

## **New recreational boating facilities at Portland, Victoria – trying to find the balance**

Ainley Belinda

*Ainley Projects*

A recreational boating infrastructure project in Portland Victoria, is seeking to balance boating needs with other foreshore uses. Land reclamation and a new 70 berth marina was completed in 2012, a four lane boat ramp and on-shore area is due for completion in June 2014.

This project has embraced best practice design and construction principles, to ensure:

- Modern boating facilities that are safe, efficient and easy to use, reducing the impact on the town's traffic flow, beach parking and other activities.
- Flexible use of space to deal with peak and non-peak boating times, so that valuable coastal space is not just used for car parking.
- Protection of the surrounding natural environment through onsite stormwater management and capturing of fish cleaning waste.
- Consultation and engagement with all stakeholders throughout the project to bring about locally appropriate outcomes.

Portland is a small coastal town on the west coast of Victoria, 400kms west of Melbourne. Recreational fishing is a big local activity and tourism drawcard. Fishing is popular all year, particularly during the tuna season. From April to August each year thousands of recreational fishers and charter boat operators roll into town, many with large vehicles towing large boats. Currently, when fish are biting and the weather is tolerable, the chaos of boat launching is a spectator sport and fish are cleaned on every flat surface available. The huge number of recreational anglers chasing tuna puts massive pressure on coastal infrastructure as well as local roads and town amenities.

### **Adapting our coast as the sea rises, who will pay?**

Attwater Clive

*SGS Economics & Planning*

Rising sea levels will require coastal assets to respond through protection, accommodation or retreat. This presentation explores some of the practical realities of making these adjustments and in particular explores the effectiveness of applying three core principles: active management of developing risk; no subsidies to occupy hazardous locations; and shared responsibilities. Examples of how these are playing out with varying success in different contexts and the factors that lead to success or otherwise are explored. These include continuity of policy/political leadership; timing, severity and location of storm events; uncertainties about appropriate and effective technical responses; activating responses; allocating costs and raising the required funds.

## **Using participatory visual methods for information exchange about climate risk in canal estate communities**

Baldwin Claudia, Ben Grant, Scott Lieske  
*University of the Sunshine Coast*

Kilometres of high value residential real estate have been created through the development of canal estates in the coastal zone of Southeast Queensland since the 1970s. Many of these are open to tidal influence in estuaries affected by the combined effects of climate change: sea level rise, storm surge, and severe weather events. This research assesses the effectiveness of multiple participatory visual methods for information exchange about climate change risk and reduction of the “gap” between knowledge and adaptive climate change action. Visual methods used in the research, and that will be illustrated during the presentation, include community digital mapping of vulnerable areas linked with resident-derived photos, as well as 3-D scenes based on local interpretation of climate change scenarios. This research identifies the residents’ perceptions and understanding of vulnerability to climate change, and their interest in possible adaptation approaches. This research is of benefit to State and local governments, the property market, and communities in communicating about climate change in coastal areas in general and in considering responses to the long term impacts of climate change in canal estates in particular.

### **Coastal Adaptation and Protection in South West WA**

Barr Stuart  
*ShoreCoastal*

The south western coastline of Western Australia is varied in exposure to ocean forces, the nature of sediment movement and the extent and proximity of coastal development. Local government, and other coastal managers, deal with issues of coastal adaptation or protection on a regular basis, in response to severe storms, changes in sediment accumulations or community pressures. This presentation focuses on the coastline between Bunbury and Augusta. Examples are provided of typical coastal engineering problems and the varied response of coastal managers. The challenges of implementing coastal adaptation or protection works and monitoring their performance are the focus.

### **State Planning Policy No. 2.6 State Coastal Planning Policy**

Bassett Ben  
*Department of Planning*

The Western Australian coastal zone is a significant asset of the state. It is our playground, a source of significant economic activity and a first line of defence against the impact of storm events. The coast is subject to pressures from a number of different groups in the community for a variety of purposes all potentially resulting in land use and development conflict. Hence it continues to be increasingly important that coastal planning ensure that coastal land use and development is sustainable for current and future Western Australians.

State Planning Policy 2.6 — State Coastal Planning Policy (SPP2.6) is a longstanding State Planning Policy of the WAPC that provides the policy basis for proper and orderly coastal planning throughout the State.

Planning for risk associated with coastal processes and provision of access and recreation opportunities on the coast are significant elements of SPP2.6 for achieving sustainable land use and development in the coastal zone.

This presentation will outline the key elements of the State Planning Policy with particular regard to establishing coastal foreshore reserves and undertaking coastal hazard risk management adaptation planning.

**Joint management arrangements for the Lalang-garram / Camden Sound Marine Park – a new park, a new beginning...**

Bignell Sarah, Alan Byrne, Todd Quartermaine  
*Department of Parks and Wildlife, Western Australia*

The Lalang-garram / Camden Sound Marine Park was created by the Western Australian government on 19 June 2012. Since the creation of the park, the WA government has implemented policy and legislative changes to pave the way for joint management of parks and reserves in Western Australia; provide greater recognition to Aboriginal cultural heritage values within conservation estate; and to further provide for ongoing customary activities such as fishing and hunting. These changes led to an opportunity to review and revise the (then) draft Camden Sound Marine Park management plan and develop formal joint management arrangements with Dambimangari Traditional Owners for implementation of the marine park. In our presentation we will outline the process used to develop an updated management plan and joint management arrangements through partnership with the Dambimangari People. This process resulted in the launch of the new and improved final management plan which provided greater recognition of and protection for Aboriginal cultural heritage values, as well as formal signing of Western Australia's first Joint Management Agreement, both occurring in November 2013. We will also reflect on lessons learnt in planning for joint management, report on progress to date with the implementation of the plan and discuss the next steps in the journey for true joint management of sea country.

**Integrating cultural heritage objectives in marine park systematic reserve design**

Bignell Sarah, Anna Smith, Roanna Goater, Matt Fossey, Chris Nutt  
*Department of Parks and Wildlife, Western Australia*

Historically, marine park systematic reserve design processes have sought to meet primary biodiversity conservation objectives whilst also providing for ongoing sustainable use. To achieve these objectives, design processes are commonly guided by reserve design principles. These principles often include a set of scientific or ecological principles aligning to primary biodiversity conservation objectives and a set of socio-economic or community design principles aligning to secondary objectives of ongoing sustainable use. Often cultural heritage considerations particularly those relating to indigenous cultural heritage are listed as a secondary goal alongside, or more often included, in the principles relating to sustainable use outcomes. In the last two years, the Western

Australian government has been reviewing and updating its policy and legislative frameworks for protected area development to provide greater recognition and protection for cultural heritage values, to provide for ongoing customary activities and uses, and to provide for joint management of conservation estate. To reflect this legislative change and to raise the profile of cultural heritage protection in protected area design, we have reviewed current best practice design guidelines used across Australia and internationally to create a new expanded set of design principles for Western Australia's marine parks network. In our presentation we will outline the expanded set of design principles and provide case studies from recent marine park planning processes in the Kimberley region where these principles have been successfully applied to provide greater outcomes for Aboriginal cultural heritage protection, whilst also meeting biodiversity conservation and sustainable use objectives.

