment and Livelihoods, Charles Darwin University, Darwin, NT Australia

The whale shark, *Rhincodon typus*, is a long-lived migratory species inhabiting tropical and warm-temperate waters worldwide. Seasonal aggregations of whale sharks in shallow coastal waters of many countries have led to the development of ecotourism industries. Whale sharks that aggregate seasonally at Ningaloo Reef, Western Australia have a migration range within Indonesian and Southeast Asian waters. However, very little is known about their behaviour, local migration patterns or potential threats faced in this region. In this paper we investigate traditional ecological knowledge of whale sharks through interviews with Bajo and other fishers from five settlements in the Timor and Roti Islands, eastern Indonesia. We found there are culturally driven prohibitions and customary beliefs concerning whale sharks among Bajo fishermen who commonly sight sharks in the Timor Sea, in southern Indonesian and Timor Leste waters. Sightings are most common during the months of August to December. Interviews also indicate a low level of harvesting of whale sharks in the region. The results demonstrate the potential combination of traditional ecological knowledge and new technology to develop whale shark management strategies, and to determine their predictability as one vital factor in determining the potential for development of small-scale whale shark ecotourism initiatives.

3:15-3:30 Establishment of a traditional Aboriginal burning program on a Northern Territory mining lease

DANIEL McINTYRE and Amber Hooke

¹Energy Resources of Australia Ltd

In 2007, Energy Resources of Australia Ltd. (ERA) established a traditional burning program on its Ranger Project Area (RPA) and Jabiluka mineral lease. The program was an outcome of consultations in 2006, where Mirarr Traditional Owners indicated interest in being involved in fire management on non-operational areas. After the pilot project in 2007, the program continued in 2009 and 2011-12. Burns were focussed around the sandstone outlier on the Jabiluka lease and north of Magela creek on the RPA. The burns were conducted in the early dry season (May-June) by small mobile groups using matches for ignitions, which resulted in cool patchy burns that were compatible with biodiversity protection outcomes. In addition, the program provided indirect protection for significant cultural sites and fire sensitive vegetation species on the Jabiluka lease through fuel reduction of native Sorghum grass around the sandstone outlier. The main success of the program has been to provide the opportunity for Traditional Owners to practice traditional fire management on their country. The long term view for the program is that Mirarr Traditional Owners can have a prominent role in fire management at and post closure.

**Symposium: Spatial connectivity and the management of threatened marine vertebrates
- Continued**

Organizers: Kiki Dethmers, Peter Kyne and Mark Hamann

4:00-4:15 Evaluation of marine wildlife conservation projects

PENROSE, H¹

¹James Cook University, Townsville QLD 4811

Many of the world's marine wildlife populations are threatened by anthropogenic processes and many species are listed as threatened by State and National and International legislation. Consequently, marine wildlife conservation projects have gained momentum and they now exist in dozens of countries throughout the world. These projects are run, managed and funded, even within single nations, by a large array of institutions and often involve considerable amounts of time, money and support to succeed. Furthermore, one could often argue that in order to achieve positive conservation outcomes the time, money and support need to be delivered over long time frames to counter species longevity. Rarely however, are the benchmarks for success, or necessary evaluation tools explored and implemented to determine project or program success. Defining "success" and how it is assessed are two of the fundamental issues that often lead to project and program evaluation being placed in the "too hard basket". There are endless criteria, and combinations of criteria that one could use to evaluate success (e.g. biological scales (single species through to ecosystem), social scales (human community benefits), economic scales etc.). In this presentation we (1) apply "program logic" and "program evaluation" to a large (~\$1million) turtle and dugong conservation project in north Queensland, Australia to serve as an example of project monitoring and evaluation processes (2) the determination of research impact and (3) provide examples of evaluation tools that can easily be incorporated into project or project plans to judge short term and long term success. Our research data indicate that we increased knowledge, attitudes and aspiration of Indigenous participants and Indigenous government agencies and that these increases have had positive conservation value. One key area that our evaluation revealed was that effective communication was challenging and communication models for researchers and stakeholders need to be "two-way" and incorporate many communication tools. Overall we show that program logic and monitoring and evaluation strategies are effective tools for researchers to use to demonstrate research impact and can aid research groups (researchers and end users) to maximize the value of research in terms of delivering conservation outcomes.

4:15-4:30 Marine Conservation Planning in New Zealand

LUNDQUIST, C¹, Cooper, S, Funnell, G and Pohl, I

¹Marine Ecosystems Team, Department of Conservation Wellington, New Zealand

New Zealand's Exclusive Economic Zone covers over 4,000,000 km², and is a global diversity hotspot due to its geographic isolation, physiographic complexity and complex circulation. "PlanBlue", the New Zealand Department of Conservation's new strategic approach, will develop, implement and promote conservation objectives as an integral part of an ecosystem-based approach to marine management. PlanBlue prioritises research into three themes: 1) Marine Conservation Planning; 2) Ecosystem Integrity; and 3) Understanding Marine Pressures. Here, we discuss progress on our MCP theme, where we are developing a transparent, inclusive, robust and efficient ecosystem-based approach to marine spatial planning. We have identified SeaSketch as a key component of our MCP process, providing a web-based tool that provides not only an end-user driven decision-making tool, but also will provide the Department of Conservation with education and communication tools, data management and display tools, and data collection tools. While early in New Zealand's MCP process, we are working together with SeaSketch to identify data requirements and geospatial frameworks, and to design the tool to maximise long-term success of the MCP process through communication and engagement with the public and stakeholders. Our first case study for MCP is anticipated to be the Hauraki Gulf, the largest population centre in New Zealand, and a location encompassing a broad range of recreational, commercial, and cultural uses.

4:30-4:45 Looking for dolphins and dugongs in northern Australia

BEASLEY, I¹ and Marsh, H¹

¹School of Earth and Environmental Sciences, James Cook University, Townsville QLD 4811

The knowledge of Traditional Owners and activities of Indigenous sea ranger groups throughout northern Australia are integral to long-term monitoring and management of little-known inshore dolphins. Australia snubfin and Indo-Pacific humpback dolphins occur in small populations in northern Australian coastal waters. Both species are susceptible to human activities, and there is significant concern about their viability. Certain areas in the Gulf of Carpentaria and northern Queensland are potentially important habitats for both species but information on their distribution and abundance is limited. This project used a combination of: (1) mapping workshops with Traditional Owners and community members, (2) data collected through general sea ranger patrols and dedicated surveys, and (3) Western-style boat-based and photo-identification surveys, to increase knowledge of inshore dolphins in northern Australia. A novel methodology for Sea Ranger groups to collect long-term information on inshore dolphin and dugong distribution and abundance is being developed, with scope for this method to be applied around northern Australia.

4:45-5:00 Sooty Shearwater conservation program in New Zealand

NEVINS, H¹

¹ Oikonos - Ecosystem Knowledge

5:00-5:30 DISCUSSION

Blue 5.1.1

16.00 - 17.30

Workshop: How to start an SCB Chapter in your city or university

Organizer: Rosalynn Anderson-Lederer

Local SCB chapters are where grass-roots conservation work is cultivated. Chapters participate in community based conservation schemes, identify and address necessary changes to public policy and engage in outreach programmes involving education (grade school to university). Chapters can comprise of professionals, students, faculty in academic institutions or a combination of all three. The chapters work closely with regional sections as well as other groups within SCB. If you or someone you know is considering starting chapter in your area, join us for this session.

Open Session: Community Conservation (continued)**4:00-4:15 Animal Conservation Status in Plant Genetic Protection Area of Nampung Dam, Northeast of Thailand**

PONGTHEP SUWANWAREE, P¹, Aroon, S, Suwanrat, J, Hengbunmee, S, and Strine, CT
¹ Suranaree University of Technology

The Plant Genetic Conservation Project, under The Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn, is set up to protect plants and animals and allows sustainable use of biodiversity resources by local people. The study area contains dry dipterocarp forest and mixed deciduous forest. Animal surveys were conducted in November 2011 and February 2012. Many standard methods for surveying vertebrate groups were used, including point count, direct observation, line transect, pitfall trapping, live trapping, mist netting, and interview. A total of 192 vertebrate species were recorded, including 121 birds, 7 mammals, 8 amphibians, 17 reptiles, and 39 fishes. Of these, only *Ophiophagus hannah* is listed as vulnerable species in the 2010 IUCN Red List of Threatened Species. The area is closed to dam office and urban area; it is under high pressure from local poachers. Big animals were not found since people, cow, buffalo, dog and cat roam the area freely. Therefore raising conservation awareness for local people and restricted area enforcement are urgently needed.

4:15-4:30 ‘Working Knowledge’: synthesising local ecological knowledge from Indigenous people, pastoralists and scientists about Oriners Station, Cape York.

BARBER, M¹, Jackson, S¹, Shellberg, J² and Sinnamon, V³

¹ CSIRO, Berrimah, Northern Territory 0822

² Griffith University, Queensland, Australia

³ KALNRMO

This presentation describes the results of a knowledge recovery project about a remote and ecologically valuable pastoral station in central western Cape York. The station is now owned by the Kowanyama community and managed for NRM and heritage values, but a wider knowledge and information base was required for future management activity. Colonialism had radically altered traditional Indigenous residence patterns and 20th century residence was sparse, but the presence of Indigenous and non-Indigenous cattlemen on a rotational basis from the 1940s enabled the collection of local ecological history to complement the scientific information available. Semi-structured interviews with former Indigenous cattlemen and/or current Indigenous rangers were complemented by interviews with key members of the Hughes family, non-Indigenous pastoralists with a 100 year history in the Mitchell River catchment and the former owners of Oriners. This in turn was combined with scientific knowledge from the literature and from one of the authors (Shellberg), a geomorphologist with extensive fieldwork experience of the catchment. The resulting synthesis is described as ‘working knowledge’, a term which describes the contexts in which local ecological knowledge was learned, it’s ongoing provisional quality, and it’s orientation towards facilitating future management action by Indigenous owners.

4:30-4:45 The suitability of Sugar Gliders (*Petaurus breviceps*) as domestic companions: an analysis of survey data

DI QUAL, A¹

¹School of Biological, Earth and Environmental Sciences, The University of New South Wales

Globally there are many threats to wild populations of animals. National Parks networks and other "traditional" conservation initiatives work in some cases, however, these can be costly, limited to specific geographic regions and are not always in the places where they are most needed or effective. As such, additional cost-effective means of conserving and protecting endangered species are appropriate and possibly required for maximising the likelihood of effective, long-term conservation. One strategy with the potential to assist with long-term conservation is to establish a well regulated companion animal industry for Australian fauna. This could become a financially self-sufficient endeavour, with the potential to increase public commitment to native animals and their habitats being secured into the future. However, little is known about the suitability of Australian marsupials as companion animals. This project looks at one such species, *Petaurus breviceps* (Sugar Gliders), to determine if they are suitable to be kept as a companion animal. A total of 216 individuals who kept 1463 Sugar Gliders between them volunteered to participate in this study. Based on a questionnaire sent to these participants, it was found that Sugar Gliders are a suitable species to be kept as a companion animal in terms of twelve criteria. These included, but are not limited to: how people interact and bond with Sugar Gliders as pets; the demands they place on owner's time and resources; animal welfare issues; potentially unfavourable behaviours or other attributes; and financial matters. Pet Sugar Gliders were found to have relatively low incidences of health problems, particularly when compared with domestic cats. This suggests that keepers were providing appropriate husbandry to their Sugar Gliders, significantly reducing concerns about poor animal welfare. These results provide support for trials that could be undertaken in Australia to further assess the potential benefits and/or problems associated with the keeping of Sugar Gliders as companion animals. Further research could include discovering the most appropriate regulatory frameworks for organisations and individuals that: own; breed; and sell Sugar Gliders. More research could be done to determine how best to provide a support network for veterinary care, advice and effective owner education. If successful, these trials and research could lead to establishing a controlled industry focusing on native animals as domestic companions, and the potential conservation benefits this could entail.

4:45-5:00 Wildlife Consumption in Sarawak, Borneo

MOHD-AZLAN, J¹ and Kirupaliny, SB¹

¹Department of Zoology, Faculty of Resource Science and Technology, Universiti Malaysia Sarawak

People have hunted wildlife in Bornean forest for over 50,000 years. The importance of hunting for subsistence has been increasingly outweighed by hunting for markets mostly for local consumptions using modern techniques. Survey on wildlife utilization and regulation in Sarawak was carried out from November 2011 to April 2012. Interview and market survey was made at selected areas of South and Central region of Sarawak. Recent subsistence hunting mostly focused on pigs (*Sus barbatus*), deer (*Rusa unicolor*), civets and pangolin (*Manis javanica*) with a minimum of thirteen species recorded with some species receiving protection status from Sarawak Wild Life Protection Ordinance 1998. The pangolin is listed in the IUCN 2012 Endangered category. Lack of awareness is partly the reason for wildlife sale. Increased resources to the enforcing agencies with evenly distributed enforcement staff according to regional areas may help mitigate this matter. This is a complex issue that needs careful attention. Additionally there is an urgent need to revise the existing legislation. Strong socio-political advocacy is desperately needed which will assist this process.

5:00-5:15 How much pest monitoring is enough? Investing resources to monitoring in pest management programs

CHOQUENOT, D¹ and Warburton, B¹

¹Institute for Applied Ecology, University of Canberra, Canberra ACT 2601, Australia

²Landcare Research, Gerald St. Lincoln, New Zealand

The proportion of a pest control budget allocated to monitoring operational success or failure is a largely arbitrary decision. A more functional approach would be to identify the proportional investment that balances the cost and benefits of monitoring. Monitoring costs are the sum of the direct costs of monitoring activity and the value of the increased probability (risk) of operational failure arising from redirection of operational budget away from control. Monitoring benefits are the value of pest impacts avoided wherever monitoring reveals an operational failure that can be remedied. Setting the relationship between monitoring and operational failure into a hypothesis setting framework allows the amount of monitoring and the probability of detecting an operational failure to be explored using the concept of statistical power and its analytical treatment. In this study, we develop this approach and apply it to the real world problem of identifying what proportion of a possum control budget should be spent on monitoring.

5:15-5:30 Broad-Spectrum-Academics' Essays in *Pacific Conservation Biology*

FULTON, GR¹

¹Murdoch University

These essays are published in the Forum Essay section of *Pacific Conservation Biology*. They are a broad range of essays written by a very broad range of academics, many of whom are drawn from outside conservation biology. Why? To capture alternative perspectives on conservation! These essays are intended *to go beyond the usual preaching to the converted* to broaden the thinking and knowledge base of conservation science: an obvious example is learning from Indigenous People. Noam Chomsky of the Massachusetts Institute of Technology (MIT) described the idea as an “Impressive Conception!”. Writers benefit from writing outside their ‘usual spheres’ through engaging lateral thinking processes and exploring new research pathways or through drawing on their specific knowledge to advocate ideas. Those with the most to gain are the essayists. Readers can reflect outside their ‘normal spheres’ of thinking and expand their worldviews to encompass a broad spectrum of ideas from a broad spectrum of academics. In a world of changing knowledge and unsolved problems bringing more academics to bear on conservation issues can only increase any likelihood of success.

Saturday 22nd September

Mal Nairn Lecture Theatre 08.30 -10.00

Dr Padma Narsey Lal

Dr Padma Narsey Lal is an ecologist and ecological economist by training. She has over 35 years of professional experience working in various capacities in many parts of Oceania, including Australia, focusing on action research and development and capacity development to make real difference to the wellbeing of people and environment they live in. In Australia she has worked as a resource economist, policy analyst, research manager, working at ABARE, ACIAR and as the Associate Professor in Resource and Environmental Economics, as well as the Director of the Environment Management and Development Program at what is now Crawford School of Economic and Government at the Australian National University. In the Pacific island region, she has held positions as a civil servant in Fiji, and as an academic at the University of the South Pacific. As a regional civil servant working with the Pacific Islands Forum Secretariat, she undertook research and facilitated evidence based policy decisions, collaborating across other regional organization, such as SPREP, SPC, SOPAC and FFA. She has helped develop key policy papers and facilitated Leaders decisions on subjects such as disaster and climate change as development issues, land management and conflict minimisation, and strengthening of national sustainable development strategies for improving effectiveness of national resources and development partner support and national resources. Padma has published widely on a diverse set of themes focusing on integrated ecological and social science, including agricultural and resource economics, based analysis to support informed resource use and management decisions. Her Pacific work includes on subjects such as evidence-based decisions in the sugar industry in Fiji; integrated ecological economics and adaptive management of mangroves, economics of forest certification, waste management, and economics of disaster risks and climate change adaptation. She has produced over 100 peer reviewed publications. Amongst her recent books on the Pacific, either individually produced or coauthored with others, include, *Ganna: Fiji Sugar Industry Profile* (2009); *Economics of Resource and Environmental Project Management in the Pacific* <http://data.iucn.org/dbtw-wpd/edocs/2010-089.pdf>; and *Economics of Coastal Zone Management* (2011) (www.iucn.org/oceania). She also served as a co-coordinating lead author of a Chapter in IPCC's Special Report, on *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*" (or SREX) <http://ipcc-wg2.gov/SREX/report/full-report/>. She is currently a Director of T2 Action Research and a visiting scientist with the Ecosystems Sciences Division, CSIRO in Canberra.

Wicked Problems in the Pacific: Challenges and Prospects

Pacific island countries realise that many of their environmental and climate risk challenges cannot be addressed effectively without integrating these concerns into their national development efforts. Mainstreaming of such concerns into national and sectoral planning and budgetary process supported by robust science and experiential knowledge is key to adopting a programmatic approach to addressing such 'wicked problems'. Using climate risk and environmental management in the region as examples of 'wicked problems', I shall highlight approaches Pacific island countries have recently adopted and the nature of challenges they have faced when attempting to adopt a systems approach to their development agendas. The paper will also suggest a country focussed analytical framework for identifying specific areas that need strengthening for more effective management of such 'wicked problems'.