### **Coastal Imaging in Australia – The Next Generation**

Blacka Matt, Nathan Guerry, Erica Davey, Joshua Simmons,  
*Water Research Laboratory, UNSW Australia*

The first automated system for capturing regular photographs of a coastline in Australia was an Argus II Coastal Imaging system installed at Palm Beach (NSW) in 1996, which was part of a network of approximately 10 stations that were operating worldwide at that time. From 2000 to 2004 a further eight Argus II stations were installed and operated in Australia by the Water Research Laboratory, and included stations at Surfers Paradise, Palm Beach (QLD), Kirra, Coolangatta, Snapper Rocks, and Duranbah on the Gold Coast, as well as Narrabeen/Collaroy and Narrabeen Lagoon in Sydney.

In 2013 WRL began an overhaul of the tiring Australian network of Argus Coastal Imaging systems, replacing four of the Argus II stations on the Southern Gold Coast with state-of-the-art Argus III digital camera systems. This was followed in 2014 with the upgrade of the remaining two stations at the northern Gold Coast as well as the station at Narrabeen/Collaroy in Sydney. This new generation of stations has once again returned Australia to the forefront of Coastal Imaging technology and analysis methods. The new generation of Argus III Coastal Imaging systems each have between 4 and 6 fixed cameras that capture a range of pictures of the beach every half hour including snap shots, time exposures, and minimum/maximum pixel exposures. These images are automatically transferred to a host server at WRL and are available on the internet within one hour of being captured. The time series of photographs are analysed every week to produce merged plan-view images of each beach, as well as quantitative long term data sets such as shoreline position and beach width. This presentation will provide a historical review of Coastal Imaging systems in Australia, and present information about the latest state-of-the-art-systems now installed.

## **Coastal Conservation Project Phang Nga, Thailand**

Bloye Carolyn

*Central Institute of Technology - Diploma, Environmental Monitoring & Technology*

Thailand Reflection- Carolyn Bloye 3May – 17 May , 2014

Carolyn Bloye has just returned from 2 weeks, on an International Exchange Program, assisting Global Vision International (GVI) with their conservation project in Phang Nga province, southern Thailand.

I must thank Central Institute of Technology, Perth, my lecturer Gun Dolva, and the Federal Government's International Student Exchange Program for this wonderful opportunity of working with GVI, which allowed me to utilize my Environmental training and skills to assist GVI's conservation efforts in this tiny Thai community, Ban Nam Khem.

I was part of a group of students from Central Institute of Technology, completing my Diploma of Environmental Monitoring & Technology studies.

This has been my third visit to Thailand but this journey was remarkably different for me –living and working in Baan Nam Khem, post Tsunami, was an awakening to the real Thailand.

The impact of the Tsunami on fragile ecosystems, loss of biodiversity and the long-term effects and challenges for a small community facing a developing world makes Baan Nam Khem a worthwhile base for GVI.

The Central students assisted GVI with biodiversity & vegetation surveys and identification baseline data, sea turtle rehabilitation and maintenance, beach debris removal and the group also cleaned up the local streets to the delight of the locals.

Baan Nam Khem, a small Thai fishing village, was the worst hit by the Tsunami, 3500 lives were lost (60% of the town) in the 2004 Boxing Day Tsunami, which has had a profound affect on every person you meet, they carry the loss of loved ones be it mother, father, sons, daughters, grand parents, friends or work mates their pain is still so raw in the memory of those lost lives.

### **Growth history of Faure Sill seagrass bank, Shark Bay, during changing sea-levels**

Bufarale Giada, Lindsay B. Collins

*Curtin University - Applied Geology*

Located approximately 800 km north of Perth (Western Australia), Faure Sill can be regarded as one of Shark Bay's most prominent geomorphic features. The bank lies east-west across the axis of the Hamelin and L'Haridon basins and acts as a barrier between these hypersaline environments and Hopeless Reach.

High-resolution shallow sub-bottom profiles and sediment cores were collected across the Faure Sill; radiocarbon dating was then used to establish the late Quaternary history and to create a local stratigraphic model of the seagrass bank growth.

The results indicate that the evolution of the bank has been controlled by three mechanisms: 1) pre-Holocene topography that shaped the initial sedimentation with highs and channels; 2) the seagrass, which acts as a sediment trap and represents a consistent source of in-situ biogenic carbonate sedimentation; 3) sea-level fluctuations, that largely controlled the hydrodynamic conditions, such as the amount of current velocities, influencing the erosion, transportation and deposition of the sediments. The development of the seagrass bank can be grouped in three different sea-levels phases. The initial onset can be traced back to the early Holocene transgression (not earlier than 8500 years BP, in lower but rising sea-levels). The bank accumulation peaked around 6800 years BP, in concurrence with the maximum highstand of the sea-level and, during the following decline to present sea-level, the bank growth continued to fill available accommodation.

The development of the Faure Sill has been critical in the initiation and persistence of the Hamelin Pool stromatolites and the entire local ecosystem.

### **Slacks Creek Catchment Restoration: baselines for community engagement**

Cannard Toni, Gary Fry, Geoff Carlin, Heidi Franklin, Andy Steven  
*CSIRO Oceans & Atmosphere*

The Slacks Creek Catchment Restoration baseline study was designed to capture current water quality conditions for comparison against future water quality improvements arising from the restoration activities. The baseline study included three main elements as follows: 1) Land-based sampling of water quality, mangrove sampling and record of habitat; 2) Longer term deployment of in situ water quality (several weeks to several months); and 3) Boat-based creek transects to monitor water quality, mangrove video sampling and record wildlife and habitat, and conduct bathymetric mapping. Additionally, data was collected for vegetation, habitats, sediment types and sightings of wildlife e.g. freshwater turtles, various species of birds, water dragons, etc were recorded. Video footage of mangrove stands along the lower part of Slacks Creek can be analysed in the future against footage collected in the future at six monthly or annual intervals. We have determined that the salinity extent in ambient conditions extends to north of the golf course. When rain falls in the Slacks Creek Catchment, the estuarine system converts to a freshwater system and these conditions can persist for four or more weeks before the salinity starts to fluctuate again based on tidal influence. For this reason plants used for riparian enhancement will need to be tolerant of changes in salinity. This study led to the provision of various recommendations for the inclusion of innovative methods to enhance the efficacy of riparian zone planting. More importantly, options for establishing citizen science opportunities are expected to enhance community involvement and stewardship.

## **The value of coastal monitoring in responding to the challenges of sea level rise and coastal management.**

Carroll Neil  
*City of Mandurah*

Mandurah's coastline consists mainly of sandy and limestone perched beaches and are highly valued by the community. The sandy beaches display an ongoing trend of erosion which is reducing the buffer between the ocean and adjacent infrastructure. We believe that improving our monitoring of daily shoreline characteristics, shoreline responses to storm events and beach responses to interventions such as sand renourishment or coastal infrastructure will greatly assist our day to day decision making. The natural corollary of this is a more refined and localised approach to coastal adaptation in response to predicted sea level rise.

As such, we have adopted the following methods to monitor our beaches. All Waterways staff are encouraged to use personal observation at any opportunity as a primary surveillance tool. At a minimum, we undertake weekly photo monitoring of all of our beaches and archive these pictures with relevant tide and wave data. Cross-sectional beach surveys are undertaken monthly by our survey section. We obtain annual hydrographic survey data from Dept of Transport. We have recently installed a permanent camera at the Dawesville Surf Club which has software algorithms designed to estimate beach width and average wave height and direction. We receive daily shoreline photographs at disposal sites during the annual sand bypassing. In the coming months, the initial installation of two AWACS and a directional swell buoy will assist us to collect wave and current data at a number of local beaches. Building a strong relationship with the Department of Transport and coastal engineers familiar with the local coastline is imperative in improving the sensitivity of future management strategies. Additionally, these relationships will improve technical knowledge within the organisation.

Keywords: coast, monitoring, sea level rise, adaptation, data, coastal management

### **Dealing with sea level rise - Evidence based decision making**

Carroll Neil  
*City of Mandurah*

Local Government Agencies (LGA's) who are responsible for managing coastlines, estuarine and inland waterways face a number of challenges in the coming years with regard to predicted increases in mean sea level (SLR) as a result of longer term climatic changes. Evidence-based decision making applies fundamental scientific research principles to better inform current and future management options. These principles can be utilised by LGA's in dealing with financial planning for future capital works and maintenance, community education and risk management with regard to future SLR. The use of literature and information reviews to establish an accurate assessment of the natural history of shoreline processes, coastal protection structures, inundation, flood events, previous maintenance works, biology of local eco-systems and recurrence intervals of known events will greatly assist in establishing the normal dynamics of land/sea interfaces and how any increases in SLR may be superimposed on such events so as to better predict future outcomes. Every effort should be made to review methodologies, statistical analysis and interpretation to

ensure that the information received is accurate and applicable to your situation. This may involve quality assurance via peer review. Once LGA's are confident that the information they have acquired is relevant, accurate and unambiguous, they should use this information to educate the community, the organisation, the Council and any other stakeholders about the logic and rationale of any decisions made with regard to dealing with the impacts of SLR.

### **Tackling the rolling maul of federal coastal NRM funding: getting back on track**

Clarke Beverley  
*Flinders University*

Support for coastal community groups funded through NRM schemes has varied significantly around Australia both spatially and temporally. Federal support for coastal NRM has wavered and now withered. This paper first provides a brief overview of the trajectory of federally funded schemes between 1995 until present. The aim of the paper is to consider possible methods of dealing with the 'rolling maul' of federal policy delivery (policy cycling and rehashing and reducing). The second output of the paper is a commencement of discussion of possible tactics to defend the maul. The paper is based on a desk top study of a variety of sources and data.

### **Strategic planning for integrated coastal governance? Insights from a critical discourse analysis of coastal strategic planning in Victoria, Australia**

Coffey Brian  
*Deakin University*

This paper considers the discursive politics of coastal strategic planning, using Victoria, Australia as a case study. The dynamic nature of coastal environments, multiple challenges involved, and diversity of stakeholders, means that coastal areas are sites of considerable political contestation. Components of these debates include competing objectives (economic, social and environmental), competing visions, the challenges associated with integration, and the need to keep pace with developments in thought and practice. Strategic coastal planning is a prominent governing practice used for managing these issues. Such plans identify the problems and trends impacting coastal areas and articulate the strategic visions, objectives, principles and directions for coastal management efforts. They also articulate roles and responsibilities and coordinate the views and ideas of a diverse range of stakeholders on a diverse range of issues. However, little attention has been directed towards understanding the discursive dimensions of coastal planning. As a consequence this paper draws on the theory and methods of critical discourse analysis (CDA) to illustrate some of the discursive politics associated with strategic coastal planning. While the empirical focus is on Victoria Australia, the lessons may have wider relevance for understanding the contribution of strategic planning in coastal governance.



### **Who do coastal stakeholders trust?**

Coffey Brian, Patrick Gilmour, Kevin O'Toole

*Deakin University, Roberts Evaluation*

Integrated coastal zone management (ICZM) draws on a range of biophysical and social science disciplines. It also involves a wide range of stakeholders operating through multiple processes and crossing various levels. Conceptually and practically this means that ICZM represents a significant governance challenge. Within this context, trust is clearly a critical ingredient that is necessary for ensuring that the diverse forms of knowledge and understanding about the coast are appropriately considered in decision making. However, the number and diversity of stakeholders with an interest in the coast means that building and maintaining trust is challenging. For example, if people tend to trust those they are similar to and in proximity with (people who are similar to themselves) then how can trust be built between stakeholders who are not alike? Drawing on insights from semi-structured interviews with a diverse range of stakeholders involved in coastal management in Victoria, Australia this paper contributes to an improved understanding of the importance of trust in coastal zone management. In doing so: the importance of trust in coastal zone management is reinforced; stakeholders' perspectives on who they trust to obtain advice from and why, are unpacked; and, the broader implications for coastal zone management discussed.

### **Microbialites in Shark Bay: World Heritage Coastal Assets**

Collins Lindsay, Ricardo Jahnert

*Department of Applied Geology, Curtin University, Petrobras Company, Brazil (formerly Curtin University)*

Australia has World Heritage coral reefs (Great Barrier, Ningaloo Reef), but seagrass banks and microbialites (stromatolites and microbial mats) at Shark Bay are also important both for natural beauty and scientific significance.