Bilawara Lee

Flinders University

Bilawara Lee is an Elder of the Larrakia Nation of Darwin NT and her name means “Black Cockatoo”. She is a cross Cultural Awareness and Cultural Protocols trainer, Conflict Resolution Mediator and Authorised Marriage Celebrant. Bilawara has over 61 years experience with working, living and being part of a vibrant, highly respected Aboriginal family. She is acknowledged and respected as a community communicator, healer and teacher of the ancient wisdoms of Aboriginal Spirituality and Healing. She is the Australian Aboriginal representative on the International Indigenous Grandmothers Council who are recognised as the Wisdom Keepers of the World of Ancient Sacred Knowledge. She is a faculty member of the Casa de La Luna Institute in the USA and is an emerging International author. Bilawara is the Elder on Campus with Flinders University’s Northern Territory Medical Program where she teaches medical students (both Indigenous and non-Indigenous) cultural safety, cross cultural communication, Aboriginal healing and spirituality and lessons to be learned from traditional healing.

Spirituality and conservationMorning Tea Break

10:00-10:30am

Mal Nairn Lecture Theatre – 10.30 -12.30

Symposium: Science-culture-policy linkages in changing land and seascapes

Organizer: Melanie Bradley

Science-culture-policy linkages are central to effectively meeting the needs and protecting the values of people and country. These linkages are particularly important in land and seascapes subject to pervasive threatening processes and/or targeted for large-scale or intensive developments (e.g. minerals and petroleum extraction, agriculture, forestry). This symposium will present case studies that reflect on the challenges, opportunities and lessons learnt where integrated (science-culture-policy) approaches are taken to tackling conservation issues in changing land and seascapes. It will explore topics such as: managing/addressing different cultural perspectives and value systems; grappling with varying qualitative and quantitative datasets; communication challenges; identifying and dealing with threatening processes; and how integrated approaches are attempting to deliver cost-effective conservation outcomes. The symposium will draw together presenters from diverse backgrounds, each speaking to different case studies, who will highlight a range of innovative, bold and contemporary attempts to link science, culture and policy-making.

10:30-11:00 Country-based planning - A tool for Traditional Owner leadership and engagement in environmental management

SMYTH, D¹

¹Smyth and Bahrtdt Consultants

Environmental managers tend to operate in scales that match their legal and policy interests and responsibilities. Hence protected area managers focus on environments within the boundaries of protected areas, catchment managers focus on catchments, fisheries managers focus on target species etc. Traditional Owners also have their preferred scale for interacting with the environment – it's called 'country'. Country-based planning supports Traditional Owners to consider, plan and manage their traditional estates for all their cultural and natural values, whether or not they have legal tenure over those estates. Though non-statutory, country-based plans provide Traditional Owners with a tool to engage with other planning and management scales from culturally appropriate foundations. Holistic country-based plans that link separately managed environments, such as adjacent national parks and marine parks, provide Traditional Owners with opportunities to lead engagement processes and to deliver improved whole-of-country management that integrates and enhances other management arrangements. This paper outlines the rationale for country-based planning and provides examples of how country-based planning is providing new pathways and new partnerships for managing Australia's environments.

11:00-11:15 Weeds spread as a growing biodiversity threat midst the Northern Territory's onshore resource rush

BRADLEY, M¹

¹Environment Protection Authority NT

Recent growth in onshore mineral and petroleum exploration has led some to suggest that the Northern Territory (NT) is on the cusp of a resource rush. There are varying perspectives on what this resource rush means and the potential implications for biodiversity conservation. In anticipating future management challenges it is important to understand the nature of the rush and how it is playing out on the ground. Arguably, one of the more important rush-associated biodiversity threats is weeds spread – given the well-established link between land disturbance, particularly infrastructure penetration, and increased weed incidence. Current and proposed resource exploration activities could have serious biodiversity implications for landscapes such as the Arnhem Plateau, which is relatively weed-free at present and of international conservation significance. In this landscape there will likely be a need for ongoing, dedicated weed surveillance and control efforts both during and after resource exploration. Potentially, a weed control program could act as a catalyst and focal point for integrated landscape management cross-government, -industry, -landholder and -land tenure. If integrated approaches are to succeed they will require support from new partnerships and management processes.

11:15-11:30 Freshwater wetlands, Indigenous livelihoods and rising sea levels

WHITEHEAD, PJ¹

¹Research Institute for Environment and Livelihoods, Charles Darwin University, Darwin NT 0909 Australia

Many of north Australia's iconic freshwater floodplain systems were created over the last few thousand years, during periods of sea level rise and in-filling of estuaries. Their transformation from estuary through mangrove to predominantly freshwater systems was associated with increases in local populations of Indigenous people, who remain dependent on their resources today. Present rates of sea level rise threaten to return these systems to the sea, putting both customary and market-based livelihoods at risk, and releasing substantial quantities of stored carbon. Given the improbability of timely greenhouse gas mitigation to reduce risk associated with global warming, are plausible adaptation strategies available? I argue that given present climatic, biophysical and political uncertainties, continuation of present, sometimes clumsy, physical interventions by both private and public landowners is most likely, emphasising more intensive management of culturally, biologically and commercially valuable sites. Research to improve understanding of the dynamics of these systems and their implications for livelihoods and conservation should be done in tandem with these management actions. Indigenous people should position themselves to ensure that their interests and values influence associated decision-making.

11:30-11:45 Anson Bay Restoration Project – an integrated approach to delivering conservation outcomes

SPENCER, A¹

¹R.M.Williams Agricultural Holdings

While R.M. Williams is long established as a bush outfitter, R.M. Williams Agricultural Holdings (RMWAH) focuses on food production, alternative energy solutions, combined with land restoration programs centring on biodiversity, carbon and water. RMWAH owns Labelle Downs and Welltree Station, 100,000 hectares within the Anson Bay, a region of International conservation and Indigenous cultural significance in the Daly-Reynolds-Finiss floodplain area of the Top End. In 2010 RMWAH was awarded Caring for Our Country funding, bolstering the significant private investment and ongoing commitment from RMWAH to tackle a range of challenges including weed of national significance *Mimosa pigra*, pigs, wildfire, and better herd management, while also improving knowledge and skills and coordination amongst landholders in the region. This project provides a demonstration of how sustainable farm practices can work at a landscape scale and contribute to ongoing conservation management at a catchment level. Key outcomes include establishment of monitoring programs for management activities, vegetation mapping and production of an applied land use map, the physical removal of *Mimosa pigra* and feral pigs, and the sharing of knowledge and skills among neighbouring landholders. The recent formation of the RMWAH led Finiss Reynolds Catchment Group will take the project beyond the funding period and see an integrated catchment management plan applied across 550,000 hectares.

11:45-12:00 Research reflections from both sides: Lessons learned through an Indigenous water values project

WOODWARD, E¹ and McTaggart, PM²

¹CSIRO

²Naiyu Inc.

Increasingly Indigenous people are seeking inclusion in historically top-down government driven decision-making processes, including planning for future water use. However, current reductionist planning processes operating on tight budgets and within short time frames typically exclude the spiritual and relational dimensions of knowledge and any opportunity for cross-cultural learning. Likewise, research project funding and its associated milestones and timelines, are frequently inflexible and administered within a one-size-fits-all template. This paper will draw on lessons learnt through a research project that documented Indigenous interests in water so that they might be incorporated in water planning processes. Using a participatory action research approach the project evolved in response to the interests and concerns of members of the Naiyu community on the Daly River, Northern Territory. One result of this engagement was the community-driven creation of an Indigenous seasonal calendar to renew local interest in Indigenous language and knowledge. Lessons learned from this engagement include the importance of local context, relationship building, trust, researcher flexibility and appropriate timeframes. Research holds a lot of potential for facilitating Indigenous aspirations in natural resource planning and management. However certain criteria must be filled to ensure mutual benefit.

12:00-12:15 Where is our guiding model for the transition to an “*Alternative Path*” valuing environmental limits and social well-being?

GRATTIDGE, A¹

¹Environmental Consultant

The tropics and subtropics are the world’s hotspot for biodiversity, relatively intact ecosystems and a diversity of indigenous cultures. This region is destined for increasing pressure from resource extraction and harvesting. However, investment in biodiversity conservation offsets and carbon sequestration is also growing. Sustainability on a global scale requires a radical shift towards an economy and management regime which acknowledges and values environmental limits, social capital and thresholds of impact. A key theme will be accountability for all parties to implement changes which are mutually beneficial to all sectors and yet respectful of environmental limits. Key players include: Governments, large corporations, NGOs, consultants, researchers, and indigenous communities. The vast difference in values, perceptions and capacity between these sectors is destined to create unique and considerable tensions. Appropriate support is essential for Indigenous communities develop an empowering place in environmental sustainability and secure lasting benefits. The contributing authors put forward a conceptual framework for effective engagement and multi-level accountability. Key elements include: paradigm conscious policy, priority setting, adaptive management, effective community engagement, capacity building, cross-cultural skills, data collection, reporting, feedback and collaborative learning.

12:15-12:30 DISCUSSION

Symposium: Integrating systematic conservation planning with local management actions in Fiji

Organizers: Stacy Jupiter, Bob Pressey and Rebecca Weeks

For the past several decades in Fiji, terrestrial, freshwater and marine protected areas have largely been declared on an ad hoc basis, with very few areas selected due to outstanding biodiversity features or ecological properties. Nevertheless, there is great potential for community-based establishment of protected and managed areas in Fiji to be combined with systematic prioritization based on biodiversity and ecosystem service values. Since the establishment of the Fiji Locally Managed Marine Area network in 2000 and the national Protected Area Committee in 2008, there is growing momentum to incorporate local knowledge and opportunities into a more systematic approach to protect Fiji's unique and fragile island biodiversity. This dual approach would meet national and international objectives for conservation while involving communities, maximizing socio-economic benefits and enhancing compliance. This symposium focuses on creative methods introduced by practitioners in Fiji and collaborating research scientists to: incorporate local knowledge and opportunities into conservation planning designs; and use planning outputs to communicate key messages and facilitate dialogue among key stakeholders involved in protected area implementation. We also discuss the current legal and institutional barriers for establishing protected areas in Fiji, with recommendations for how these challenges could be overcome. Some of these challenges stem from a lack of formal recognition of indigenous community conserved areas (ICCAs), despite land tenure and recognized rights to freshwater and marine resources. The lessons learned in Fiji have broader applications for conservation planning throughout Oceania and the Coral Triangle.

10:30-10:45 Opportunities and challenges for integrating community-based and systematic planning approaches to protected area design and management in Fiji

JUPITER, S¹

¹Wildlife Conservation Society Fiji Country Program, 11 Ma'afu St, Suva, Fiji

Fiji's marine and terrestrial protected areas have been established on a fairly ad hoc basis. While national priorities for terrestrial protection and management were documented through top-down planning processes for the National Environment Strategy and the Fiji National Biodiversity Strategy and Action Plan developed through the 1980s and 1990s, community-based initiatives simultaneously emerged in the 1990s and 2000s across Fiji to conserve and manage marine resources. Recent gap analyses indicate that Fiji needs to considerably expand terrestrial and marine conservation efforts to meet national and Aichi targets by 2020. However, limitations on government resources for management and monitoring of nationally gazetted reserves mean that the burden of additional biodiversity and conservation measures will fall on communities. Yet, local communities managing for local objectives alone are unlikely to set aside large enough areas in a representative network to adequately protect Fiji's biodiversity by 2020. I therefore discuss needs for: (1) financial and non-monetary incentives to enable communities to sustainably manage larger areas sufficient to achieve biodiversity targets; and (2) legislative and institutional reform to provide adequate recognition of indigenous community conserved areas.

10:45-11:00 Adaptive Co-management of a Marine Protected Area Network in Fiji

WEEKS, R¹ and Jupiter, S²

¹ARC Centre of Excellence for Coral Reef Studies, James Cook University AND Wildlife Conservation Society - Fiji Country Program

²Wildlife Conservation Society - Fiji Country Program

Adaptive natural resource management describes an iterative process of decision-making whereby management strategies are progressively changed or adjusted in response to new information. Despite an increasing focus on the need for adaptive conservation strategies, there remain few applied examples of completed adaptive management cycles. Here, we describe the nine-year process of adaptive co-management of a marine protected area network in Kubulau District, Fiji. In 2011, a review of protected area boundaries and management rules was motivated by the need to enhance management effectiveness and the desire to improve resilience to climate change impacts. Through a series of consultations, with the Wildlife Conservation Society providing scientific input to community decision-making, the marine protected area network was reconfigured to a more robust, resilient design, with a greater potential for compliance. We identify factors that contributed to this successful outcome and discuss lessons learnt during this process.

11:00-11:15 Strategic decisions at the local scale for determining spatial locations for management

Wendt, HK¹, COMLEY, J¹, Weeks, R^{2,3} and Roelfsema, C⁴

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² Wildlife Conservation Society Fiji Country Program, 11 Ma'afu St, Suva, Fiji

³ ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD, Australia

⁴ Centre for Spatial Environmental Research, University of Queensland, St. Lucia, QLD, Australia

Fiji, like many countries in Melanesia and across the Pacific with similar systems of marine tenure, relies on communities through community-based management to protect inshore areas of coral reefs. The outcomes of this management may however result in small, fragmented patches of protection. In this study I use reserve design planning tools to integrate ecological, social and governance factors collected through a range of participatory methods to re-design a collection of protected areas with the aim that it may better achieve the benefits of a network. The re-designed network had an increased number, area and representation of habitats and key ecological features yet had a lower average 'cost' per unit area protected based on lost fisheries potential and enforceability of the network. These results suggest that such reserve design undertakings may play an important role in the scaling up from individual community-based managed sites to a functioning network of marine protected areas. However we caution that there needs to be a solid foundation of belief and trust amongst communities in management on which to build more complex integrated planning approaches.

11:15-11:30 Selection of Fiji's national priorities for terrestrial conservation

TORA, K¹, Erasito, E¹, Lagataki, S², Masibalavu, V³, Nawadra, S^{4,5}, Rounds, I⁴, Thomas, N⁶, Tokaduadua, E⁷, Tuiwawa, M⁸ and Watling, D⁷

¹National Trust of Fiji, 3 Ma'afu St, Suva, Fiji

²Department of Forestry, Suva, Fiji

³BirdLife International, Suva, Fiji

⁴Conservation International, Suva, Fiji

⁵Secretariat of the Pacific Regional Environment Programme, Apia, Samoa

⁶Nature Fiji-MareqetiViti, Suva, Fiji

⁷Department of Environment, Suva, Fiji

⁸South Pacific Regional Herbarium, Institute of Applied Sciences, University of the South Pacific, Suva, Fiji

Fiji has a highly diverse and endemic island flora and fauna, but its protection has been limited as the locations of existing protected areas have been selected on an ad-hoc basis. To fulfil Fiji's commitments as a signatory to the Convention on Biological Diversity (CBD), a National Protected Area Committee (PAC) was established in 2008 with an objective to carry out an ecological gap analysis to determine how advanced Fiji is against CBD Aichi and national targets of 17% and 20% terrestrial protection, respectively. Our gap analysis indicated that the 23 existing protected areas cover 2.7% of Fiji's total land area and 5.8% of Fiji's remaining forests. Nearly all target habitat types were found to be underrepresented, with the most significant gaps found in mangroves, lowland, dry forests, upland forests and freshwater wetlands. In filling these gaps, forty proposed priority conservation forest areas were matched against nine criteria considering richness, habitat diversity, economic importance, size, degradation, scarcity, feasibility, cultural importance, and connectivity. If protected, the resultant priority areas will cover 18% of the total land area and 8.3% of targeted terrestrial habitats. We further discuss legal and socioeconomic constraints that may impede the establishment of these protected areas in Fiji.

11:30-11:45 Improving the success of marine protected area networks: integration of social considerations into conservation planning

Gurney, G¹, ADAMS, VM^{1,2}, Jupiter, SD³ and Pressey, RL¹

¹Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD 4811, Australia

²Northern Australia NERP Hub, RIEL, Charles Darwin University Darwin NT 0909

³Wildlife Conservation Society South Pacific Program, Suva, Fiji Islands

Given that the lack of successful implementation of conservation plans is largely attributed to insufficient consideration of human factors, there is a pressing need to advance techniques for integrating socio-economic considerations into conservation planning. To this end, we develop novel approaches for integrating social factors into the spatial prioritisation process for marine protected area (MPA) planning, using a case study from the Kubulau District, Fiji. We present a method for calculating the opportunity costs to fishers from their displacement by the establishment of MPAs, which we incorporate in Marxan to examine potential MPA configurations designed to achieve equity of impacts. We model opportunity costs by gear type as a function of food fish abundance, probability of catch, and market value of species. To further enable MPA designs to align with the needs of local stakeholders, we directly elicit stakeholders' fisheries livelihood objectives and determine how they can be translated into appropriate data inputs to be used in spatial prioritisation. Further, we examine how fisheries livelihood goals can be integrated as explicit objectives rather than costs into spatial prioritisation, and evaluate the potential benefits this approach affords over the traditional minimum-cost technique in terms of achieving equitable impacts across stakeholder groups.

11:45-12:00 Incorporating ecosystem connectivity between the land and sea to protect coral reefs

MAKINO, A¹, Beger, A¹, Klein, CJ¹, Jupiter, SD² and Possingham, HP¹

¹ Australian Research Centre of Excellence for Environmental Decisions, School of Biological Sciences, The University of Queensland, Australia

² Wildlife Conservation Society, Fiji Country Program

Coral reefs are threatened by human activities on both the land (*e.g.* deforestation) and the sea (*e.g.* overfishing). Most conservation planning for coral reefs addresses threats in the sea, neglecting threat reduction actions on the land that are often just as important. To provide a more integrated approach for coral reef conservation that accommodates processes that connect the land and the sea, we develop a land-sea planning method within the decision-support software Marxan and test it in Fiji. Our aim is to compare how the location and cost of conservation priorities differ when connections between and among reefs and terrestrial catchments are incorporated. We considered connections both with and without considering the directionality of flow and discovered that integrated land-sea planning delivers substantially different spatial priorities depending on the type of connectivity considered. When we considered connectivity, priority reefs were 81-91% different than reefs selected when we ignored connectivity. Priority reefs were clustered with only adjacent reefs or with connected catchments, or both of them depending on the connectivity model used. Our approach can be applied at a variety of spatial scales to incorporate different kinds of connection between the land and sea, or indeed any pair of realms.

12:00-12:30 DISCUSSION

Open Session: Conservation Science Practice**10:30-10:45 Integrating Multiple Perspectives: The Illusory Barriers of Feral Pig Management in the Wet Tropics of North Queensland**SHUSTER, G¹¹Department Of Environmental Studies, Antioch University, New England, Keene, NH 03431 USA

The development of management programs for multiple use resources requires careful evaluation and planning. The feral pig (*Sus scrofa*) in Australia represents one such multiple use resource. Pigs impact ecological, economic, health, and social sectors. A large and heterogeneous group of stakeholders is interested in their management. This presentation examines socio-political barriers to pig management and the impact of these barriers on management practice in the Cassowary Coast Council of Northern Queensland. I used a participatory research design that included oral histories, individual interviews, and participatory sociograms to investigate the relevance of pigs to farmers, hunters, traditional owners, and managers. Despite differences in values and beliefs, all stakeholders consider management outcomes resulting in pig control acceptable. The existence of this shared community perception however, was not understood by all stakeholders. This is one example of a breakdown in the management process. Multiple barriers impede successful application of management strategies including: poor communication, stereotypes, limited available resources and property access, and competing knowledge systems and cultural values. Strategies are needed to fostering mutual awareness of stakeholder social systems in order to create a shared language for developing management decisions. It is also important to consider additional, more participatory, management planning strategies.

10:45-11:00 Metamodelling of synergistic extinction risksBROOK, BW¹¹University of Adelaide, Adelaide South Australia

Many computer-based tools have been developed to simulate single-species population dynamics and the effect of habitat loss, disease spread, response to harvest, and shifts in geographical ranges due to climate change. These applications can be individually sophisticated, yet they perform necessarily limited roles in isolation. To address these limitations, my group and I have developed a suite of synthetic 'metamodelling' applications to inter-link separate ecological simulators, allowing sharing of data structures, parameters and outputs. Using a dynamical systems approach, are validating a spatially explicit framework for multidisciplinary forecasting and sensitivity analysis. The aim is to provide improved predictions of extinction risk to the complex and typically synergistic stressors of global change, and so improve onground conservation management. Using tests against field data from a wide variety of case studies, these models integrate a variety of biological, geophysical and spatial inputs.

11:00-11:15 Strategies for Communicating Natural Resource Management Issues in Cross Cultural Contexts

CULLEN, M¹, WILLIAMS, G¹ and Wallace, R

¹Charles Darwin University, Darwin NT 0909

This presentation explores strategies for effective communication of issues and knowledges between western agencies and Indigenous communities in the field of natural resource management (NRM) in the Northern Territory. Differences exist in the way western scientific and Indigenous systems of knowledge construct and use knowledge to manage the natural environments. These differences, along with the power disparities between the systems, have been a barrier to effective cross-cultural communication and collaborative efforts to manage new and existing threats to the environment. This presentation seeks to unpack what effective communication, and protocols for sharing information, might entail from an Indigenous perspective to enable resources created in the future to be more useful. Analysis and evaluation of NRM information resources made for Indigenous audiences in the Northern Territory provided insights into what people considered to be effective communication. Thirteen NRM information resources made by a selection of agencies and produced for Indigenous communities of the Northern Territory, were reviewed. In reviewing the selected resources, it was found that a range of issues related to knowledge, power and authority in decision making are crucial in determining whether the information resources are valued and therefore used by an Indigenous audience.

11:15-11:30 Looking after Country – Indigenous land and sea management in North Australia

KENNETT, R¹

¹North Australian Indigenous Land and Sea Management Alliance Limited, Building Red 2.2.20 Charles Darwin University

Australia labours under a primal imperative to populate, and profit from, it's seemingly empty and undeveloped northern landscapes. Only in recent times has it been acknowledged that Australia's north was already occupied and managed for over 50 000 years by one of the oldest and most intact knowledge and cultural management systems on earth. Australia in 2012 remains focussed on developing the north and filling the empty places with agricultural and industrial developments models of southern Australia. The realisation that the north can developed differently and so avoid the costly mistakes now damaging ecosystems, economies and communities 'down south', is coming slowly. The land and seascapes of north Australia remain amongst the most intact in the world – of enormous value for their biodiversity and their sheer size. The key to creating a new paradigm that both values the natural functioning of these ecosystems while providing meaningful and sustainable livelihoods of human residents, lies in the growing power of Indigenous people to regain control and management of their long held estates. Indigenous land and sea managers will be part of the leadership of the new North, and partnerships and collaborations with Indigenous organisations have already become strategic imperatives for conservation organisations.

11:30-11:45 Investigating the sustainable potential of an endemic timber plantation in Papua New Guinea (PNG)

PRYDE, L¹

¹James Cook University, QLD

We investigated the long-term sustainability of an endemic timber (*Eucalyptus deglupta*) plantation on New Britain Island, Papua New Guinea (PNG). PNG has some of the largest tracts of contiguous rainforest in Oceania, however, its lowland forests have suffered extensive deforestation from logging and are under further threat from large-scale Oil Palm plantations. Lowland rainforest conversion is particularly evident on New Britain. The study area is a landscape matrix comprised of 12,000 ha of multi-aged *E. deglupta* plantations interspersed with lowland secondary rainforest, primary hill-rainforest and riparian buffer zones. Theoretically, the planting of an endemic species should confer a level of conservation of pre-disturbance biodiversity, given that the species has co-evolved with local taxa. This theory was tested by comparing the structure and assemblage of vegetation and avifauna across the landscape. We found that there was a high level of conservation of 'rainforest' flora and avifauna across the landscape matrix. This was due in part to the ecological history of the region, the relatively recent establishment of the plantations (30 years), and some incidental management practices. All three elements must be factored into future management guidelines to maintain high levels of endemism within this production landscape.

11:45-12:00 Enhancing Indigenous participation in marine science research of the Great Barrier Reef

NAIRN, K¹, Harwood, S., Wood, P. and King, D.

¹School of Earth and Environmental Science, James Cook University, Queensland, Australia

The Traditional Owners of the Great Barrier Reef waters have a growing role in the formal management protocols of the Great Barrier Reef. There is much less participation in scientific research of their sea country, despite the extensive ecological knowledge held. This research project analyses the gap between the marine science research agenda and the Indigenous agenda for management and highlights the case for improving Indigenous participation in scientific research. This involves increasing the capacity for Indigenous peoples to conduct scientific research, expanding the scientific lens to acknowledge the validity of traditional ecological knowledge in research, and lastly critically reviewing the planning process which allows the incorporation of both knowledge fields into management outcomes.

12:00-12:30 DISCUSSION

Blue 1.1.25

10:30-12:30

Workshop: Mala meeting: Land and sea management revisited*

Organizers: Otto Champion, Dean Yibarbuk, Cherry Daniels and Edna Nelson

The Mala involving key elders from Top end Communities to reflect on current progress and future directions in land and sea management – the Mala is both timely and much needed. Challenges and talk about the environment are now different from when the land and sea management or the ranger movement started, we need to meet up and

- Get together and talk about what the rangers are doing from our own knowledge side,
- Discuss new and stronger ways to support people to reconnect with country
- Finding out if current land and sea management efforts have made a difference to how Aboriginal people see things.
- We also need to talk about how Aboriginal people will face up to Climate Change.

***This workshop is open only to invited participants**

Mal Nairn Lecture Theatre 13:30-15:30

Symposium: Indigenous land management and conservation

Organizers: Catherine Robinson, Kelly Scheepers and Glenn James

Prior to colonial settlement Australia's landscapes were managed environments. Indigenous land management was driven by a holistic suite of co-dependent social, religious and environmental values. Colonial history has seen the depopulation of vast managed customary estates and the subsequent cessation of effective management. Modern conservation strategies have sought to manage for a limited suite of values and only recently have included economic drivers that might also deliver additional or 'co'-benefits. Market and conservation-driven perspectives on environmental stewardship have framed Indigenous co-benefits within environmental and climate change mitigation programs. This narrowly defined approach to valuing ecosystem services is unable to adequately capture the range of benefits derived from managing country. In addition to environmental outcomes, Indigenous land managers (ILM) seek to address socio-economic disadvantage in their families and communities, and to (re)build social and cultural capital through the relationships between people, land and spirit. 'Co-benefits' are becoming important secondary considerations in the design and accountability of environmental management programs. Market entry and performance requires some definition and measurability around co-benefits but for ILMs the broader set of benefits from looking after country are inter-related and not so usefully abstracted and commoditised. This symposium seeks to interrogate mainstream perspectives on co-benefits from environmental stewardship programs and initiatives, and to encourage debate on the practical implications for ILMs seeking to rest greater control over their well being and cultural futures.

1:30-1:45 Purpose of Aboriginal fire

BILL GAMMAGE¹

¹Australian National University

I see five stages in the purpose of Aboriginal fire:

1. Control fuel
2. Maintain diversity
3. Balance species
4. Ensure abundance
5. Locate resources conveniently and predictably.

By and large non-Aborigines in Australia battle to achieve stage 1, admire the objectives of stages 2-4, and cannot imagine stage 5. This strongly suggests that local Aboriginal expertise can not only show others how to achieve stage 1, but also guide all Australia towards a philosophy which preferences stages 2-5.

1:45-2:00 What really drives Indigenous engagement in conservation and carbon economies?

CAMPION, OB and JAMES, G

Australia's Indigenous people developed land and sea management knowledge and skills that shaped the landscape over thousands of years by living with the land and sea. They developed a complex and nuanced cultural system that captures meaning in the world through association with specific interconnected sites or places, through an overlying inclusive kin network, and through the embodiment of a pre-existing ancestral geography in Aboriginal law. The commonly used notion of 'connection' to country necessarily includes ancestral heritage and kin. Broadly understood, Indigenous technologies, customary law and socio-economic networks shaped the Australian landscape. This is the model, though eroded, largely responsible for the environmental values we are now looking to protect and enhance with conservation and climate change mitigation instruments. After generations of displacement, customary land owners are finding and forging opportunities to reinvigorate the enriching connections to land, law and family in a renaissance of Indigenous land management. Locally driven 'caring for country' delivers in local and non-Indigenous terms but is overly dependent on unreliable external resources. The economic and conservation imperatives that frame much needed support and the institutional mechanisms evolving before them raise important issues around value and well-being for new generations of land managers seeking a cultural future. Is it conservation with co-benefits or Indigenous well being with strong conservation outcomes? There may be no global solutions to the teething issues in this Indigenous space, but Indigenous groups need the confidence to strongly represent their particular world views in this potentially transformative caring for country opportunity.

2:00-2:15 Recognising the value of traditional knowledge to reduce the impacts of climate change on health and well-being in Aurukun, Cape York

GREEN, D¹ and Martin, B²

¹University of New South Wales

²Aak Puul Ngantam

Awareness of keeping, or returning, people to country has been clearly demonstrated through the 'healthy country healthy people' paradigm across northern Australia over the last decade. This paper will examine a novel project that uses Indigenous research methods to visually record Elders and Traditional Owners from Aurukun, Cape York to explore this connection; with specific reference to the indirect psychosocial impacts of climate change on the community. This project uses video recording to collate Elders, rangers and Traditional Owners discussing their perceptions of environmental change whilst they are on their country, in order to identify and prioritise climate impacts that are likely to be detrimental to the community's plans to return to live in outstations, and to the development of their newly formed local enterprises. The project will also discuss phenological changes observed by community members that are being documented to further develop their seasonal calendars. This work is being used to better inform local land management practices through the incorporation of traditional knowledge and western science. We conclude by showing how these project elements can be integrated to build the community's cultural resilience, and, therefore, increase their ability to prepare for climate change at a community and individual level.

2:15-2:30 Biodiversity co-benefits from carbon projects on Indigenous land: A national assessment

RENWICK, AR¹, Carwardine, J^{1,2}, Martin, T^{1,2}, Robinson, C², Wallington, T² and Possingham, H¹

¹Environmental Decisions Group, School of Biological Sciences, University of Queensland, St Lucia. QLD 4072

²CSIRO, 41 Boggo Road, Dutton Park. QLD 4102

The Carbon Farming Initiative (CFI) allows farmers and other land managers to earn carbon credits by storing carbon or reducing greenhouse gas emissions on their land. The initiative has the potential to produce benefits for biological conservation as well as the abatement of greenhouse gas emissions. Indigenous Australians manage around 20 per cent of Australia's land mass and have opportunities to engage in carbon farming activities that also deliver biodiversity benefits on their country. Using information on total organic carbon, biodiversity and land tenure for Australia, we determined the biodiversity co-benefits of carbon projects on Indigenous land and within regions managed by Indigenous ranger groups. These results will enable Indigenous landholders to make better decisions about carbon projects that will deliver biodiversity co-benefits on their country.

2:30-2:45 Co-benefits from fire management for greenhouse gas abatement: the Tiwi Carbon Study

SCHEEPERS, K¹, Andersen, AN.¹ and Richards, A¹

¹CSIRO Ecosystem Sciences, Tropical Ecosystems Research Centre, Darwin

Savanna burning in northern Australia accounts for 3% of the country's annual accountable greenhouse gas emissions, and there is strong interest in reducing this amount through improved fire management for sustainable development outcomes. Market and conservation-driven perspectives have narrowly framed Indigenous co-benefits within environmental and climate change mitigation programs, whereas other cultural benefits were also attainable through Indigenous land management. Based on the methodology developed for the Federal Government's Carbon Farming Initiative, current emissions from Tiwi fires averaged 68 Mt CO₂-e y⁻¹ with many, high intensity fires occurring late in the dry season. Management scenarios that incorporated changes in fire frequency and intensity produced emissions abatement of up to 46.3 Mt CO₂-e y⁻¹, and potentially worth \$1 million/yr. Stakeholder workshops showed that Tiwi people used fire for a variety of environmental, socio-cultural and economic reasons that reflected a combination of historical and contemporary interests and values. Traditional landowners and managers distinguished between cultural burning practices, associated with hunting, and opportunistic burning practices along roadsides, as one avenue for reducing emissions through early burning. Together with strategic burning and fire breaks set up to protect Tiwi forestry assets against unwanted fires, this constituted an integrated fire management plan for multiple benefits.

2:45-3:00 Indigenous country and well-being as a co-benefit to conservation. A critical analysis

ROBINSON, CJ^{1,2}, James, G^{1,3} and Scheepers, K⁴

¹CSIRO Ecosystem Sciences

²School of Geography, Planning and Environmental, University of Queensland

³North Australian Indigenous Land and Sea Management Alliance Limited, Building Red 2.2.20 Charles Darwin University

⁴CSIRO Ecosystem Sciences, Tropical Ecosystems Research Centre, Darwin

'Co-benefits' are becoming important secondary considerations in the design and accountability of environmental management and carbon offset programs. Indigenous co-benefit standards have the potential to ensure that sustainable program outcomes are arrived at via an equitable and respectful pathway that enables Indigenous communities to determine the future of country in a way that meets their cultural, social, environmental and economic aspirations. Although market entry and environmental program performance requires some definition and measurability around co-benefits, the broader set of benefits from Indigenous people looking after country are inter-related and not so usefully abstracted and commoditised. In this paper we seek to open up a critical discussion of market and conservation-driven perspectives on environmental stewardship that have framed Indigenous co-benefits within environmental and climate change mitigation programs. We query whether a narrowly defined approach to valuing ecosystem services adequately captures the range of benefits derived from Indigenous people managing country. We conclude by considering if and how the inclusion of co-benefit standards can help address Indigenous people's socio-economic issues and aspirations, and help (re)build greater control over their well being and cultural futures.

3:00-3:30 DISCUSSION

Blue 5.1.1

13:30-15:30

Workshop: Managing “Ples” in Papua New Guinea (PNG): Indigenous landowners, government, and NGO partners collaborating to manage the YUS Conservation Area under traditional land tenure.

Organizers: Zachary Wells, Dr Lisa Dabek, Dr Bruce Beehler, Dr Ashley Brooks, Benjamin Sipa and Karau Kuna

The theme of this workshop is facilitating indigenous conservation and management of land and sea within existing traditional land ownership systems. We will frame the conversation with an example from Papua New Guinea (PNG), the YUS Conservation Area (YUS CA) in Morobe Province. The workshop facilitators work with the landowners around the YUS CA, which stretches from ridge to reef and supports incredible biodiversity as well as deep cultural diversity. The YUS CA is the first and only protected area of its type in PNG – landscape scale, wholly owned by local people, with the support of the PNG Government for long-term protection, and pushing boundaries in many ways, including: community-based ecological monitoring; sustainable financing through a non-sinking conservation endowment; landscape scale management and planning; scientific research and international collaboration; and community development. YUS CA provides an example of the tools and strategies that can enable indigenous land and sea management in the face of emerging population, food security and climate challenges globally. This dynamic workshop will include short talks by the facilitators followed by an interactive discussion with participants. The intent is to bring to the forefront lessons that we can all use to promote and support indigenous land and sea management in Oceania. The facilitators ran a similar format workshop with a different theme at the Auckland SCB conference to excellent participation and discussions. Join us to showcase your work and learn from ours.

1:30-1:45 The YUS Conservation Area: An example of indigenous management in land and sea in Papua New Guinea

Dabek, L, Woodland Park Zoo, Seattle, Washington, U.S.A.