Hypersaline microbialites developed in response to a progressive change in environment, modulated by barrier seagrass banks which transformed open marine into restricted embayments with high salinity, alkalinity and evaporation. Microbial deposits commenced at ~ 2000 years ago after the Holocene highstand of sea level (~ 6,000 yr BP) in response to SL fall of about 2.5 m. Growth rates vary from < 0.1 mm/year to 0.5 mm/year. Surficial and internal microbial fabric features were constructed according to position in the tidal zone by distinct microbial communities, and into the subtidal zone. Evidence of shallowing-upward microbial fabric features reflects falling SL as stromatolites became stranded despite low gradient shorelines, and microbial communities show zonation related to water depth. Salinity, depth, turbulence, luminosity, with shore morphology, waves, wind direction and sediment influx control occurrence and distribution. A new subtidal community has only recently been discovered. Substrate morphology controls build-up structures with conical, domical, elongate/ellipsoidal or club shaped morphologies dominant with steep gradients contrasting with mats that cover extensive areas with gentle substrate gradient.

Likely responses to future climate change vary from resilient to more vulnerable systems.

## **Photo Monitoring at Lake Clifton - the results**

Comer Christine

*City of Mandurah in partnership with Peel-Harvey Catchment Council*

Presentation of 2 slides (2 minute duration) and 1 video (5.07 duration) demonstrating the outcomes of the public photo monitoring at Lake Clifton.

The Lake Clifton Photo Monitoring Project, spanning 12 months, shows the rise and fall of water levels over the the season. The photographic data, collected and submitted by the general public, was compiled into a video presentation titled 'One Breath'.

## **Practical Engineering Advice on Adaptation to Climate Change and Variability fo Australian Coastal Development**

Cox Ron, Tony Webb, Peter Nielsen, Doug Lord, Murray Townsend

*Water Research Laboratory, UNSW, Environmental Hydraulics & UNSW, University of Queensland, Coastal Environment,*

*SA Government and NCCOE*

Presentation 1 of Coastal Climate Change Guidelines by National Committee on Coastal and Ocean Engineering

Since 1990 NCCOE has developed guidelines for professionals working in the coastal environment. The early guidelines were updated in 2012 with a third added dealing specifically with intervention measures for adaptation.

1. Guidelines for Responding to the Effects of Climate Change in Coastal and Ocean Engineering. This Climate Change Guideline sets out for practising coastal engineers the background to climate change issues, describes the current status of scientific debate, gives latest global scenario projections, offers guidelines for response and adaptation measures, includes an extensive bibliography and outlines a risk-based methodology with example assessments.

2. Coastal Engineering Guidelines for working with the Australian coast in an ecologically sustainable way. Aimed at a borader audience thn Vol. 1, this guidelines emphasises how our designs, decisions, structures etc, impact on the long-term viability of the environment. It encompasses coastal zone government policy, ethics and duty of care, the coastal environment, development in the coastal zone and outlines a methodology for considering sustainability in coastal engineering.

3. Climate Change Adaptation in Coastal Management and Planning. The third guideline aimed at local government level looks to provide practical guidance that will assist coal-face decision makers with appropriate choices when confronted with coastal development under threat of climate change and other environmental hazards. The focus is on physical intervention approaches and it uses practical examples to clearly demonstrate advantages and disadvantages of various climate change adaptation options whether to adapt/protect or retreat.

## **Southern Shores - Restoring and Protecting Coastal Coastal Environments in the South West of WA**

Dal Pozzo Brett, Dylan Gleave

*South Coast Natural Resource Managemnt Inc*

Southern Shores supports community and land managers to protect coastal environments and urban waterways, ecological communities, and EPBC species across coastal environments of the South Coast. The project is being delivered over 5 years in priority sites identified by the community and partner organisations under the guidance of the Regional NRM Strategy 'Southern Prospects' and the Regional Coastal Strategy 'Southern Shores'. Coastal community groups including Indigenous, land managers, schools and coastal users are being engaged in on-ground coastal and waterway protection, education and capacity building activities. The project will directly involve coastal communities in partnership with managers to protect and enhance healthy coasts in the South Coast NRM Region through the following activities;

- Coastal environmental protection and rehabilitations works across the Region in partnership with South Coast NRM, South Coast Management Group and coastal stakeholders and land managers.
- Coastal community group engagement including Indigenous engagement and participation in education, skills and knowledge activities.

The current focus of Southern Shores is in addressing the impacts of off-road vehicles on our coastal environments. This is being achieved through community awareness activities, on-ground works and partnering closely with Local Governments on a regional scale to develop policy and guidelines for vehicle use.

Southern Shores plays a strong role in delivery of coastal and marine environmental education to the community through various public events, partnerships with local schools and providing practical support to community groups.

### **Popping the Bubbles and Filling the Gaps with CoastSWaP -building and enhancing a regional coastal network**

Darvill Blair

*South West and Peel Harvey Coastal Management Group*

The South West and Peel – Harvey Coastal Management Group (CoastSWaP) is a regional community network of coastal planning and management stakeholders in the South West of Western Australia.

CoastSWaP's vision is to care for and protect the coastal and marine environment by bringing together and assisting key stakeholders to share information, develop partnerships and address issues.

CoastSWaP can be regarded as a conduit of coastal planning and management information. It is often difficult for volunteers, staff and organisations to find the time or resources to effectively share information to other stakeholders who may find this useful. For example, sharing information on a successful interpretive education, monitoring or rehabilitation project that could be implemented in other local government areas.

By providing regular forums (both local and regional) with key stakeholders, the opportunity exists for this type of information to be shared along with other discussions regarding coastal planning and management topics. This also promotes possibilities to develop partnerships and co-operative initiatives. Key themes, outcomes and case studies are shared regionally via digital newsletters, emails and through direct communication.

Many coastal issues exist across organisational boundaries, therefore by bringing these people and organisations together they can combine resources and assets and develop initiatives which tackle the issues on a larger scale more efficiently and effectively. CoastSWaP believes this type of independent community based network assists with implementing ICZM principles in a practical way.

### **South West Regional Coastal Stakeholders Forum**

Darvill Blair

*South West and Peel Harvey Coastal Management Group*

The South West and Peel – Harvey Coastal Management Group (CoastSWaP) is a regional community network of coastal planning and management stakeholders in the South West of Western Australia.

CoastSWaP's vision is to care for and protect the coastal and marine environment by bringing together and assisting key stakeholders to share information, develop partnerships and address issues.

By September 2014 CoastSWaP will have facilitated a series of six sub-regional coastal stakeholder forums from Mandurah to Walpole (Three completed as of June 6th 2014). Representatives from Local Government, Dept of Parks and Wildlife, regional and sub-regional catchment groups, community groups and the Peron Naturaliste Partnership have provided input through discussing priority coastal issues and identifying potential actions and management solutions.

Key topics, outcomes and case studies from these forums will be presented at the SW Regional Coastal Stakeholders Forum. A major SW coastal issue/ threat will be focused on with participants workshopping practical solutions to assist in addressing this. Specific actions, timelines and delegated responsibilities will be recorded and compiled through an action plan.