1:45-2:00 Experimenting with enabling structures for indigenous management, government support, and long-term partnerships

Wells, Z, Tree Kangaroo Conservation Program

2:00-2:15 Using GIS and participatory planning to engage landowners for conservation of land and sea

Kuna, K Tree Kangaroo Conservation Program

2:15-2:30 Harnessing livelihood and development opportunities to reinforce indigenous conservation action

Sipa, B, Tree Kangaroo Conservation Program

2:30-2:45 The role of scientists in supporting indigenous management and ecological monitoring

Beehler, B, Conservation International

2: 45-3:00 Landscape level planning: Aligning community and environmental action to add value to national government priorities

Brooks, A, Tree Kangaroo Conservation Program

3:00-3:30 DISCUSSION

Open Session: Restoration ecology and translocation**1:30-1:45 Restoration of native vegetation on the Temehani Rahi plateau, Raiatea island (French Polynesia): the importance of post-control monitoring and a study of plant succession**Taputuarai, R¹, Laitame, T² and MEYER, J-Y³¹ Association Tuihana, Raiatea, French Polynesia² Université de la Polynésie française, Tahiti, French Polynesia³ Délégation à la Recherche, Government of French Polynesia

The Temehani Rahi high elevation plateau, located on the island of Raiatea (French Polynesia), is of high conservation value, with 28 endemic flowering plants. This unique flora is directly threatened by invasive alien plants including the small trees *Chrysobalanus icaco* and *Rhodomirtus tomentosa* that form nearly monospecific stands on the lower part of the plateau. In 2011, a management program was initiated by a local nature protection group to find efficient control methods. In order to assess weed control effectiveness and habitat restoration success, we set up eighteen (24x24 m) permanent plots and monitored 833 plants. The different control methods consisted of cutting trees and spraying stumps with herbicides (sodium chlorate, glyphosate, or triclopyr) or injecting them into the trunk. The recruitment of native and alien plant seedlings after control was studied in 576 small (2x2 m) quadrats. After six months of monitoring, the cut-stump treatment using triclopyr appeared to be the more efficient. However, a massive recruitment of alien seedlings occurred, and non-native pioneer species were newly recorded. An increase of native species abundance was also observed, but there was no change of species composition. Conversely, plant reinvasion was significantly less important in plots treated with the injection method, characterized by a progressive tree defoliation. Long-term monitoring will be crucial to choosing the best method both in terms of weed control and native plant recruitment, i.e. to achieve “true” habitat restoration.

1:45-2:00 Surface elevation dynamics in restored mangrove forests in Indonesia

SIDIK, F and Lovelock, C

School of Biological Sciences, University of Queensland, St Lucia, Qld 4067, Australia

Increases in soil surface elevation are the key to the maintenance of mangrove forests with projected acceleration in sea level rise. This study assessed changes in the soil surface elevation in abandoned aquaculture ponds that have been replanted into mangrove forests in Bali, Indonesia. Rates of surface elevation change were measured with rod surface elevation – marker horizon technique (RSET---MH). We found that surface elevation increased over the time and the rates of surface elevation change in this estuarine system varied significantly over the seasons. The amount of sediment accreted on the soil surface was similar in both ponds and in the natural forest and thus differences in accretion on the soil surface could not explain differences in soil surface elevation gain between ponds and forests. The increasing surface elevation trend coincided with the growth of basal area of the trees in both the ponds and forests but mangroves in the ponds had higher growth rates than those in the forests. Our study suggests that below ground processes, either root growth or soil subsidence are important processes in the maintenance of surface elevation in mangroves in the region.

2:00-2:15 Does age matter? Dispersal and settlement patterns of a forest passerine reintroduced to a mainland fenced sanctuary

SCHADEWINKEL, RB¹ and Jamieson, IG¹

¹ Department of Zoology, University of Otago, P.O. Box 56 Dunedin 9054

Since the early 1990s the intentional translocation of birds has been increasingly used as a conservation tool for the management of threatened species. The main goal for the translocation of any animal species is to establish a persistent and growing population at the introduction site. In contrast to the translocation of bird species to 'predator-free' true islands, the main threat for a new population in predator-free mainland sanctuaries is dispersal due to the open nature of the release areas. Here we investigate the demographic and environmental drivers for the successful establishment of a persistent founder population of South Island robin/toutouwai (*Petroica australis*) in a fenced mainland reserve, Orokonui EcoSanctuary. Birds from two different age classes, post-dispersal juveniles aged 4 months or more (n=25) and pre-dispersal fledglings aged 1-2 months (n=20) were translocated during the 09/10 and 10/11 breeding seasons, respectively. Results indicate that choosing fledglings drastically increases the likelihood to establish a persistent founder population. In addition, the fledglings released in 10/11 were fitted with radio transmitters and each bird's movement was tracked for six weeks. Spatial analysis of movements, settlement patterns and environmental factors using ArcGIS are used to gain a better understanding of the population ecology of recently reintroduced SI robins.

2:15-2:30 Investigating factors influencing post-release survivorship of amphibians in breed-and-release programs

KLOP-TOKER, K¹, Stockwell, M, Valdez, J, Bainbridge, L, Clulow, S, Clulow, J and Mahony, M

¹University of Newcastle, Newcastle, NSW 2308 Australia

Habitat degradation is a major factor in recent global amphibian declines due to amphibians' complex life-cycles and habitat requirements. Releasing captive bred animals into rehabilitated habitat is a conservation tool ideal for amphibians as they are behaviourally simple, requiring no pre-release training, and have high reproductive outputs that can result in rapid population establishment. However, few studies have attempted to determine factors affecting post-release survivorship. This study follows the survivorship of an endangered Australian anuran population released into two plots of created habitat; one plot unfenced, and one plot fenced to limit predation and competition. Mark-recapture surveys were conducted weekly for 12 months following release at metamorphosis. Encounter histories were generated to estimate apparent survival probability using Cormack-Jolly-Seber open population models in program MARK. Survival was modelled as constant or time varying and as a function of release plot. Air temperature, body length at release, release dates, release ponds, and clutch were added to the model of best fit. Animals had a higher survival probability in the protected, fenced plots, and when released at a larger size. Therefore breed-and-release programs can be improved by preliminary protection of released animals and releasing larger animals when feasible.

2:30-2:45 Assessing the viability of replenishing depleted wild wobbegong shark populations with captive-bred animals

LEE, K^a, Huvneers, C^{b,c}, Peddemors, V^d and Harcourt, R^a

¹Graduate School of Environment, Macquarie University, Sydney, Australia

²SARDI – Aquatic Sciences, Adelaide, Australia

³School of Biological Sciences, Flinders University of South Australia, Adelaide, Australia

⁴Cronulla Fisheries Research Centre of Excellence, New South Wales Department of Primary Industries, Cronulla, Australia

Re-stocking of depleted wild populations with captive-bred animals has been extensively used for fisheries management. Surprisingly, (*sic*) this has never been attempted before with shark populations. With shark populations declining, both globally and in the Oceania region, testing the viability of re-stocking depleted populations is becoming increasingly imperative. Between 2008 and 2010 a total of fifteen captive-bred spotted wobbegongs (*Orectolobus maculatus*), an endemic and ‘iconic’ species to Australia, were released into a small marine reserve off Sydney. Two different size classes (83 and 119 cm mean total length) were released and their movements were monitored using novel passive acoustic technology to an accuracy of 5–10 m. The residency period and movement patterns of these sharks were compared to thirteen tagged, wild counterparts. A higher proportion of the larger captive-bred sharks remained within the area post-release than the smaller sharks. There was no statistical difference between the residency periods, home-range or habitat use of the wild vs captive-bred sharks. Neither size class nor sex had an impact on success of assimilation into the wild. This study suggests that while captive-bred sharks can be viably used to replenish depleted wild populations.

2:45-3:00 Post-release monitoring of buff weka reintroduced to mainland New Zealand

WATTS, J¹, Moore, A² and Seddon, PJ¹

¹Department of Zoology, University of Otago, Dunedin, New Zealand

²School of Surveying, University of Otago, Dunedin, New Zealand

Post-release monitoring is a vital component of animal reintroductions. Importantly, post-release monitoring can answer questions relating to factors influencing the success or failure of reintroductions. In this privately funded conservation project, 19 buff weka (*Gallirallus australis hectori*) were reintroduced from predator-free islands into a heavily trapped mainland site near Wanaka, South Island, New Zealand. The buff weka is a large, flightless rail that is endemic to New Zealand and culturally significant to the indigenous Ngai Tahu. This species is currently extinct in its natural range in the eastern parts of the South Island. Past reintroductions of buff weka to the mainland have failed, but a lack of post-release monitoring has meant the exact cause and timing of failures is unknown. Using a combination of GPS and VHF telemetry, the reintroduced population of buff weka was intensively monitored for four months post-release from December 2011. This research documents the survival, dispersal and habitat selection of buff weka within a ‘mainland island’. Preliminary results show that no buff weka dispersed outside of the ~2500ha trapping area, however 74% (n=14) of the birds died from predation due to exotic mammals during the monitoring period.

3:00-3:30 DISCUSSION

Mal Nairn Lecture Theatre 16:00-17:45pm

Open session: Protected area management

4:00-4:15 Indigenous use of coastal wetland resources in a changing climate; adaptation in the Alligator Rivers Region, Northern Territory of Australia

LIGTERMOET, E¹, Baker, R², Bayliss, P³, Jackson, S³ and Scheepers, K³

¹Fenner School of Environment and Society, Australian National University (ANU)

²ANU

³CSIRO

Coastal freshwater wetlands and floodplains play a vital role in indigenous livelihoods and cultural practices across Northern Australia. The freshwater floodplains of the Alligator Rivers Region, including those of Kakadu National Park, are highly valued and utilised by indigenous communities, but are also highly vulnerable to the impacts of climate change. Saline intrusion from rising sea levels and increased storm surge is a serious threat to freshwater biodiversity, which is already under pressure from existing and synergistic threats of invasive weed species and feral animals. This research aims to better understand the potential impacts of climate change on floodplain resources of value to indigenous communities in the Alligator Rivers Region, and what adaptation strategies might be employed to best (culturally and ecologically) manage the resources in a changing climate. Participatory research methods will be adopted in this study as sharing knowledge systems will be crucial to developing appropriate adaptation strategies, particularly for wetland systems under co-management, like those in Kakadu National Park.

4:15-4:30 Expert elicitation of a Bayesian Belief Network for the Great Barrier Reef

BAN, S¹

¹ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville QLD 4811

Coral reefs globally face a variety of threats, both natural and anthropogenic, that may act synergistically in ways that are complex and currently not well understood. Bayesian belief networks present an ideal tool for modeling the range of uncertainties that exist in the interface between social and ecological systems. They enable decision makers to solicit input and preferences from experts and non-experts alike through the use of subjective or qualitative knowledge and preferences about costs, threats, and values. Beyond weighting network/model parameters, stakeholder input may also drive the structure of the model itself. In this study, expert opinion from coral reef ecologists and managers was solicited to construct a Bayesian belief network (BBN) about the Great Barrier Reef ecosystem that highlights potentially synergistic relationships of concern as well as areas with knowledge gaps. This Bayesian network can then be applied under various climate change scenarios to explore the consequences of uncertainty on management decisions for the Great Barrier Reef.

4:30-4:45 The costs of managing Queensland's protected areas

CRAIGIE, ID¹ and Pressey, RL¹

¹ARC Centre of Excellence for Coral Reef Studies

Protected areas are the cornerstone of global conservation efforts yet despite their importance our knowledge of the financial resources required to effectively manage them is remarkably poor. For the vast majority of protected areas we have little understanding of what is being spent, what should be spent or what factors drive costs. Here I present the initial results of a project to answer these questions for Queensland's protected areas and discuss them in the context of other cost estimates from Australia and around the globe. The key factors driving variation in spending levels change with location within Queensland, however it is clear that visitor numbers, ecosystem type and the frequency of extreme meteorological events all play important roles. These new data offer the opportunity to gain a much improved understanding of the costs of managing protected areas, which in turn will lead to better spatial planning and improved allocation of limited funds across management and organisational networks.

4:45-5:00 Strategic Adaptive Management in the Macquarie Marshes and Lake Eyre Basin – learning from the South Africans

KINGSFORD, RT¹

¹Australian Wetlands, Rivers and Landscapes, School of Biological, Earth and Environmental Sciences, University of NSW, Australia

Aquatic ecosystems are connected over large spatial scales, have varied drivers, strong and often conflicting societal interests and interacting management processes. Many of the world's protected areas (>100,000, ~12% of land) include freshwater ecosystems, some specifically declared for freshwater protection. Such complex social-ecological systems have considerable challenges. The Strategic Adaptive Management (SAM) approach is a management framework implemented in Kruger National Park, South Africa. The stages of SAM should produce an agreed vision and/or mission among stakeholders, with an appropriate hierarchy of objectives that determines indicators to be measured, allowing ongoing reflection, learning and adaptation. Early implementation of SAM has begun within the Murray-Darling Basin, focusing on the Macquarie Marshes and in the Lake Eyre Basin. There are many challenges, including varied governance, different institutions but the process potentially allows tracking of natural resource management and a focus on achieving goals and specific objectives. There is no panacea for achieving aquatic conservation, but Strategic Adaptive Management offers hope with its interlinked processes for navigating complexity and learning. SAM in freshwater conservation is progressing because of the imperative for sustainability, history of interaction between scientists and managers and the need for transdisciplinary governance of rivers.

5:00-5:15 A Management Strategy Evaluation framework to adapt to risks from sea level rise and invasive species to the coastal wetlands of Kakadu National Park, Australia

BAYLISS, P¹, Setterfield, S², Douglas, M², Jackson, S³ and Woodward, E³

¹CSIRO Marine & Atmospheric Research (Wealth from Oceans flagship), EcoSciences Precinct, PO Box 2583, Brisbane QLD 4001

²Charles Darwin University, Darwin, NT 0909;

³CSIRO Ecosystem Sciences (Water for Healthy Country flagship), PM 44 Winnellie NT 0821

Climate change threatens the resilience of Indigenous coastal communities that rely on ecosystems for their well-being by reducing opportunities for sustaining and developing future ecosystem-based livelihoods such as ecotourism. The Northern Australia Biodiversity Hub has commenced a three year study on Kakadu National Park (KNP) that focuses on managing risks from sea level rise and invasive species to its coastal wetlands. However, managing complex socio-ecological system such as co-managed KNP is a very difficult task because managers are required to achieve high-level goals in the face of uncertainty and budget constraints. Whilst most would agree that adopting an Adaptive Management (AM) framework is the solution, it does not come with operational guidelines. We have therefore adopted a version of AM called “Management Strategy Evaluation” (MSE) that has its origins in fisheries management. The applied approach is outlined here and links objectives, targets and performance indicators to decision-making by managers and other stakeholders, and focuses on comparing outcomes with objectives. It uses computer simulation models to assess the consequences of a range of management strategies in a “safe” environment, and presents the results as a set of trade-offs in agreed performance measures of selected indicators across a range of management objectives.

5:15-5:30 Measuring performance in the joint management of protected areas in northern Australia

STACEY, N, Izurieta, A and Garnett, ST

Research Institute for the Environment and Livelihoods, Charles Darwin University, Ellengowan Drive, Casuarina, Darwin NT 0909 Australia

Responsibility for management of many protected areas in the Northern Territory, Australia, is shared between the management agency and the Aboriginal owners of that land. In this paper we describe 1) the creation and types of indicators developed by partners in a participatory process to measure management effectiveness, 2) the assessment method used to monitor progress and 3) the results of the first cycle of evaluations in four jointly managed parks. We were able to identify a set of common indicators that were applied across the four park areas. The agreed indicators, which were scored using a color scale to indicate level of achievement, were primarily concerned with process rather than outcome, with particular emphasis on the strength of social relationships. There were indicators that assessed performance in governance and decision making, application and interpretation of cultural heritage and traditional ecological knowledge, expansion of social capital, human and financial resources, and visitors, with little emphasis on the biophysical outcomes of the management. We discuss opportunities and difficulties for replication and adaptation of indicators to all jointly managed parks in the Northern Territory.

5:30-5:45 DISCUSSION

Blue 5.1.1

16:00-17:45

Symposium: Improving governance for integrated natural resource and biodiversity management across northern Australia

Organizer: Allan Dale

While the biophysical foundations behind a range of integrated natural resource and biodiversity management issues are generally well understood across northern Australia, less attention has been paid to analysing and improving governance systems. Effective governance is the key to efficiently and effectively resolving natural resource problems, and northern Australia's landscape faces unique governance challenges quite different to other parts of the nation. This symposium will explore the foundation principles that underpin healthy governance systems, and will explore the strengths and weaknesses in different governance domains across the north. The session will conclude with an open discussion concerning priorities for Governance reform in the north.

4:00-5:15 Indigenous Governance

MORRISON, J¹

¹North Australian Indigenous Land and Sea Management Alliance Limited, Building Red 2.2.20 Charles Darwin University

4:15-4:30 Governance System for Effective Biodiversity Management

DALE, A¹ and Vella, K

¹James Cook University

While the biophysical foundations behind a range of integrated natural resource and biodiversity management issues are generally well understood across northern Australia, less attention has been paid to analysing and improving our governance systems. Good governance is the key to efficiently and effectively resolving natural resource problems, and northern Australia's landscape faces unique governance challenges quite different to other parts of the nation. This paper will explore the foundations that need to underpin the development of healthy governance systems in the north, providing a basis for exploring the strengths and weaknesses in our current system. In this regard, it will outline the multi-level nature of Australia's governance systems for biodiversity management, and the heavy fragmentation between the many different themes and domains involved in integrated natural resource management. Finally, having articulated some key evaluative criteria for effective governance systems in northern Australian, the paper will provide a basis for thinking through possible short and longer priorities for reform.