Results from the forum will be shared throughout the CoastSWaP regional network, as well as to other regional and state coastal stakeholders. CoastSWaP will conduct a review and followup of this action plan six and twelve months prior to this event.

## **Development and Environmental Management of Carnegie Wave Energy Limited's Perth Wave Energy Project**

Davies Ward Edwina HR, Tim Sawyer  
*Carnegie Wave Energy Limited*

Carnegie Wave Energy Limited is the inventor, developer and 100 % owner of the CETO wave energy technology. CETO is designed to extract energy from ocean waves to generate clean, renewable and emission-free electricity and desalinated water. Carnegie is based in North Fremantle, Western Australia and is publically listed on the Australian Stock Exchange.

Carnegie is now focussed on the construction and commissioning of a commercial CETO power generation plant, known as the Perth Wave Energy Project. The Project will be the world's first grid and water mains-connected wave energy project and will use Carnegie's CETO wave energy technology. The Project is located at Garden Island, Western Australia, a Commonwealth-listed heritage site and home to Fleet Base West, Australia's largest naval base.

The Project is supported by AU\$22 m of grant funding from the Australian Federal Government's Emerging Renewables Program and Clean Technology Innovation Program, and the Western Australian State Government's Low Emissions Energy Development fund. The Project will supply both power and desalinated potable water to the Australian Department of Defence.

The onshore and offshore aspects cover multiple jurisdictions requiring a range of Federal, State and Local government permits and approvals, is fully consented and supported by a comprehensive community consultation program.

This presentation will share Carnegie's development and environmental management of the Project, the targeted environmental monitoring and assessment and community consultation undertaken, lessons learned and application to future CETO project developments. (234 words)

### **Climate change effects on fisheries in Western Australia**

De Lastang Simon  
*Department of Fisheries*

The lower west coast of Western Australia (WA) has been identified as a hotspot for water temperature increases in the last 50 years and is also affected by a long-term reduction in winter storms. These changes have resulted in major implications to the valuable western rock lobster fishery. A marine heat wave event in the mid-west of WA in the summer of 2010/11 also had significant short and longer-term implications to some fisheries.

The heat wave had a short-term effect of inducing fish kills with a 99% mortality of Roei abalone in some areas of the mid-west of WA. The abalone fishery was shut and research on the translocation of abalone and release of hatchery-reared abalone into these depleted areas is being assessed.

A longer-term effect has been the reduced recruitment (and mortality of adults) of scallops and blue swimmer crabs in Shark Bay.

The western rock lobster fishery is the most valuable single-species fishery in Australia and one of the best fisheries in Australia to examine effects of climate changes. It has long time series of data to

assess trends in the fishery and it is located in one of the hotspots of long-term increases in water temperature in the Indian Ocean. The decline in puerulus (post larval stage) settlement in the recent seven years (2006/07 – 2012/13) appears to be due to long-term environmental factors.

These case studies highlight the value of reliable pre-recruit abundance for early detection of changes in abundance, early management adaptation response before fishing took place on the poor year classes, and long-term environmental data on a range of spatial and temporal scales.

### **Multi-disciplinary protection requirements for threatened coastal raptor species in South Australia**

Detmar Sharie, Terry Dennis

*Department of Environment, Water and Natural Resources*

Top order predators, such as the White-bellied Sea-Eagle *Haliaeetus leucogaster* and Eastern Osprey *Pandion cristatus*, are important 'indicator species' by which to measure and monitor environmental integrity and wilderness quality. South Australia (SA) has small and isolated populations of both species and both are listed as Endangered under SA legislation. As with many large raptor species, White-bellied Sea-Eagles and Eastern Osprey are sensitive to disturbance, which can result in reduced breeding success and/or territory abandonment, and recent surveys indicate a significant decline has occurred in the breeding range for both on the SA mainland. Contemporary and potential threats to both species and their breeding habitat have been identified in SA, however many threatening processes continue, including some recreational activities, persecution and residential and tourism infrastructure developments in key coastal areas.

Due to the varying nature of existing and potential threats, as well as differing land tenure where breeding habitats occur (ie. private land vs. protected Reserve areas), a multi-disciplinary approach to endangered species protection is required. The land-use planning and regulatory system at both state and local government level should play a key role in mitigating threats from development pressures. While other measures such as National Park Management Plans and community awareness/education programs are required to address species and habitat protection measures and to regulate recreational activities in key remnant habitats. Ideally, the development of endangered species management (or recovery) plans would bring together the necessary guidelines and strategies to protect and manage threatened species and their habitat from in-appropriate developments, recreational and other pressures.

### **Ecological restoration – benefits for all**

Dixon Kingsley

*Kings Park and Botanic Garden, Western Australia*

Ecological restoration is a critical activity for reversing biodiversity loss, increasing the provision of ecosystem services, and contributing to sustainable livelihoods. What makes restoration uniquely valuable is its inherent capacity to provide people with the opportunity to both repair ecological damage while improving the human condition. By sustaining and enhancing the provisioning, regulating and cultural services provided by ecosystems, ecological restoration holds significant potential for increasing economic benefits, strengthening communities and protecting and enhancing biodiversity values.

## **Hydrodynamic impacts of tropical cyclones along the Australian North West coast**

Drost Edwin, Ryan Lowe, Christine Pequignet, Nicole Jones, Greg Ivey

*University of Western Australia*

The northwestern Australian coastline is subject to frequent extreme wave forcing resulting from tropical cyclones (TCs) during the summer months on Australia's North West Shelf (NWS). TCs on the NWS show variability in paths as some tropical cyclones move predominantly parallel to the coastline, while others propagate in a cross-shore direction. It has been speculated that the generation of surface wave fields due to these coast-parallel moving TCs is different compared to TCs moving in a coast normal direction across the shelf, which both affects the potential of large surface waves on the shelf and the coastal impacts. Because TCs on the NWS develop over a relatively shallow continental shelf, in contrast to previous studies on the generation of surface waves due to TCs that were mainly focused on different tropical cyclone basins, knowledge of the surface wave fields due to TC forcing on the NWS is limited. In fact, scientific publications on the wave climate on the NWS are lacking in general. This study evaluates the performance of a numerical wave model (SWAN) to hindcast the surface wave fields under different TC conditions forced by a parametric TC wind model of the region. Ongoing work is focused on assessing the nearshore impacts of TCs, for which an extensive fieldwork campaign was completed during TC season 2013-2014 that captured TC Christine.

### **Coastal Vulnerability Study Scoping – Synthesis of Previous Studies**

Eliot Matt

*Damara WA Pty Ltd*

Application of coastal vulnerability studies has gradually widened from a strategic regional tool through to a site specific tool for local government decision making and adaptation planning. This has required increased study complexity, whilst also bringing a greater weight of expectation for any study. Comparison over a range of completed CVS provides insight into key study factors, some of the challenges faced, and degrees of freedom available to make the study more readily applicable.