4:30-4:45 Next Generation NRM Plans and Emerging Ecosystem Service Markets in Northern Australia

VELLA, K and Dale, A

Australia's new Clean Energy Act 2011 (CEA) comes into force on 01 July 2012. The \$A1.7 billion Land Sector Package is a key implementation strategy. It uses market-based payments to incentivise improvements in energy efficiency and carbon storage and importantly, it recognises the important ecosystems services that landholders and landscapes provide. The new mechanisms created under the Clean Energy Act provide a real opportunity to drive sustainable landscape reform across regions to achieve biodiversity, land, carbon, economic and social benefits on a scale not yet seen in Northern Australia. Importantly the reforms will be delivered at the regional scale through a next generation of NRM planning coupled with practice improvements across the forestry, farming, land and indigenous sectors. The opportunities for long-term biodiversity and land management envisioned under the CEA require deeper thinking about governance systems for biodiversity, land, and NRM planning. Planning and governance in this system will require the coordinated efforts of government and non-government actors and the alignment of statutory and non-statutory arrangements for land use and environmental management across boundaries, sectors, and scales to improve management, mitigate carbon in the landscape and generate tradable carbon credits. This paper reviews challenges and opportunities for the next generation of planning in Northern Australia.

4:45-5:00 Resource Governance Systems in the Northern Territory and Queensland's Gulf Country

ANDREWS, K and IKIN, N¹

¹Northern Gulf Natural Resource Management Group, Georgetown, QLD, 4871

The cultures and landscapes of the Territory and Queensland's gulf are similar in that they are each carved by remote area life and nature herself. We will discuss just what it is like to live in the bush of Northern Australia and how this fashions the principles and challenges for the community governance arrangements of two separate natural resource management organisations. Regional processes and projects are designed to deliver fit for purpose environmental and resource management outcomes and often require interaction across the States and Territories of Northern Australia. Regional planning and community practice can be disconnected from statutory planning systems and government priority setting. We will suggest how this could be improved as we look forward to an interesting future for Northern Australia's biodiversity and natural resource use and management.

5:00-5:15 Applications of Spatial Analysis to NRM and Agency Conservation Management in Northern Australia

PRESSEY, RL¹

¹Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville QLD 4811

Decision making about spatial priorities in the landscape will play an increasingly importance role in the governance of north Australia's landscape. Emerging collaborations between university conservation planners and managers across northern Australia hold promise for more effective allocation of limited resources to achieve explicit objectives. This applies not only to supporting decision making about biodiversity but also about investment in the protection of ecosystem services and livelihoods. This presentation begins by summarising diverse collaborative projects in spatial planning with the WA Department of Environment and Conservation (Pilbara Islands), Queensland Parks and Wildlife (Great Barrier Reef Islands), catchment managers of the Fitzroy (Kimberley), Daly (Northern Territory), and Gilbert (Queensland Gulf) Rivers, Terrain NRM, Mackay Whitsundays NRM, and Cape York NRM. The problems addressed by these projects include: prioritisation of management actions on islands, management of turtle nesting sites on western Cape York, prioritisation of sites for riparian restoration, balancing multiple objectives for catchment management, and adapting systematic methods to NRM planning. Managers in these areas have been engaged with the projects from the outset, helping to shape the science and ensuring that the science is useful. This is welcome progress in linking conservation science to management, but significant challenges remain. These include the difficulty of coordinated management across private land, fragmented governance, funding tied to counterproductive indicators, lack of institutional support for adaptive planning, and the need for more strategic engagement by scientists.

5:15-5:45 DISCUSSION

Open session: Fragmentation and islands**4:00-4:15 The effects of translocation-induced isolation and fragmentation on the cultural evolution of bird song**PARKER, KA¹, Anderson, MJ², Jenkins, PF³, Brunton, DH¹¹The Ecology and Conservation Group, Institute of Natural Sciences, Massey University, New Zealand²New Zealand Institute for Advanced Study, Massey University, New Zealand³Apt. 2106, 122 Shakespeare Road, Takapuna 0622, New Zealand

Understanding the divergence of behavioural signals in isolated populations is critical to knowing how certain barriers to gene flow can develop as these changes can have both evolutionary and conservation effects. For many bird species, songs are essential for conspecific recognition and mate choice. Measuring the rate of song divergence in natural populations is difficult, but translocations of endangered birds to isolated islands for conservation purposes can yield insights, as the age and source of founder populations are completely known. We found significant and rapid evolution in the structure and diversity of bird song in North Island (NI) saddlebacks, *Philesturnus rufusater*, in New Zealand, with two distinct song lineages evolving in < 50 years. The strong environmental filters of serial translocations resulted in cultural bottlenecks that generated drift and reduced song variability within islands in a similar manner to genetic evolution. Critically, NI saddlebacks in isolated island populations show a preference for familiar over unfamiliar songs. Therefore, this rapid divergence coupled with loss of song diversity has important implications for the behavioural evolution of this species, demonstrating previously unrecognised biological consequences of conservation management.

4:15-4:30 Impacts of rainforest fragmentation on ant biodiversity in New Caledonia: a multi-level assessmentBERMAN, M^{1,2,3}, Andersen, A², Austin, C⁴ and Miller, A⁵¹Research Institute for the Environment and Livelihoods, Charles Darwin University²CSIRO³University of Montpellier⁴Monash University⁵University of Melbourne

The extent of New Caledonia's highly diverse and biogeographically significant rainforests has been reduced by 50% during the last 3500 yrs, mostly due to anthropogenic fires. The remaining forests are fragmented and surrounded by a matrix of fire-derived savannas, dominated by exotic species. Responses to fragmentation have been shown to be largely species-dependant; therefore, integrating species -, community - and phylogeographic - level responses should provide a broader understanding of the impacts of fragmentation on the ecosystem. We investigate how fragment size and connectivity affect functional group composition and species richness. We have sampled litter ants using Winkler sacks in six fragments (ranging from 3.1 to 7.75 ha) and three sites in the adjacent continuous forest. Our sampling design allows us to infer fragmentation impacts using a species density approach (same sampling effort across sites) as well as the classical species-area approach (adjusting sampling intensity according to fragment size). Additionally, we use the phylogeographic signal from a variable region of the mitochondrial DNA of a rainforest endemic, *Leptomyrmex pallens*, collected in a further five fragments and one continuous forest, to infer past forest connectivity.

4:30-4:45 Implications of life-history characteristics of a rare herb (*Trioncinia retroflexa*) to species resilience in a fragmented landscape

HALLER, A¹, Mayfield, M and Fensham, R

¹ School of Biological Sciences, University of Queensland, St. Lucia, 4072, Australia

Habitat fragmentation is the foremost driver of biodiversity loss. While the general implications of fragmentation are understood, how these effects fluctuate among species with different life-history traits is less so. Quantifying the relevance of species' traits to its historical persistence is vital when evaluating threats to modern persistence under fragmented conditions. The objectives of this study are to: define the life history traits of the endangered grassland endemic, *Trioncinia retroflexa*, assess the historical significance of traits to species persistence and evaluate how their interactions influence species' vulnerability to fragmentation. Seed viability and germination, seed bank viability, seedling establishment and community biodiversity were analyzed. Seed germination varied significantly (0 – 36.1%) across treatments and was not indicative of seed viability (81.7%). Seed banks maintained viability up to 18 months but decline rapidly afterwards. Seeding trials demonstrate no significant response to land treatment with < 1% seedling survivorship the subsequent year. Community composition varied significantly between populations; with both native (*Dichanthium*) and introduced (*Aristida* and *Heteropogon*) grasses dominating. The relative success of mature individuals over earlier life stages suggests traits associated with population recruitment may be under greatest pressure from habitat fragmentation and of highest priority to future persistence.

4:45-5:00 Remnant tree decline in agricultural regions of South Australia

MOGOUTNOV, A¹

¹The University of Adelaide

The decline of paddock trees within the agricultural matrix has been widely reported across south-eastern Australia. Traditionally paddock trees—scattered relics of formally intact ecological communities—have not received the same level of conservation status as remnant patches. Increasingly, the lack of recruitment in the harsh agricultural environment coupled with the inevitable senescence of the current stock advocates greater protection be granted to perpetuate paddock trees as part of the sustainable management of agricultural landscapes. Eleven sites were chose (nine in the south-east agricultural region of South Australia and two in the Mount Lofty Ranges region) to assess paddock tree decline via counts using a combination of aerial photography and Geographical Information Systems. Four sets of counts were undertaken for each site ranging from the late 1940's through to 2008. Results across the eleven sites varied, with some site exhibiting little to no change in paddock tree numbers whilst others reveal a substantial decline—largely a result of agricultural intensification. I propose that the cumulative effect of incremental paddock tree clearance falls within the scope of a shifting baseline, and that this vegetation type needs to be afforded the same amount of protection as its remnant patch counterparts.

5:00-5:15 Optimal planning for mitigating the impacts of roads on wildlife

POLAK, T¹, Rhodes, J¹, Jones, D² and Possingham, H¹

¹Environmental Decisions Group, The University of Queensland, and ARC Centre of Excellence for Environmental Decisions

²Environmental Futures Centre, School of Environment, Griffith University

Roads have a major effect on wildlife worldwide through direct mortality, habitat destruction and fragmentation or indirectly through impact on animal behavior, habitat degradation, increased predation and invasive species effects. Two of the main ways to mitigate the impact of roads are through improving connectivity and reducing mortality (road passages, bridges, fences, etc.) and by altering the physical attributes of the road system (i.e. traffic volume, speed, vegetation cover, location, etc.). In this paper, we provide the first formal formulation of the road mitigation problem and find optimal solutions that will maximize persistence of key species for a fixed budget. We present our approach using a case study of the koala (*Phascolarctos cinereus*) in a part of South-East Queensland, where cars cause about a third of all deaths. By exploring all mitigation options we are able to choose the best combination of actions for any budget.

5:15-5:30 Which parasites ‘catch the boat’: The origins and characteristics of an avian malaria community in an isolated island avifauna

EWEN, JG¹, Bensch, S², Blackburn, TM^{1,3}, Bonneaud, C⁴, Brown, R¹, Cassey, P⁵, Clarke, R⁶, and Prez-Tris, J⁷

¹Institute of Zoology, Zoological Society of London, Regent’s Park, NW1 4RY, London, United Kingdom

²Department of Biology, Lund University, S’lvegatan 37, 22362 Lund, Sweden

³Distinguished Scientist Fellowship Program, King Saud University, P.O. Box 2455, Riyadh 1145, Saudi Arabia

⁴Station d’Ecologie Experimentale du CNRS USR 2936, 09200 Moulis, France

⁵School of Earth and Environmental Sciences, University of Adelaide, SA 5005, Australia

⁶School of Biological Sciences, Monash University, Clayton, Victoria 3125, Australia

⁷Department of Zoology and Physical Anthropology, Complutense University, Madrid 28040, Spain

Our knowledge of the processes favoring the establishment of exotic parasites is poor. Here we test the characteristics of successful exotic parasites that have co-established in the remote island archipelago of New Zealand, due to the introduction of numerous avian host species. Our results show clearly that avian malaria parasites (AM; parasites of the genus *Plasmodium*) which successfully invaded are more globally generalist (both geographically widespread and taxonomic range of hosts) than AM parasites not co-introduced to New Zealand. Furthermore, the successful AM parasites are more prevalent in their native range than AM parasites found in the same native range but not co-introduced to New Zealand. This has resulted in an increased number and greater taxonomic diversity of AM parasites now in New Zealand. Understanding the characteristics of parasites aiding their establishment is invaluable for predicting patterns of human-mediated global change in parasite faunas, and managing their occurrence and impact.

5:30-5:45 Avian movement patterns through Torres Strait – a significant flyway for Australian landbirds

CLARKE, RH¹ and Ewen, J¹

¹School of Biological Science, Monash University, Victoria, Australia

In Australia the study of cross-border avian movement patterns has largely been restricted to shorebirds, and to a lesser extent seabirds and waterfowl. Little attention has been given to the cross-border movement of passerines and terrestrial non-passerines (e.g. pigeons, kingfishers etc) and this contributes to a common perception that relatively few landbirds cross international borders in the Australasian region. Formerly an ancient land bridge between Australia and New Guinea, Torres Strait now poses a significant (marine) barrier to many landbirds. Here we quantify the extent and nature of landbird movement through Torres Strait using mist-net surveys that included a mark-recapture component, and ground surveys of community composition covering all seasons. This is the first attempt to document landbird movement in Torres Strait using quantitative approaches. We show that previous reviews have incorrectly labelled a number of resident Torres Strait landbirds as migrants whilst overlooking others that can be defined as regular migrants, irruptive nomads or occasional visitors within the flyway. Extrapolation of count data for landbirds identified as migrants in this study demonstrate that >500,000 individuals move through Torres Strait on an annual basis. Given both conservation and quarantine concerns such a substantial avian flyway is deserving of more attention.

Workshop: I-Tracker: Indigenous people collecting and mapping data to support local land and sea management

Organizer: Micha Jackson and Erica McCreedy

I-Tracker, short for 'Indigenous Tracker', is a project run by the North Australian Indigenous Land and Sea Management Alliance (NAILSMA), which supports Indigenous land and sea managers across north Australia to undertake natural and cultural resource monitoring and management, and conservation and research activities. It is guided by principles which ensure I-Tracker activities respect Traditional Owner authority and cultural protocols, and protects Indigenous Intellectual Property and data ownership rights.

Field tough computers using standardised data collection applications created using the renowned CyberTracker software allow Indigenous land and sea managers to collect and manage information that informs local planning and decision making. The types of data collected include wildlife sightings and biodiversity surveys; marine management activities; quarantine, customs and fisheries information; feral weeds and pests; fire; cultural site protection; and visitor management. I-Tracker applications include significant input from scientists, experts, government agencies, and fee-for-service organisations. The program allows for data collected locally to be pooled with other data collected using the same application, so that local data collection can contribute to land and sea management at regional, national and even international scales. It is also a program that facilitates collaboration and transfer of knowledge between Traditional Owners, scientists, and land management and government agencies.

This workshop provides an opportunity to present the I-Tracker applications that have been developed to support data collection by Indigenous land and sea managers. It will include a presentation about these applications, and then provide the opportunity for participants to move outside and collect data using handheld PDAs loaded with I-Tracker applications and CyberTracker software installed. It will also showcase some of the mapping and reporting capabilities of CyberTracker software.

Sunday 23rd September

Mal Nairn Lecture Theatre 08.30 – 10:10

8:30-10:00am Plenary Session

Joe Morrison

North Australian Indigenous Land and Sea Management Alliance

Joe Morrison is the Chief Executive Officer of NAILSMA Ltd. Both Dagoman and Torres Strait Islander, he has spent the last 20 years working with remote communities throughout the Top End of the Northern Territory, and more recently across north Australia, to develop capacity to lead “Caring for Country” initiatives. For the past decade, Mr Morrison has been advising Federal, State and Territory governments about Indigenous natural and cultural resource management, advocating for increased resources as part of the reform agenda in Indigenous communities and has overseen research relating to Indigenous livelihoods, water policy and planning, carbon, climate change, marine management and Indigenous Knowledge. He is currently a member of the Federal Government’s Indigenous Advisory Committee. He has a BA in Natural Resource Management from the University of Sydney

The future of indigenous land and sea management in northern Australia

The caring for country renaissance expressed as modern day Indigenous land and sea management has grown exponentially over the last 30 years across northern Australia. It is now emerging as the job of choice for many remotely located Indigenous people wanting to fulfil their cultural obligations and broader aspirations to their families and country. The caring for country movement became an expression of the long standing commitment to ancestral lands and seas, and so it made sense to use the ‘environment’ banner as a means of achieving sometimes unrecognized but purely Indigenous ambitions. Today, well over 80% of northern Australia has some form of legally recognized title or interest by Indigenous people. With a rapidly growing and young Indigenous population, caring for country is now viewed as a success in Indigenous public policy. But the future of caring for country will require a comprehensive rethink to reinvigorate the Indigenous discourse and associated social, cultural and customary values that underpin Indigenous efforts. Without this uniqueness rising up, caring for country will wither along with many other great Indigenous created ideas.

Zoe Ryan

Fauna and Flora International

Zoe Ryan is a Registered Professional Forester with twelve years experience in research, design and implementation of forest carbon projects. As the Senior Forest Carbon Specialist under the Fauna & Flora International/BioCarbon partnership, Zoe provides technical oversight of a series of REDD projects located in Asia-Pacific, Africa and South America. She is responsible for design and implementation of forest inventory, vegetation classification, baseline forecasts, forest monitoring, data analysis and writing of the Project Document in accordance with the Verified Carbon Standard (VCS). She has experience working with a range of forest carbon project types including REDD (both unplanned and planned deforestation); Improved Forest Management; and Afforestation, Reforestation and Deforestation. Her projects cover a range of forest types including tropical lowland rainforest, peat swamp forest, miombo woodland and mangroves. Zoe was appointed to the VCS AFOLU Steering Committee in 2011, as well as to the expert review panel for Peat Rewetting and Conservation (PRC) projects, and the Jurisdictional and Nested REDD Initiative. She is an Honorary Fellow at the School of Forestry and Ecosystem Science at the University of Melbourne, where she lectures in the Forestry Masters program. She is recognised by her professional organisation as Registered Professional Forester (RPF), with specialist expertise in REDD and carbon accounting.

Carbon credits and conservation: To the rescue, or REDD herring?

What is shapeless, odourless, weightless (but equivalent to one tonne), and is widely considered to be the last great hope for conservation of the world's natural forests? Why carbon credits, of course. Since 2005, the United Nations Framework Convention on Climate Change (UNFCCC) has been making steady progress towards inclusion of a mechanism to harness the power of carbon markets to reward developing countries for reducing deforestation. This mechanism, known as 'Reduced Emissions from Deforestation and Degradation' (REDD+), has raised at least \$3.11 billion in donor funds, and now contributes 71% of credits traded on the voluntary forest carbon market. There are at least 50 active REDD projects registered globally, and at least that many again in the project 'pipeline'. Given these vast sums of money, effort, and associated flight emissions(!), one might ask, has REDD+ been successful in conserving threatened ecosystems? Or would the money have been better spent on conservation initiatives more directly? These questions are explored via a series of REDD+ case studies. Lessons learned are examined, and the future prospects of achieving widespread conservation by harnessing carbon markets is discussed.

10:00-10:10am Managing water and energy resources two-ways

Nerida Beard, Power and Water Corporation

Morning Tea Break 10:10-10:45 am

Mal Nairn Lecture Theatre – 10.45 – 12.45

Symposium: Indigenous knowledge integration and Land and Sea Country management: lessons learned from northern Australia

Organizer: Alana Grech

'Indigenous ecological knowledge' identifies the cumulative body of knowledge, practice and beliefs on local natural environments, that is handed down through generations by cultural transmission. Indigenous knowledge is recognised in national and international policies, including the Convention on Biological Diversity, as integral to both the cultural survival of traditional and Indigenous peoples and the conservation of global biodiversity. Despite this, Indigenous knowledge is frequently overlooked due to the privileging of western perspectives of natural resource management by government, research and management agencies. In this symposium we present case studies and conceptual and technical frameworks from northern Australia to provide new insights on Indigenous knowledge integration into Land and Sea Country management. We begin with an overview of Indigenous knowledge integration in northern Australia, and follow with a discussion on the importance of appropriate co-management governance structures to support knowledge integration and how this can be identified spatially. We end with a series of case-studies from the Torres Strait, Arnhem Land and Wet Tropics World Heritage Area to demonstrate how Indigenous knowledge is effectively integrated into Land and Sea Country management in northern Australia. The lessons learned from northern Australia provide valuable insights on Indigenous knowledge integration that can be applied to other regions of Oceania.

10:45-11:00 Indigenous knowledge integration and Land and Sea Country management in northern Australia

GRECH, A¹, Marsh, H², Pressey, RL¹

¹ Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD 4811

² School of Earth and Environmental Science, James Cook University, Townsville, QLD 4811

The Indigenous Traditional Owners of northern Australia are custodians of Land and Sea Country of globally significant biodiversity value and relatively low human impact. In this region and others, the knowledge and capacity of Indigenous communities is integral to the understanding and management of natural and cultural resources. We present an overview of Indigenous knowledge integration and Land and Sea Country management to set the scene for a series of case-study presentations that provide new insights on knowledge integration in northern Australia.

11:00-11:15 Indigenous governance and knowledge integration into environmental management: towards equitable recognition

HILL, R^{1,2}, Pert, PL^{1,2}, Davies, J¹, Walsh, F¹, Robinson, CJ^{1,3} and Falco-Mammone, F⁴

¹CSIRO Ecosystem Sciences

²School of Earth and Environmental Sciences, James Cook University

³School of Geography, Planning and Environmental, University of Queensland

⁴Focus on Research

Our recent literature review of Australian Indigenous Land Management identified lack of recognition and support for Indigenous knowledge and world views as significant barriers to Indigenous roles in formal environmental management. Earlier analysis, of twenty-one case studies, showed a positive association between Indigenous governance/co-governance, and successful integration of Indigenous ecological knowledge (IEK) into environmental management. Indigenous governance and co-governance enable the customary law authority for Indigenous people to develop innovations that deploy their IEK into formal environmental management, while maintaining its integrity. Collaboration between science and IEK under such Indigenous governance supports co-generation of new amalgamated forms that are often distinctly Indigenous, such as paintings of country spatially located onto scientifically-derived vegetation maps. Given these positive outcomes, the barriers encountered by Indigenous peoples seeking to deploy IEK for environmental management are problematic. These barriers arise from three main sources: legal and administrative structures that impede recognition of Indigenous cultural rights; power imbalances between knowledge systems that favor Western epistemology; and lack of practical guidance about management of knowledge boundaries across Indigenous, scientific and management domains. We argue that Indigenous-specific IEK programs, building on the successful Indigenous Protected Area program characteristics, will help ensure equity for IEK in formal environmental management.

11:15-11:30 A spatiotemporal analysis of investment in indigenous land and sea management in Australia

PERT, PL^{1,2}, Hill, R^{1,2}, Davies, J¹, Walsh, F¹, Robinson, CJ^{1,3} and Falco-Mammone, F⁴

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³School of Geography, Planning and Environmental, University of Queensland

⁴Focus on Research

Few reviews have been undertaken of external investment in indigenous land management. Our recent work has included a comprehensive review and spatiotemporal analysis of investment in indigenous land and sea management in Australia over a 10-year period. Source data on funding was primarily gathered from annual reports and summaries on Australian Government programs such as Caring for Our Country, National Heritage Trust, National Landcare Program, Environmental Stewardship Program and the Working on Country program. We also included funding from a number of large philanthropic organisations as well as from the Queensland Government. We derived spatial datasets, enabling the spatiotemporal visualisation and analysis of various attributes relating to indigenous funding across Australia. We identified approximately 571 sites and at least 126 organisations that had received funding for land and sea management over the 10-year period. These sites include the 51 declared Indigenous Protected Areas (IPAs), 34 IPA consultation projects and 7 co-management consultation projects, as well other areas of Aboriginal land and sea country. Using this information, we produced maps that allow users to visualise where government, philanthropic and other investment had been allocated across the sea and

landscape as well as over time; the amount of funding; and the years funding was allocated. Among other things, the analysis shows the spatial imbalance of funding across both the land and seascapes. Factors which contribute to explaining this imbalance include: the heterogenous distribution of Aboriginal land and sea country; the disparate location of Indigenous communities; and the distribution of priority biodiversity values and threats as assessed by external investors.

11:30-11:45 Torres Strait turtle and dugong community based management plans LUI, S¹

¹Torres Strait Regional Authority

The Torres Strait is home to Eddie Koiki Mabo who was a significant national and international figure in altering the traditional land rights landscape in Australia. The High Court delivered the decision of *Mabo and others v Queensland (No.2)* in 1992. To date, 27 native title determinations have been made over the land and waters in the Torres Strait. Most recently, in 2010, the Federal Court of Australia recognized non-exclusive native title rights over about 37,800sq km of sea in the Torres Strait., including the non-exclusive rights of group members of the inhabited island communities to access, remain in and to use their own marine territories or territories shared with another, or other communities to access and take resources for any purpose, including trading. A complex system of State, Commonwealth and International law governs the interests of Torres Strait Islanders, the Commonwealth government, the State government, commercial industry and Treaty villages in Western Province, Papua New Guinea. The traditional hunting of turtles and dugongs within the Torres Strait is regarded as a fishery in the sense that it is managed through the *Torres Strait Fisheries Act 1984*. All management arrangement decision making processes are driven through the consultative framework of the Protected Zone Joint Authority (PZJA). The PZJA members are the Federal and State Fisheries Ministers and the Chairperson of the Torres Strait Regional Authority. Through a significant consultation process beginning in 2008, 14 Torres Strait Island communities developed and endorsed Community Based Dugong and Turtle Management Plans (Plans). Although the Plans are not legislated and voluntary, each Plan has been endorsed by the appropriate Traditional Owners, Clan Groups and Native Title Representatives for each community. The Plans have been provided to the PZJA and passed through the Australia/PNG Bilateral Treaty process and have the endorsement of the Queensland DERM and the Commonwealth SEWPAC Ministers. The Plans contain traditional hunting rules not captured in legislation, welfare statements to ensure the animals are treated with respect, communication and education activities and catch and habitat monitoring actions. This presentation will provide an account of the Torres Strait journey thus far including, important aspects of the Plans, the challenges and achievements, current activities, and what we believe the future holds.

11:45-12:00 Protecting culturally and ecologically significant freshwater billabongs in southern Arnhem Land using Indigenous and non-Indigenous techniques

DANIELS, C¹ and ENS, E²

¹Yugul Mangi Rangers

²The Australian National University, Canberra, 0200, Australia

Feral ungulates are increasing in abundance across Australia and impact on many linked ecosystem and cultural features. Although these impacts are of concern to conservationists, there can be a range of socio-economic and cultural challenges to feral animal control. In southern Arnhem Land, Indigenous Rangers are concerned about the cultural and ecological impacts of feral ungulates (buffalo, pigs and horses) on freshwater billabongs and have worked with a non-Indigenous ecologist to document ecological and cultural effects and raise local awareness. The Rangers steered the project design which included fencing around three culturally significant billabongs and identification of ecological and cultural indicators of feral animal damage and healthy country. The team worked together to develop a monitoring program using a range of techniques including CyberTracker data collection software. After three years, exclusion of the ferals resulted in measured improvements to water quality, water lily and grass cover and rapid declines in feral animal signs. After initial community concern about the project, only two months passed before other Traditional Owners noticed the positive effects and asked if fences could be erected on their country. This information will be used to inform local decision making and develop regional management plans for freshwater resources and feral animals.

12:00-12:15 Indigenous land managers at the cutting edge: I-Tracker tools for better land management

McCREEDY, E¹

¹North Australian Indigenous Land and Sea Management Alliance Limited, Building Red 2.2.20 Charles Darwin University

Indigenous land managers are responsible for some 30% of land in northern Australia, with a further 80% of land under Indigenous land rights claims. To fulfil traditional and contemporary responsibilities, Indigenous land managers are combining traditional and cultural knowledge with modern tools to manage country. The I-Tracker Land Patrol Application, an initiative of the North Australian Indigenous Land and Sea Management Alliance (NAILSMA), and based on the famous CyberTracker software provides a robust way to collect, analyse and report on field data. Regardless of geographical location, Indigenous land managers face similar environmental threats from invasive species and wildfires to impacts on fresh water sources and biodiversity. I-Tracker is designed to collect standardised data while allowing for customisation to reflect local and regionally specific priorities. Partnerships with researchers and scientists encourage best practice methodologies and support data sharing to improve regional management responses. Incorporating community based planning goals with external contractual requirements has been a major aim throughout development. Developing the Land Patrol Application has included an on-country trial and working group made up of Traditional Owners, Indigenous rangers, scientists and researchers to evaluate its useability in the field and ensure it address Indigenous land management objectives.

**12:15-12:30 Integrating traditional knowledge with land management activities:
Development of the Ngurrara seasonal calendar.**

LEONARD, S¹, Mac Laren, G¹, Murray, P², KOGOLO, A³, Langton, M¹.

¹ University of Melbourne.

² *Ngurrara Ranger program.*

³ Warlu Jilajaa Jimu Indigenous Protected Area.

Traditional Ecological Knowledge (TEK) paradigms have high levels of complexity that help explain relationships between cycles of annual weather patterns, water availability and the subsequent response of flora and fauna in the landscape, providing an understanding of a entire environmental system. This project aims to use Indigenous seasonal calendars to develop tools and associated methodologies that allow the application of TEK to inform contemporary conservation activities in Indigenous land management. The Ngurrara seasonal calendar is being developed in partnership with the Warlu Jilajaa Jimu Indigenous Protected Area and the Ngurrara ranger program from the northern Great Sandy Desert region of the Kimberley. A seasonal calendar database provides a mechanism to capture and store TEK to describe the interactions between changing weather patterns and flora and fauna behavior within Ngurrara's 75,000km² native title estate. The database design provides an organized structure for the quantification of TEK to inform conservation activities by rangers and IPA managers. The database is enabling traditional owners to identify cultural keystone species and bi-temporal indicators of change to significant cultural sites of high biodiversity. This in turn allows rangers to evaluate both positive and negative feedbacks within the environment to design targeted action based work plans that respond to ecosystem needs for better conservation outcomes.

12:30-12:45 DISCUSSION

Open session: Threatened Species Management**10:45-11:00 Investigating the overwintering micro-habitat used by the vulnerable amphibian *Litoria aurea* and the effect on chytridiomycosis infection loads**GARNHAM, J¹, Stockwell, MP¹, Pickett, EJ¹, Pollard, CJ¹, Clulow, J¹ and Mahony, MJ¹.¹Amphibian Research Laboratory, School of Environmental and Life Sciences, University of Newcastle

The green and golden bell frog (*Litoria aurea*) has followed the pattern of global amphibian declines experiencing an 80% reduction in its distribution most likely attributed to the pathogenic fungus, *Batrachochytrium dendrobatidis*, which causes the disease chytridiomycosis. *Litoria aurea* mortality events attributed to chytridiomycosis have been observed during the winter months when temperatures fall within the optimal temperature range for chytrid (17°- 22° C). *Litoria aurea* seeks shelter during winter making them difficult to access, thus it is unknown what effect overwintering habitat and chytrid infection has on individual survival rate. Radio-telemetry was used to repeatedly locate 20 individual *L. aurea* from May to July 2011 at Sydney Olympic Park. Body temperature, micro-habitat structure and infection load were recorded weekly for each frog. In addition, mark-recapture was used during summer to compare seasonal chytrid loads in the population. Chytrid prevalence was minimal over summer but rapidly increased following the temperature decline in autumn. Whilst no chytrid related mortality occurred in radio-tracked frogs during the study, infection loads reached high levels in some individuals. Knowledge of the seasonal variation in chytrid prevalence and load can assist in understanding frog behaviour and the population's demography.

11:00-11:15 Sexual segregation in the foraging ecology of juvenile New Zealand sea lions: implications for intra-specific competition, population dynamics and conservationLEUNG, ES^{1,2}, Louise Chilvers, B³, Nakagawa, S¹, Moore, A² and Robertson, BC¹¹Department of Zoology, University of Otago, PO Box 56, Dunedin 9054, New Zealand²School of Surveying, University of Otago, PO Box 56, Dunedin 9054, New Zealand³Department of Conservation, Aquatic & Threats Unit, PO Box 10-420, Wellington 6143, New Zealand

Sexual segregation (sex differences in spatial organisation and resource use) is observed in a large range of taxa. Investigating causes for sexual segregation is vital for understanding population dynamics and has important conservation implications, because sex differences in foraging ecology affect vulnerability to area-specific human activities. We examined potential conservation repercussions of the sexual segregation observed in juvenile New Zealand sea lions (*Phocarctos hookeri*) by assessing sex differences in spatial overlap with trawl fisheries activities. Male juvenile sea lions foraged over greater ranges than females, but female foraging grounds had proportionally double the overlap with fisheries operations than males. As a consequence of the sexual segregation in foraging ecology, female juvenile NZ sea lions are at greater risk of resource competition and bycatch from fisheries than males, which can result in higher female mortality. Such sex-biased mortality could impact population dynamics, because female population decline can lead to decreased population fecundity. Thus, effective conservation and management strategies of this nationally critical, vulnerable species must take into account sex differences in foraging behaviour, as well as differential threat-risk to external impacts such as fisheries bycatch.

11:15-11:30 Who's who of palm cockatoos

ZDENEK, C¹

¹The Australian National University

Palm cockatoos (*Probosciger aterrimus*) are a large, iconic species of parrot that only occur on Cape York Peninsula (far north QLD), New Guinea, and some offshore islands. A recent Population Viability Analysis determined that the Australian palm cockatoo population may be in severe decline (Heinsohn et al. 2009). More information on certain demographic parameters is required to understand their conservation status. However, previous attempts to capture and mark palm cockatoos proved both extremely difficult and stressful for the birds, making traditional capture-mark-recapture techniques unfeasible for this species. As such, I evaluated two non-invasive techniques to 'mark' and track individual palm cockatoos over time: 1) vocal individuality (VI) (using sound analysis of individual bird calls) and 2) photo-identification (building upon similar dolphin dorsal fin photo-ID techniques). Several aspects of the palm cockatoo vocal behaviour and breeding system preclude the usefulness of the VI technique for identifying individuals of this species; however, photo-ID showed promising results and should be explored further.

11:30-11:45 Is reproductive activity in Kākāpō linked to a novel steroid-binding domain and hormonal activity in native plants?

DAVIS, CEJ¹, McNatty, KP¹ and Pitman, JL¹

¹Victoria University of Wellington, Wellington, New Zealand

Kākāpō (*Strigops habroptilus*) are a critically endangered species (current population = 126) with an unusual reproductive strategy; they breed predominately in "masting" years. It has been hypothesised that their reproduction is synchronized with a steroidal "trigger" present in plants during masting. If this is valid, then Kākāpō and closely related parrots would be receptive to these plants in an unusual manner. The aims of this study were: (i) to identify unique amino acid sequences encoding the steroid-binding domains for several receptors and; (ii) to test plant extracts that are known food sources for Kākāpō for steroidogenic activity. The ligand binding domain of the steroid receptors for Kākāpō and other NZ parrots demonstrated a number of amino acid differences from chicken and human. *In silico* modelling suggests changes in the ligand-binding domain of these receptors in Kākāpō and other parrots which may influence the binding affinity/potency of certain plant chemicals for this receptor. Some NZ plant extracts screened for their oestrogenic binding ability in a yeast-based assay expressing human estrogen receptor α had weak estrogenic activity. However, it remains to be determined whether the steroidogenic potency of these extracts is modified when interacting with the unique ligand binding domain of NZ parrots.

11:45-12:00 Endangered species management planning in New Zealand

MCBRIDE, N¹, Holland, J¹, Minot, E¹ and Cassells, S¹

¹Environmental Management, Zoology Department, Institute of Natural Resources, Massey University, Palmerston North, 4442, New Zealand

Conservation efforts depend upon a number of factors, including knowledge, availability of resources, management planning and a willingness of the government and community to commit to long-term recovery actions. New Zealand has recovery plans for only 50 species despite the fact that there are some 2800 species classified as threatened and facing potential extinction. This research analysed the content of New Zealand's threatened species recovery plans and compared them with selected national threatened species recovery plans written for Australian threatened species. The study revealed that if threatened species recovery efforts are to be successful in the future, there needs to be an immediate review of existing recovery plans. Recovery planning in New Zealand would also benefit from increased advocacy in the community about the Department of Conservation's plans for the long term management of our threatened species and legislation at the national level that specifically addresses threatened species (such as the Wildlife Act 1953 and Conservation Act 1987) should be revised and enforced.