Key study factors are the values of interest; relevant time and space scales; and the corresponding processes which are active. These factors are intrinsic to the issue being assessed, and should be used as the basis for developing a CVS scope. Representation of these factors may vary significantly according to study methodology, affecting study accuracy.

Challenges faced in CVS scoping that have been identified through recent studies include balancing policy with site-specific relevance, integrating regional and local-scales processes and finding a common metric for different hazards.

Transparency regarding scenario setting, how uncertainty is recognised and the role of interventions is a potential means of increasing study value. For example, the transition between CVS for active management, planning and possible adaptation pathways is essentially related to increasing uncertainty and more severe scenarios. By distinguishing the contribution of uncertainty, a CVS can more readily be interpreted to provide information at multiple levels of coastal management.

## **Gippsland - A new approach to coastal planning**

Ellis Richard, Carmel Henderson

*Chair of the Gippsland Coastal Board, The Victorian Department of Environment and Primary Industries*

The Gippsland coast extends 700 kilometres from the eastern side of Melbourne to the Victorian, New South Wales border. This coastal economy provides significant value to the regional, state and national economies as it is largely based on natural resources such as fisheries, oil and gas extraction from Bass Strait.

The predominately natural state of the coastline provides a strong nature-based tourism industry drawing visitors from around Australia and overseas to enjoy activities such as boating and fishing to swimming, diving and surfing, walking and touring. The coast is also becoming an increasingly popular place to live with many communities experiencing increased population growth.

The diversity of these values and the increasing development pressures creates many unique challenges to effectively manage the coast and provide a framework for future strategic planning.

The Victorian Coastal Strategy sets the long term vision for the Victorian coast, introducing the new initiative of three Regional Coastal Plans that will address issues and develop complementary and shared approaches of management consistently across the state.

A primary focus of the Gippsland Regional Coastal Plan is building partnerships and sharing knowledge with stakeholders and community groups. It aims to assist planners, land managers, Traditional Owners and communities identify values and emerging policy, planning and management procedures at a regional level. It will build on existing state, regional and local plans and strategies; clarify and confirm roles and responsibilities of agencies and stakeholders and include effective regional coordination and implementation arrangements including monitoring, evaluation and reporting.

### **Perceptions of risk: what are coastal households concerned about?**

Elrick Carmen

*University of Sunshine Coast*

There is an increasing volume of research suggesting that coastal communities are particularly vulnerable to the impacts of climate change. However, there is limited knowledge regarding perceptions of risk and hazard-related concerns in coastal communities and few studies integrate coastal climate risk perceptions with other household concerns. Here we present empirical data regarding perceptions of risk in Australian coastal communities at the household scale. A survey of 400 coastal households in two communities and semi-structured interviews provide insight into households ordering of climatic and non-climatic risks. The results suggest that linking climate driven hazards to the every-day concerns of households, such as finance and health, may raise the profile of climate issues in the coastal zone.



## **Innovative thinking for knowledge advancement and effective coastal action**

Fisher Judy

*Western Australia Museum*

Coastal ecosystems are subject to daily fluctuations and constant change led by the offshore marine environment, onshore alterations influenced by riverine and estuarine ecosystems, people, managers, planners, developers and decision makers to name a few. Indigenous and local communities living in coastal regions have important and informed knowledge and understandings of their regions. They have a role to play as key partners in effective collaborative coastal partnerships to guarantee that coastal regions are managed and developed in sympathy with those who live and well understand their local environments. Case studies of Best Practice following the Guidelines of the International Union for the Conservation of Nature (IUCN) Commission on Ecosystem (CEM) Thematic Group Ecosystem and Invasive Species in tropical monsoon rainforest with Kimberley aboriginal rangers, Perth urban limestone and dunal ecosystems with Stirling Natural Environment Coastcare (SNEC) and Mangrove forests with local communities in Myanmar will demonstrate the importance of effective measurement and evaluation and the incorporation of local and traditional knowledge, alongside western science, to ensure those ecosystems which play a key role in protecting and mitigating against rapid and sometimes unexpected coastal change are being managed and incorporated into sustainable use, management and development of our coasts. The approaches to be outlined have direct relationships with International Conventions including the Convention on Biological Diversity, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) and the Ramsar Convention, while also being highly relevant to local on ground coastal projects in varying coastal ecosystem types.

### **Australia's Temperate Bays and Estuaries.....Identifying and Scaling Management "Bright Spots"**

Fitzsimons James, Geoffrey Wescott, Lynne Zeitlin Hale, Rebecca Koss,  
*The Nature Conservancy, Deakin University*

Southern Australia's temperate marine ecosystems are unique and of local, national and international significance. Its estuaries, bays, and coasts are adjacent to where the majority of Australians live and provide a foundation for the productivity of the country's marine environment and fisheries. Yet many of its bays and estuaries are under enormous pressure from human activities and important habitats and ecosystem services have been lost. At the same time, there are multiple "bright spots" – examples of action taken by local and state government, community groups, corporations, and recreational fishers—to improve bay and estuary condition.

The objective of this special workshop session is to share examples of bay and estuarine management "bright spots" and explore ways to replicate these good practices. We will target participation by the full range of Conference participants with interest and experience in bay/estuary management. We will start with a moderated panel. Five panelists—representing a range of bays/estuaries and stakeholder groups- will make short (5-7 minute) presentations about a "bright spot." These presentations will focus both on outcomes and stakeholder engagement. Session participants will then be invited to share additional bright spots—seeking to develop a more comprehensive suite of "good practice" examples. The session will transition to small group discussions (30-45 min) where participants will be asked to 1) identify attributes that have

contributed to the success; and 2) offer recommendations as to how to share lessons and replicate successful examples. The session will conclude with a full group review of the outputs; seeking consensus on good practice and next steps for scaling up.

The Nature Conservancy, in partnership with Deakin University, will organize and moderate the panel.

### **Protecting and Restoring Australia's 'Great Southern Seascapes'**

Fitzsimons James, Lynne Zeitlin Hale, Boze Hancock  
*The Nature Conservancy*

Based on the recommendation of a 2012 expert workshop on Conservation and Restoration of Temperate Australian Marine and Coastal Habitats, The Nature Conservancy is starting work with a wide range of partners—from government, the private sector and the vast number of Australians who rely on the ocean for both their livelihoods and recreation—to dramatically accelerate and scale the conservation and restoration of Bays and Estuaries in southern Australia. The Great Southern Seascape (GSS) program is built around a “two-track” approach: an in-depth focus on “in-water” work; complemented by work at the state and national scale to leverage results and funding.