12:00-12:15 The state-contingent approach to the Noah's Ark problem

Shankar, S and PERRY, N¹

¹University of Western Sydney

The traditional economic and conservation biology approach to the Noah's Ark problem – the problem of efficiently allocating limited funds to conserve biodiversity – relies on a static understanding of risk. Concepts such as the probability of extinction, the expected diversity of a group of species, and the probability of success of conservation projects are not contingent on the state of nature in any formal sense. We develop a theoretical model to study the Noah's Ark problem using the state-contingent approach to managing risk, which is commonly applied in the economics of natural resource management. The state-contingent approach makes current management decisions (in this case the prioritisation of species or biodiversity projects) contingent on future states of nature and this is especially appealing in the context of climate change which has uncertain future impacts. The state-contingent approach leads to a higher priority for ecologically important species even when the ultimate biodiversity objective function is based on anthropocentric values.

12:15-12:30 Measuring amphibian immunocompetence: validation of the Delayed-Type Hypersensitivity (DTH) assay in multiple Australian frogs

CLULOW, S¹, Harris, M¹ and Mahony, M¹

¹School of Environmental and Life Sciences, University of Newcastle, Callaghan, NSW 2308, Australia

The need to assess and compare immunocompetence in vertebrate organisms is obvious; reduced immunocompetence impacts survival and species persistence. Immune system maintenance comes at a cost, and trade-offs occur between an organism's level of energy investment in immune system function and other costly physiological processes. Knowledge of immunoeology is advancing rapidly in the endotherms; however ectothermic groups including amphibians are less studied, largely due to a lack of available tools for assessing immunocompetence. We investigated the effectiveness of using DTH assays to assess amphibian immunocompetence, trialing various lectins injected subcutaneously into the lower leg of numerous Australian frogs. The lectins trialed elicited swelling in all species compared to the control injection; however, there were significant differences in the magnitude of swelling response between higher taxon groupings, and between lectins used. We found the traditional method of validating swelling response to be inadequate, and developed a novel methodology for more accurately determining peak-response. Finally, we experimentally tested the validity of our DTH assay, comparing deliberately stressed and non-stressed individuals of a single species. We conclude that the DTH assay provides a valid, inexpensive, and rapid quantitative measure of amphibian immunocompetence, but warn against its use without validation in new species.

12:30-12:45 Run-Stop-Roost: The need for undisturbed high-tide roosts for migratory shorebirds

LILLEYMAN, A¹, Franklin, D¹, Szabo, JK¹, and Lawes, M¹

¹Research Institute for the Environment and Livelihoods, Charles Darwin University, Darwin, Northern Territory, 0909 Australia

Natural and anthropogenic disturbances at high-tide roosts negatively affect migratory shorebirds. High disturbance rates decrease the time shorebirds spend resting and may have long-term effects on shorebird population size. We investigated the responses of Sand Plovers (*Charadrius* spp.) and Knots (*Calidris* spp.) to natural and anthropogenic disturbances at Lee Point-Buffalo Creek in Darwin, Australia. Shorebird responses to disturbance stimuli were examined using generalised linear models. The shorebirds were more likely to respond by flight to birds of prey than to humans or humans with dogs. Vigilance in mixed species flocks was higher than in single species flocks of shorebirds and mixed species flocks were less likely to respond by flight to disturbances than single species flocks. Anthropogenic disturbances are additional to natural disturbances and incur extra costs. Wildlife managers can help protect roost-sites for migratory shorebirds by patrolling at critical times of the year, especially in October and April, when shorebirds are arriving and departing, respectively. Educational signs about shorebirds should include safe approach distances to better inform the public and also include the impacts of disturbances. This will lead to a balance between shorebird conservation and human recreation.

Blue 1.1.1

10:45-12:45

Symposium: Catchment-to-coast planning and management in Northern Australia

Organizer: Vanessa Adams

At the heart of the meeting's theme, "People and conservation on land and sea country", is the challenge for conservation scientists to build on traditional knowledge and approaches to management as well as ensuring that they strike a balance between conservation and social outcomes. This symposium will draw upon the cohesive body of research being funded by the Northern Australia NERP Hub to examine social, economic and ecological aspects of catchment-to-coast planning and management in Northern Australia. The research presented will cover terrestrial, freshwater and coastal ecosystems of the northern savanna landscapes to provide a rounded perspective of conservation management opportunities and challenges across northern Australia. Understanding the individual ecosystems and their linkages is integral to conservation efforts. Therefore, this symposium will present innovative research across ecosystems and highlighting their linkages. In particular, research presented will address understanding of biodiversity patterns and processes across ecosystems, social and cultural values and benefits derived from community-based natural resource management, and integrated catchment-to-coast planning that responds to current and emerging threats.

10:45-11:00 Research Priorities in Northern Australia

EDGAR, B¹

¹National Environmental Research Program Northern Australia Hub, Charles Darwin University, Darwin NT 0909

Charles Darwin University has been a lead partner in undertaking research into tropical rivers across Northern Australia since 2005. This began with the TRaCK (Tropical Rivers and Coastal Knowledge) research program that drew together more than 70 of Australia's leading social, cultural, environmental and economic researchers. TRaCK focused on generating the science and knowledge that governments, communities and industries need for the sustainable use and management of Australia's tropical rivers and estuaries. More recently the National Environmental Research Program (NERP) has been funding research that addresses gaps in our understanding of biodiversity patterns; supports adaptive planning; develops methods for monitoring and reporting on biodiversity and ecosystem health; determines benefits derived from community-based natural resource management, and identifies opportunities to support Indigenous livelihoods. Despite this considerable base of research activity TRaCK has identified a range of research gaps that still require further work including:

- Ensuring sustainable use of water resources, particularly groundwater
- Minimising the impacts of land use intensification on river and coastal system
- Managing coastal industries and development to maintain healthy rivers, estuaries and coasts
- Planning for and adapting to the impacts of climate change and variability on tropical rivers, coasts and communities
- Indigenous communities and sustainable livelihoods around catchment and coastal management
- Providing education, training and leadership in tropical rivers and coastal management

11:00-11:15 Developing a decision support tool to improve management of aquatic invasive grasses in Kakadu National Park

PETTY, A¹, Setterfield, S¹, Douglas, M¹, Adams, V¹ and Ferdinands, K²

¹Research Institute for the Environment and Livelihoods, Charles Darwin University, Darwin, NT, 0810, Australia

²Weeds Management Branch, NT Department of Natural Resources, Environment, the Arts and Sport, PO Box 496, Palmerston, NT 0831

Kakadu National Park (KNP) contains significant areas of floodplain wetlands that are internationally recognised for their environmental and cultural values. These wetlands are threatened by sea level rise and invasive species such as para grass and olive hymenachne. One of the aims of the National Environmental Research Program (NERP) Northern Australia Hub is to develop decision-support tools to aid in the adaptive management of these threats. These tools will integrate environmental, social, cultural and economic assessments of sea level rise and the expansion of invasive grasses on biodiversity and related ecosystem services. In this presentation we focus on research to assess the threat from invasive aquatic grasses and the cost-effectiveness of management strategies. Our research includes comprehensive mapping of the current distribution of aquatic invasive grasses across the floodplains of northern KNP, and the development of a spatially explicit spread model to predict future patterns of invasion. Models to test the cost-effectiveness of alternative management scenarios are being developed. We show that although large areas of KNP floodplain have been invaded or are under threat of invasion, the development and implementation of a management plan now could limit weeds spread and minimise future impacts on biodiversity and cultural values. We then explore how the weed spread and distribution models will be integrated into a decision-support tool assessing the options for adaptive management of the risks of sea level rise and invasive alien grasses.

11:15-11:30 Evolutionarily informed conservation planning

HUEY, J¹, Hermoso Lopez, V¹, Kennard, M¹ and Hughes, J¹

¹Australian Rivers Institute, Griffith University, Nathan, QLD 4111

Conservation planning requires the definition of quantitative objectives. These objectives must be adequately defined to maintain biological patterns (e.g., species distributions) and the ecological processes on which they depend (e.g., gene flow) to secure the long-term persistence of biodiversity. However, it is difficult to meaningfully define thresholds that are linked to the long term persistence of populations (e.g., Minimum Viable Populations) and conservation targets are usually defined using poorly informed rules of thumb. The “effective size” of a population (N_e) has been proposed as a possible index which can inform an “Evolutionarily Minimum Viable Population”. This approach has become increasingly attractive as recent developments in conservation genetics have made this parameter easier to indirectly estimate using genetic data. However, definitions of a minimum N_e to maintain long term evolutionary potential are conflicted and controversial. Also, applying these concepts to a complex spatial system (e.g., river) is difficult. We discuss and provide preliminary data for a current project being undertaken in the NERP that aims to use genetically informed targets (the effective size of meta-populations) to inform conservation planning of populations in the Daly River catchment.

11:30-11:45 To the white man the spoils¹ – a social, ecological, and economic assessment of the impact of ‘development’ on Indigenous people in northern Australia

STOECKL, N¹, Jackson, S, Kennard, M, Pusey, B, Pantus, F and Finn, M

¹James Cook University

In urban systems, changes that occur in the broader environment do not always have a directly noticeable impact upon socio-economic systems. But rural economies are often dependent upon the natural environment, so the links between biophysical and socio-economic systems are more apparent. In rural Indigenous societies (where culture, identity and nature are all but inseparable), these links are even more apparent and considerably more important. Using data and insights from several inter-related but independent projects conducted over four years (2008-11) in the Daly River Catchment in the Northern Territory, this paper looks at the way in which expansion of different industry sectors (e.g. government, tourism and agriculture) could affect the region’s water resources and at the way in which those changes in water resources could affect the availability of wild-resources thus generating negative feed-back effects (consumptive and cultural) in Indigenous communities. We present estimates of the net financial impact of these sectoral expansions on Indigenous households and qualitatively assess some of the associated social impacts, concluding that these expansions have, at best, a relatively benign impact on the well-being of Indigenous people, and at worst, a detrimental effect brought about through associated changes in the region’s water resources.

11:45-12:00 Multi-objective catchment-to-coast planning

ALVAREZ-ROMERO, JG.¹, Pressey, RL¹ and Adams, VM.²

¹Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, 4811 QLD, Australia

²Research Institute for the Environment and Livelihoods, Charles Darwin University, Darwin, NT 0909, Australia

Ongoing land use change (LUC) is a major threat to biodiversity and the services that ecosystems provide. A full-catchment approach to identify areas for intervention and to develop strategies to minimise the impacts of LUC is desirable because of ecological processes (e.g., those mediated by hydrological flows) and downstream impacts of catchment modifications and management. Managers face difficult decisions regarding the areas that need to be managed or protected to achieve development and conservation objectives. Previous studies regarding prioritisation for biodiversity conservation and other objectives (e.g., maintaining ecosystem services) show some discrepancies in the distribution of priority areas to achieve these objectives. Our study aims further develop the methods and tools to: identify and explore competing objectives (i.e., estimate conflicts between objectives in terms of their spatial coincidence); find spatially explicit ways to balance these objectives in the context of land use change; and identify appropriate management strategies. The project includes developing a planning framework for integrated catchment management and adjusting/integrating existing modelling and conservation planning tools to facilitate stakeholder engagement and exploration of the tradeoffs associated with management decisions to achieve multiple objectives. We focus on three catchments in northern Australia (Fitzroy, Daly, and Gilbert), where we are engaged with managers and ongoing planning initiatives are underway.

¹ After: Turner, R. and Fisher, B. 2008, 'To the Rich Man the Spoils', *Nature*, vol. 451, pp. 1067-1068

12:00-12:15 Progress and challenges to the identification and effective management of freshwater conservation priority areas in northern Australia

KENNARD, MJ¹

¹National Environmental Research Program Northern Australia Hub and Australian Rivers Institute, Griffith University, Nathan, Qld Australia, 4111

Northern Australia freshwater ecosystems and biodiversity have important socio-economic, cultural and intrinsic ecological values. The ecological sustainability of the region is increasingly threatened by the pervasive effects of human activities, invasive species and climate change. These issues pose important conservation challenges for scientists, managers, landowners and other stakeholders in northern Australia. This presentation outlines recent research to identify freshwater conservation priority areas across northern Australia. This involved characterising and mapping aquatic ecosystems throughout the region, developing predictive models of biodiversity patterns (e.g. fish, turtle and waterbird species distributions), and applying several spatial prioritization frameworks to identify areas that can be targeted for efficient conservation management actions to sustain biodiversity. I also provide an overview of current research to address some of the significant technical and socio-political challenges to achieving efficient and effective conservation management in the region. These include: i) employing landscape and conservation genetics approaches to determine the appropriate size and configuration of priority areas to ensure long-term population viability of aquatic species; ii) accommodating the special connected nature of freshwater ecosystems by incorporating lateral and longitudinal connectivity among aquatic habitats in the conservation prioritisation processes; iii) estimating the ecological benefits and socio-economic costs of alternative management actions to sustain or restore aquatic biodiversity in the region.

12:15-12:30 Searching for cost synergies between market and non-market objectives in Northern Australia: can we improve the efficiency of biodiversity Investment?

CHAI ECHI, T¹, Esparon, M¹ and Stoeckl, N¹

¹School of Business, James Cook University, Townsville QLD 4811

Those seeking to maximise biodiversity ‘outcomes’ with scarce investment dollars, need to know if it is cheaper to protect biodiversity on some types of land than others. But to date, most economic investigations of the costs of achieving biodiversity outcomes have been conducted at a property scale; comparative information is lacking. So too is information about the compatibility of biodiversity, social, and economic objectives. This paper outlines a method for identifying ‘cost synergies’ between market and non-market objectives on different property types (e.g. on grazing properties, in national parks, and in Indigenous protected areas). The approach is frequently used in multi-output industries such as health and agriculture, and has – on occasion – been used to identify ‘synergies’ between agricultural and biodiversity objectives. But to the best of our knowledge, the approach has never been used to simultaneously assess synergies between ecological, economic, and social objectives. Second, the paper describes how researchers will collect data to populate, and econometrically estimate the model, thus identifying ‘synergies’. On completion, researchers will not only know more about the costs of achieving biodiversity objectives: they will also have learnt more about which types of objectives (commercial, biodiversity and social) ‘go well together’, and which do not.

12:30-12:45 Planning for regional development and conservation: linking human wellbeing to spatial priorities

ADAMS, VM^{1,2} and Pressey, RL²

¹ Northern Australia National Environmental Research Program Hub, Charles Darwin University, Darwin, NT 0909

² ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD, 4811

Development of land resources results in land use changes which can decrease the extent and condition of native vegetation, jeopardize native species, reduce water quality, and erode ecosystem services. Spatial planning must therefore account for likely patterns and rates of land use change and their impacts on biodiversity and ecosystem services if planning is to strike a balance between conservation, social, and development outcomes. In the Daly River catchment, Northern Territory, even with protected areas, many species and ecosystems are inadequately protected, and further conservation management is needed. In addition, although the catchment has relatively little clearing, there is interest in future development projects including intensifying agricultural and pastoral uses. Therefore, a concurrent development and conservation planning process is being undertaken to allow for objectives to be formulated and trade-offs to be considered explicitly. Both development and conservation of natural resources in the catchment will affect human wellbeing and the long-term provisioning of ecosystem services. Thus, an innovative engagement process is discussed in which we ask the Daly residents to quantify the importance of key factors to their wellbeing. Our engagement process uniquely links these factors to spatial features in the catchment. The relationship between spatial features and wellbeing factors is discussed and the factors most important to wellbeing are compared to the priorities (objectives) of the catchment management authority.

Mal Nairn Lecture Theatre 1:30-3:45

Symposium: Stopping the next wave of extinction... addressing mammal decline in northern Australia

Organizer: Brydie Hill

The theme of this session is how we are attempting to halt the decline of the mammalian fauna across northern Australia. Relatively recent evidence shows declines in a broad range of mammal species including many that are ecologically and culturally significant. The declines are occurring across all jurisdictions and land tenures in northern Australia, including well resourced conservation areas. There appears to be no single casual factor. The issue is one where researchers, conservation biologists and land managers need to work together to develop and implement solutions. This symposium will present some background to the issue of mammal decline in northern Australia and case studies on how solutions are being sought through research and adaptive land management.

1:30-1:45 Mammal decline in northern Australia: background and response

FISHER, A¹

¹Biodiversity Conservation Division, Northern Territory Department of Natural Resources, Environment, the Arts and Sport

The historic loss of mammals from arid and temperate Australia is well known, but until recently it has been thought that the mammal fauna of northern Australia was relatively secure. However, accumulating evidence from a range of sources indicates recent, severe declines in many smaller mammal species. While the evidence base is spatially and temporally patchy, it suggests decline is occurring across multiple taxonomic groups, geographic locations and land tenures. A number of causal factors have been implicated in the declines - including habitat modification by fire, grazing and invasive species; predation, particularly by feral cats; spread of cane toads; and disease – and these are likely to be acting interactively as well as differentially on particular species. The dramatic nature of observed declines demands an immediate management response, with research to clarify the extent and cause of decline embedded within an adaptive framework. The other presentations in this symposium explore some of the recent and current approaches to tackling this challenge.