Initial focal bays are Port Philip Bay and Western Port. In both bays, the GSS program will launch pilot projects to develop good practice models through collaborative, partner driven projects that improve ecological function, provide services to coastal communities and have potential for replication.

Work in Port Philip Bay is focusing on sub-tidal habitat restoration. As a first step towards the reconstruction of the Bay's lost shellfish reefs, a bivalve habitat restoration project will be launched with the aim of restoring areas of native oyster (*Ostrea angasi*) reef and blue mussel (*Mytilus edulis planulatus*) beds. The project aims to demonstrate techniques for restoration and measure the benefits of restored bivalve habitat to recreational fish stocks and the angling community. Work in Western Port will initially focus on the coastal fringe habitats, considering innovative options to allow for habitat migration (e.g. saltmarsh, mangroves) with sea level rise.

### **An integrated hydrodynamic/hydraulic modelling tool for urban flood mitigation analysis**

Fraser Ryan, Mahesh Prakash, James Hilton, Yunze Wang, Fletcher Woolard.  
*CSIRO*

We present an integrated flood modelling tool that is able to evaluate different mitigation solutions for areas that are prone to floods from storm surge and heavy rainfall. Our model integrates catchment and coastal flood modelling (spatio-temporally dynamic), including sea level rise, to provide a holistic inundation model for future flooding. Additionally, the model aims to enable simulation of a combination of flood mitigation and adaptation options. To date, the practice has been to model either drainage augmentation solutions alone, or (for coastal inundation) single coastal adaptation solutions. This tool aims to deliver the capacity to model a range of both coastal and drainage adaptation solutions to understand what combination of solutions might be effective.

The model is demonstrated for example cases in the City of Port Phillip in Victoria and a preliminary evaluation around the Shire of Murray Delta in WA.

### **Vulnerability and Progress in Adaptation of South East Queensland Coastal Council**

Gainza June, Marcello Seno, Scott Baum, Rodger Tomlinson  
*Griffith University*

Coastal communities in South East Queensland (SEQ) are exposed to coastal hazards and climate change, and local Councils are responding to these threats by setting up different strategies for adaptation. Here we show the results of a spatial vulnerability assessment of the SEQ coastal region and we compare it to the progress in adaptation of its five coastal Councils. An integrated framework was used to assess vulnerability at suburb level. This methodology is based on the combination of indicators, which include external (exposure) and internal (sensitivity and adaptive capacity) dimensions, in one single index to produce a measure of vulnerability to coastal hazards. The progress in adaptation assessment is based on the semi-quantitative assessment of pre-determined Adaptation Functions, These Functions, adapted to SEQ context, were used to assess the progress in adaptation for each Council. Finally, the spatial vulnerability and progress in adaptation were compared providing specific information on local needs for adaptation investment. It is concluded that even if the five coastal councils analysed have considerable capacity to deal with coastal hazards and climate change, the majority of the SEQ coastal region is intrinsically highly exposed and sensitive to climate drives and consequently there are numerous coastal suburbs that are highly vulnerable. We argue that reduction of vulnerability can be addressed by progressing further in the adaptation of the SEQ coastal Councils coastal planning and management frameworks.

### **Practical Application of Western Australian Coastal Policy – a Guide by Case Studies**

Garcia-Webb Joanna, Paul Branson,  
*Cardno*

In July 2013 the Western Australian Planning Commission gazetted the revised State Planning Policy No 2.6 – State Coastal Planning Policy (SPP2.6). The goal of the policy is to provide guidance on the long term sustainable use of WA's coast. It has adopted a Coastal Hazard Risk Management and Adaption Planning (CHRMAP) approach where adaption planning is preferably based on a hierarchy of four broad adaption categories: Avoid – Retreat – Accommodate – Protect.

The planning of new coastal developments requires allowance for a coastal foreshore reserve to accommodate coastal processes; effectively providing a buffer to mitigate the risk of coastal hazards over the planning timeframe. Guidelines for the calculation of coastal processes are provided in Schedule 1 of SPP2.6. Where a new development is required to be within the calculated foreshore reserve, steps to reduce the risk with mitigation measures are also provided.

This paper demonstrates the practical application of the revised SPP2.6 to coastal development around Western Australia through a series of case studies: Broome, Point Samson and Yancheep. We present a flow chart of key studies, plans and inputs that establish the context for the CHRMAP process and identify where each of these fits in the policy context. Each case study has a unique

context; presented together they provide local managers with a comprehensive understanding on how to apply the new planning process to future coastal developments.

### **Monitoring Seas And Inspiring Communities (MOSAIC): citizen science contributions to monitoring South Australia's new Marine Park network**

Gaut Alex, Kathryn Warhurst  
*Conservation Council of South Australia*

South Australia's new Marine Park network will be monitored to assess the effectiveness of the high protection sanctuary zones, the success of which is critical to the entire marine park network and broader marine biodiversity conservation objectives. There are few examples of a citizen science program designed specifically for marine parks, therefore MOSAIC, a partnership between the Conservation Council of South Australia, the SA government and the community, was established in 2013 with the production of a comprehensive scoping study, including 'key success factors'. The MOSAIC project is using a citizen science approach to collect good quality, relevant data to support Marine Park management and evaluation. The project also seeks to develop an increased level of understanding and stewardship of the marine environment in regional communities, as well as increasing their capacity to undertake useful and rigorous monitoring in the marine environment. The second phase of the project focused on the implementation of two pilot projects and is now in transition to a third phase. This presentation will include an overview and important learnings of the pilot projects, especially as assessed against our 'key success factors', and next steps.

### **You Tube video as a tool to developing and strengthening coastal partnerships**

Gibbs Chris  
*South West Catchments Council*

Encouraging continuity in coastal volunteer group membership, developing and maintaining partnerships, providing a interesting record of achievements and rewarding those who give so much of their time can all be achieved to some degree using video and 'You Tube' as a publishing and marketing tool. With the advent of high resolution, wide angle and relatively cheap video cameras such as Go Pro and the ease of using commonly available and simple video editing tools such as Windows Movie Maker it is relatively easy to produce well edited, entertaining and factual video records. These can show community groups relationship to their coastline and celebrate their successes. In a time of easy environmental pessimism so much is achieved by volunteers that is worth celebrating. By on-line marketing of success, camaraderie, having fun, enjoying the relationships developed through volunteering and being reminded of tangible achievements, this can encourage a more positive and energetic outlook by community groups and draw others to the cause. This workshop demystifies movie making and on-line video publishing by developing an edited project during the workshop. Video examples of community group's achievements are shared with participants.