1:45-2:00 Small mammal declines in Litchfield National Park between 1996 and 2011

CRASE, B, Fisher, A, Armstrong, A, Brennan, K, Milne, D, Low-Choy, J, Griffith, T, Mahney, T, Price, O, Stuart, A, Trikojus, N, Young, S and Woinarski, JCZ
Biodiversity Conservation Unit, Department of Natural Resources, Environment, the Arts and Sport, Northern Territory Government

Recent declines in small mammals have been reported in northern Australia, with much of the most detailed evidence from long-term monitoring within Kakadu National Park. Here we present similar monitoring data from Litchfield National Park, 80km south of Darwin and provide further evidence for marked mammal declines, particularly between 2006 and 2011. A baseline survey was undertaken in 1996 (116 sites), and then repeat sampling following a consistent protocol in 2001 (47 sites), 2006 (37 sites) and 2011 (32 sites). Over this period, the mean abundance and richness per site of small mammals declined significantly. Small mammals were not detected in 6% of sites in 1996, but in 2011 almost 60% of sites were empty of small mammals. The mean abundance of all 20 small mammal species present in 1996 has declined, with 13 of these species undetected in 2011. Five small mammal species have not been recorded since 1996. Of all small mammal species, *Melomys burtoni* declined the least, which is consistent with observations in other areas in the Top End. We discuss the extent to which the patterns of decline observed in Litchfield National Park provide insight into the potential role of fire and cat predation.

2:00-2:15 Evaluating the status of species using Indigenous knowledge: novel evidence for major native mammal declines in northern Australia

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A small series of recent monitoring studies has reported major declines for many native mammal species in localised regions in northern Australia. However, the broader spatial context of these studies is uncertain. This study aims to assess the extent and timing of change in mammal status across a broad area of northern Australia (the monsoonal tropics of the Northern Territory). Indigenous information about terrestrial native mammal fauna (excluding bats) was compiled from a large series of interviews conducted across Indigenous communities. A collection of mammal skins was used to help facilitate discussions and verify identifications. The resulting information was analysed with non-parametric statistics to test for changes in mammal status across different time periods, between different regions, and between different groups of mammal species. Declines were reported as extending from the earliest memory of informants, but the rate of decline has increased recently. These changes were reported across all five regions within the broad study area and were greater for “critical weight range” species than for other species. Indigenous consultants suggested several factors were associated with the changing status of species. The study’s results reveal a pattern of widespread decline in the mammal fauna of the monsoonal tropics of northern Australia, thereby corroborating the conclusions of recent more local wildlife monitoring studies. The study also demonstrates the value and capability of Indigenous ecological knowledge to complement and corroborate more intensive and local scientific studies. The results also reinforce concern for the conservation status of the mammal fauna of northern Australia.

2:15-2:30 Catastrophic decline of tropical marsupials: is history repeating?

Fisher, DO¹, Johnson, CN², Lawes, MJ³, Fritz, SA⁴, McCallum, H⁵, Blomberg, SP¹, VanDerWal, J⁶, Abbott, B⁷, FRANK, A^{2,8}, Legge, S^{9,10}, Letnic, M^{11,13}, Thomas, CR⁷, Fisher A^{8,10}, Gordon, IJ¹² and Kutt, A^{7,14}

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Australian mammals suffered severe declines around a century ago, resulting in a third of modern global mammal extinctions. These extinctions were restricted to southern Australia, but a new wave of declines is now affecting a third of mammal species in the northern tropics, including 19 marsupials, representing a globally significant proportion of species. Causes of the southern extinctions are debated, but introduced predators are widely held to blame. Using multiple regressions and random forest models to analyse traits that predispose species to decline and extinction, we compared the selectivity of past extinctions with current declines, to test if the same process that began with the spread of European influence across southern Australia is implicated in current northern marsupial declines. In both northern and southern Australia, the same two key variables, body mass and habitat structure, predict extinction vulnerability, but the form of the relationships differs. In the south, medium-sized species in open habitats of lower rainfall (desert) were most likely to go extinct. In the north, small species from open habitats with moderate rainfall (savanna) are experiencing the most severe declines. These attributes are consistent with predation impacts of introduced foxes in the south, and cats in the north, exacerbated in both regions by reduced ground level vegetation. Our results show how comparative analysis can be used to help diagnose causes of multi-species decline before it is too late to prevent extinction.

2:30-2:45 Fire size and small mammal declines in northern Australia

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Mammals, especially small mammals (<5kg), have declined dramatically in abundance and species richness in many parts of northern Australia over two decades. Although there are many putative causes of mammal decline, change to fire regimes is one of the most prominently supported causes. To date the focus has been on fire frequency and at the best studied locations there is a trend of lower species richness at sites with greater fire frequency. However, there is considerable variation about the estimates of richness suggesting other mechanisms or aspects of fire history are also responsible for the declines. In this study we examine the effect of fire size, in conjunction with fire frequency, on mammal declines. In recent decades fires have typically burned at a landscape scale over large areas, whereas before then they tended to be small scale patch burns. Small mammals have small home ranges and cannot easily escape the effects of large and less patchy fires. We investigate whether fire size is a better or additional predictor of small mammal declines in northern Australia than fire frequency alone.

2:45-3:00 Uncovering the role of feral cats in the decline of northern mammals

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We still do not know for certain what is causing the current declines of small mammals across northern Australia, but there is compelling comparative and circumstantial evidence to suggest that feral cats are at least partly to blame. A collaborative research project, involving U Tasmania, AWC, CDU, CSIRO, WA DEC and NRETAS, is currently investigating the role of feral cats in the northern mammal declines with support from an ARC Linkage grant. The project involves a landscape-scale cat-exclusion experiment, studies of behavioural ecology of cats, ecological surveys of cat abundance in relation to status of small-mammal populations, and simulation models of the interaction of cats and their prey. This paper will describe these studies, and summarize results so far.

3:00-3:15 Can we manage landscapes to elicit small mammal recovery?

SARAH LEGGE, John Kanowski, Katherine Tuft, James Smith, Alex James, Hugh McGregor

Australian Wildlife Conservancy, Morington Wildlife Sanctuary, King Leopold Ranges via Gibb River Rd, Derby, Western Australia 6728

Small- to medium-sized mammals are in decline across northern Australia, with rapid decreases in abundance and species richness and the regional extinction of several species. The most likely causes of this decline are changed fire patterns, the impact of introduced herbivores and predation by feral cats. However, the relative importance of each threat, and how they might interact remains unclear.

We are examining this issue by measuring the response of mammals to a series of landscape-scale management interventions at sites spread between the Kimberley, NT and Queensland. Here, we describe the broader study design, and then present data on the impacts of fire management and introduced herbivore removal on small mammal abundance and species richness from a long-term study in the Kimberley. Small mammals have been monitored annually over a period of nine years (2004 – 2012) from up to 106 permanent monitoring sites across six properties in the central Kimberley. Coordinated fire management has been active across the study area since 2006. Destocking in 2004 removed introduced herbivores from 40 000 ha of one property. Monitoring sites are stratified by fire history, stocking status and habitat. We found that when we decreased the scale and frequency of fires, and removed introduced herbivores, mammal richness and abundance increased; moreover, the impacts of fire and introduced herbivores were additive. The recovery in mammal populations was associated with an increase in ground cover as a result of the management interventions, which may in turn have made small mammals less vulnerable to predation by feral cats.

Similar studies at properties in the NT and Queensland will reveal whether these management interventions can elicit mammal recovery in a broader array of historical and environmental contexts.

3:15-3:30 Finding solutions with Indigenous land managers in the Warddeken IPA, Arnhem Land, Northern Territory

STEVENS, A¹ and the rangers of the Warddeken IPA

¹Northern Territory Government

The Warddeken Indigenous Protected Area (IPA) in Arnhem Land has not escaped the small mammal decline that is prevailing in northern Australia. Since 2010 the Northern Territory Government has had a biodiversity scientist exclusively dedicated to developing research and management capacity on the Warddeken (and Djelk) IPAs utilizing both western and indigenous approaches to the pursuit of scientific knowledge. As a result of early inventory surveys, the rangers of the Warddeken IPA palpably identified small mammal decline and chose to focus on the threat of feral cats within and adaptive management framework. This approach was formalized with landowner support through the process of Healthy Country (Conservation Action) Planning supported by The Nature Conservancy. With funding through the National Environmental Research Program, and focused initially in the Manmoyi-Kamarrkawan (Ngulkwardde-Kordwalewale) areas of the IPA, we are establishing a baseline for both small mammals and feral cats using trapping, motion sensor cameras, sand plot monitoring and spotlight transects or 'cat patrols', after which we will then undertake a campaign of eradication, re-measure and evaluation. We are engaging the expertise of the Australian Wildlife Conservancy to utilize their cat-detecting-dog to catch feral cats for radio-collaring to allow us insight into general behavior, response to other land management activities such as fire, and as a community education activity. We understand the incredible difficulty of feral cat control on the mainland; and maybe we are crazy to think we can tackle it. However, it is only with the combined information of our and other's on-ground research, that we feel we can make an informed decision as to the viability of concerted and strategic feral cat management for small mammal conservation becoming a regular component of ranger work program, both within Ngulkwardde dja Kordwalewale, other significant areas of the Warddeken IPA and ultimately other indigenous managed lands.

3:30-3:45 DISCUSSION

Blue 5.1.1

1:30-3:30

Workshop: Integrating science with community-based conservation

Organizer: Catarina Silva

The importance of community participation in conservation is broadly recognized but not always successfully integrated with science-based methods and practices that offer measurability of a project's effectiveness. This workshop reports on relevant community-based conservation (CBC) experiences from New Zealand, Canada, the USA and Brazil, covering a range of ecosystems and scales. Consideration of these case studies will be followed by an interactive discussion in which participants are encouraged to share their experiences of CBC, and ways to better integrate scientific practices with CBC will be sought. Projects discussed will include 1) forest re-vegetation by government agencies and local community groups in Wellington, New Zealand; 2) The Eastern Scotian Shelf Integrated Management (ESSIM), a coastal management plan for the east coast of Canada; 3) student participation in community conservation through the Victoria University of Wellington chapter of SCB; 4) community involvement in the development of bycatch reduction devices in an artisanal penaeid trawl fishery in southern Brazil; 5) Places for Penguins, a community restoration and monitoring program for little blue penguins in Wellington, New Zealand and 6) examples of projects utilizing the internet as a tool for reaching the public on large scales for conservation purposes. Lessons from the case studies will be discussed including the complexity of CBC at different scales and contexts, methods, limitations and the importance of promoting citizen science.

1:30-1:45 Government agencies and local community groups: comparing restoration success

Anton, V, Victoria University of Wellington

1:45-2:00 The Eastern Scotian Shelf Integrated Management (ESSIM): a coastal management plan for the east coast of Canada

Stroeder

2:00-2:15 SCB chapters: involving members in local conservation projects

Charles, K

2:15-2:30 Community involvement in the development of bycatch reduction devices (BRDs) in an artisanal peraeid trawl fishery in southern Brazil

Silva, C, Victoria University of Wellington

2:30-2:45 Places for Penguins: combining efforts of various community groups in species protection

Lynh, J

2:45-3:00 Using citizen science to contribute to conservation and restoration efforts on a regional scale

Brasch, A, Victoria University of Wellington

3:00-3:30 DISCUSSION

Blue 1.1.1

1:30-3:30

Open Session: Conservation Planning

1:30-1:45 Prioritizing refuge areas for freshwater biodiversity conservation in highly seasonal ecosystems in North Australia

HERMOSO, VIRGILIO, Ward, D., Kennard, M.J.

Australian Rivers Institute, Griffith University, Nathan, Queensland 4111, Australia

The persistence of biodiversity in landscapes subject to natural or human stressors depends largely on the existence of refuge areas that offer the opportunity to survive during harsh conditions. Temporary rivers experience dry periods of varying duration and intensity, during which freshwater habitats become constrained to a reduced and disconnected set of pools or become completely desiccated. Although some aquatic organisms have developed desiccation-resistant life stages to cope with loss of aquatic habitat, most obligate aquatic species depend on the use of remnant habitats containing water as refuge to survive these otherwise natural events. We identify priority refuge areas in the Mitchell River catchment (North Queensland, Australia) to adequately represent freshwater biodiversity and maximize the potential recolonisation after dry periods. We then integrate these priority refuge areas into a broader conservation plan for the catchment, where we address the special peculiarities of freshwater conservation to account for longitudinal connectivity and to reduce the impact of different perturbations on freshwater biodiversity. This would help enhance the resilience of freshwater biodiversity by ensuring the inclusion of key refuge areas and the consideration of ecological processes.

1:45-2:00 Indigenous peoples' perception of natural resource management planning in the Philippines

IBANEZ, J¹, Ramos-Castillo, A² and Garnett, ST¹

¹Research Institute for Environment and Livelihoods, Charles Darwin University

²Institute of Advanced Studies, United Nations University

Despite efforts made to incorporate traditional knowledge into contemporary NRM in the Philippines, Indigenous perspectives on NRM planning have not been investigated. This paper examines the perceptions of Indigenous informants from Mindanao Island about what constitutes a good Indigenous NRM plan with respect to planning resources, processes and the plan content itself. Based on the analyses of questionnaires (n=170) and results of focus groups with 10 tribes, it was found that informants valued participatory processes and equal representation in planning but also appreciated external support for planning Indigenous resource management. There was also a general feeling that more Indigenous knowledge should be incorporated into the plans and that plan objectives should include mechanisms to help revitalize traditional knowledge. Innovations in community engagement that could be adopted by facilitators include integrating Indigenous epistemologies and traditional ecological knowledge into contemporary planning practice. Suggestions as to a possible social learning framework for Indigenous planning are also offered.

2:00-2:15 Tools for implementing sea country planning in Indigenous communities

MICHA JACKSON¹

¹North Australian Indigenous Land and Sea Management Alliance Limited, Building Red 2.2.20 Charles Darwin University

Indigenous people either own or have a strong legal interest in extensive coastal and marine areas (collectively known as ‘sea country’) in northern Australia; for example nearly 50% of land and some 85% of coastline in the Northern Territory has been transferred to collective Indigenous ownership. Indigenous communities have increasingly been expressing their aspirations for these areas through a process known as sea country planning. Communities have taken a number of approaches to developing sea country plans (for example through the Australian Government’s pilot Sea Country Planning Program, the development of Traditional Use of Marine Resources Agreements, and using the Nature Conservancy’s Conservation Action Planning method). Regardless of the method used to develop the plan, aspirations to manage and maintain healthy marine species, resources, and habitats are common across the plans. In order for them to be effective, support for implementation is crucial, and research and data collection are essential components of many of the goals set out. Participatory action research and effective, community-friendly data collection and mapping methods are increasingly being utilised to support the implementation of sea country plans. Indigenous rangers employed to carry out management activities on Traditional land are a capable workforce to perform much of the work associated with these activities.

2:15-2:30 Systematic planning for multi-tiered river protection in the Northern Territory

LINKE, S, Hermoso, V and Kennard, M
Griffith University

After lagging behind the terrestrial and marine realms systematic conservation planning has gained traction in freshwater systems since 2003. This is mainly due to the rise of novel approaches to consider the connected nature of rivers and direct conservation efforts away from upstream disturbances. However, current approaches only assign subcatchments to new protected areas, while the modern river management literature prescribes three tiers of actions: a) freshwater focal areas - analogous to terrestrial reserves (b) critical management zones -upstream and downstream areas needed to maintain critical species and processes and c) catchment management zones - the entire area upstream. In this project, we modeled fish distributions for 39 fish species from the Daly River (NT) using GIS-derived landscape predictors. Based on these, we developed a systematic approach to assigning zones to the different tiers of freshwater protection, similar to the multi-zone frameworks used by the software package ‘Marxan with Zones’. As package cannot deal with the needed connectivity requirements for the riverine framework, we re-programmed the algorithm in Visual Basic. Highly relevant to satisfying the tradeoffs between human use and nature protection, we found that less area is needed in actual reserves to adequately protect rivers when using a multi-tiered framework.

2:30-2:45 Conservation objectives and sea surface temperature anomalies in the Great Barrier Reef

BAN, NC¹, Pressey, RL¹ and Weeks, S²

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²Centre for Spatial Environmental Research, and Coral Reef Ecosystems Lab, The University of Queensland, Brisbane, QLD 4072 Australia

Spatial and temporal dynamics of processes have long been considered important in marine systems, but seldom have conservation objectives been set for them. We analyzed sea surface temperature (SST) trends and variability in Great Barrier Reef Marine Park (GBRMP) for 25 years and formulated and tested whether 3 sets of notional conservation objectives were met to illustrate the potential for planning to address climate change. The objective sets were (1) at least 50% of temperature refugia (i.e., pixels that had high-temperature anomalies <5% or <7% of the time) within no-take zones; (2) maximum occurrence of high-temperature anomalies is <10%, <20%, or <30% of total no-take area 90% of the time; and (3) coverage of any single no-take zone by high-temperature anomalies occurs <5% or <10% of the time. We used satellite imagery from 1985-2009 to measure SST to determine high-temperature anomalies. Sea surface temperatures in the Great Barrier Reef increased significantly in some regions, and some of the conservation objectives were met by the park's current zoning plan. Dialogue between conservation scientists and managers is needed to develop appropriate conservation objectives under climate change and strategies to meet them.

2:45-3:00 Planning for ecosystem services and biodiversity conservation in the Atlantic Forest

MILLS, M¹; Giorgi, AP²; Metzger, JP² and Possingham, H¹

¹University of Queensland

²University of Sao Paulo

This study assesses opportunities for systematic conservation planning to guide conservation initiatives that focus on ecosystem services in Brazil. Two of the world's 15 largest urban areas, Sao Paulo and Rio de Janeiro, are located within the Atlantic Forest - among the most biodiverse and threatened forests in the world. While population pressure and increasing resource use leads to the destruction of the Atlantic forest, human well-being is dependent on healthy ecosystems and the provision of ecosystem services (i.e. all benefits provided to humans by ecosystems). Systematic conservation planning, provides insight into where, how and when limited resources should be allocated to maximize the achievement of defined goals (such as the protection of biodiversity or water provision). We review the literature relating to ecosystem service provision in the Atlantic Forest to assess the current state of knowledge on their distribution. We then map various ecosystem services in the Atlantic forest and assess the synergies and trade-offs between the allocation of funds to protect each service individually. Our study provides insight into improving human well-being within and outside cities while increasing biodiversity conservation.

3:00-3:30 DISCUSSION

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