## **The Coastscapes Project – Protecting and Enhancing Biodiversity Resilience in the Coastal Macro Corridor of the South Coast of WA**

Gleave Dylan, Robyn Cail, Melanie Stock, Sean Hazelden,  
*South Coast Natural Resource Management (NRM) Inc.*

The South West Botanical Province of WA is recognised as a 'biodiversity hotspot'. Within this hotspot the almost continuous strip of intact coastal native vegetation along the south coast is the major east-west link in the region's macro corridor network.

The project aims to protect and enhance the coastal macro corridor which is 512 km long and made up of two major coastal corridors: the Two Peoples Bay to Fitzgerald Corridor; and Fitzgerald to Cape Arid Corridor as defined in the South Coast Macro Corridor Network. The project will undertake strategic works across 8402 ha to improve the connectivity, quality and resilience of the regions coastal corridor, address threats whilst protecting and increasing biodiversity.

The project involves strategic assessments to identify priority 'pinch point' areas in the coastal corridor and the implementation of strategy works including;

- Biodiversity plantings expanding the extent of native habitat within priority areas of the coastal corridor building resilience and connectivity.
- Protecting and enhancing existing native vegetation within priority areas of the coastal corridor.
- Managing invasive species threats to biodiversity within priority areas of the coastal corridor.
- Community capacity will be built by facilitating technologies to enable best-practice restoration works such as direct seeding by supporting equipment purchases, modifications and training to support the direct seeding of native vegetation species by community organisations and land managers.
- Building community capacity to deliver rehabilitation and protection works through technical support, skills and training.

### **Adaptive sea walls and breakwaters – a counterintuitive approach**

Gordon Angus  
*Coastal Zone Management and Planning*

The design of breakwaters and revetments, has become increasingly complex and often utilises sophisticated interlocking armour units. It has long been recognised that the size of primary armour unit required is directly proportional to wave height cubed. Therefore, where climate change studies project even a modest increase in wave height, the implication is that sea walls and breakwaters designed for contemporary conditions will be at risk of failure in the future. Further, for revetments and breakwaters, experience dictates that the more sophisticated the primary armour, the more catastrophic the failure; and, the more sophisticated the primary armour, the more difficult it is to retrofit an armour upgrade.

Rock revetments and sea walls have been employed as sea defences and harbour works for centuries yet the theory for their design only dates back to the 1930s. Many have been constructed by tipping the largest rock available and repairing the wall with more rock, or concrete armour units if failure occurs. Over time, the addition of mass combined with the slumping of the wall adjusts the slope to the point where the armour size-slope combination becomes stable to the wave conditions; a "living" example of a flexible, adaptive design. This option is not necessarily viable for more sophisticated designs.

The paper will explore the lessons from history that demonstrate the less sophisticated designs, not only for the primary armour, but also the underlay, are the more readily adaptable to potential changes in future wave energy.

### **Thrombolites in the South West Australian Lakes: General Aspects and a Case Study from Lake Richmond**

Guerreiro João, Alonso Lluesma Parellada, Lindsay B. Collins, Ryan Vogwill,  
*Curtin University, Petrobras*

The southwestern coast of Australia comprises several lakes where sedimentation is strongly influenced by the microbial activity, resulting in the formation of significant thrombolite deposits. Many of them lie in wetlands of the Yalgorup National Park and of the Rockingham Regional Park, including 2 threatened ecological communities at the lakes Clifton and Richmond. Whilst Lake Clifton is the most well-known, other occurrences still remain poorly studied. Georeferenced maps presenting distribution of the thrombolites across the entire Yalgorup and Rockingham systems have been generated for the first time as part of this project and aspects related to their formation, composition of the microbial communities and links to the lake hydrology investigated.

Lake Richmond, a slightly brackish lake with thrombolites dating back to approximately 3000 years ago has been selected for presentation as a case study. The distribution and growth of the thrombolites in this lake was influenced by a progressive water level fall that led to the colonization of basinward areas and increased thrombolite exposure in the landward direction, causing erosion of older structures. Thrombolites are often covered by smooth or pustular soft microbial mats whose distribution is controlled by the seasonal variations in water level. Green algae proliferation represents the most likely disruption to thrombolite growth and is being triggered by the excessive discharge of nutrients into the lake, as suggested by water analyses.

This research expects to provide baseline data for future impact assessments in these significant wetlands characterized by delicate environment and under pressure of ongoing urbanization.

### **A mechanistic description of Lyngbya algal blooms for inter-tidal coastal embayments**

Gunaratne Gayan, Ryan Vogwill, Matthew Hipsey  
*The University of Western Australia*

Extensive Blooms of *Lyngbya Majuscula* (*Lyngbya*) have been recorded in tropical coastal waters across the globe in recent years, including Roebuck Bay north-western Australia. Such blooms are driven by environmental changes, with anthropogenic input of nutrients the major contributing

factor, threatening coastal ecosystems, as well as being harmful in instances of human contact. While there is a general consensus on factors regarding Lyngbya bloom initiation and growth, a clear process-based formulation of the bloom process is lacking. This study offers a mechanistic model to predict Lyngbya biomass in an intertidal zone of a coastal ecosystem. The model structure is based on three state variables of Lyngbya biomass; 1) benthic submerged, 2) floating and 3) benthic exposed. It links these three states with key environmental factors for growth: bioavailability of nutrients (including iron, phosphorus, nitrogen and dissolved organics); light, salinity and temperature regimes; biological and physical processes such as growth, mortality, respiration, sloughing, floating to surface, sinking to bottom, and drifting. This model has been implemented within the open-source “Aquatic Ecodynamics” (AED) model library. The Roebuck Bay coastal wetland will be used as a case study for model application using output from a hydrodynamic model, a nutrient mass balance model together with catchment and aquifer nutrient export rates. This conceptual but mechanistic model can be used as a framework for setting Lyngbya management priorities in Roebuck Bay and as a basis for future research into coastal ecosystem impacts from Lyngbya blooms.

### **Protecting and Enhancing the Coast’s Natural Wealth**

Hale Lynne

*The Nature Conservancy*

Mangroves, seagrasses, coral and bivalve reefs, along with other coastal and marine ecosystems, have sustained fish, fishers, and coastal communities for generations. Their thoughtful conservation, sustainable use, and restoration are central to continuing the many economic benefits they provide. Globally, these natural systems are changing at an unprecedented rate and scale. Yet, in many bright spots around the globe, scientists, conservationists, fishers, and businesses are working with engaged citizens and communities to reverse declines. Progress is also being made in quantifying the multiple values that coastal ecosystems provide. Examples of how communities around the world are protecting and re-building their “natural coastal capital” and realizing a wide range of benefits—from fish production, to coastal protection, to better water quality, to enhanced recreational opportunities include the Gulf of Mexico and Long Island in the United States and Grenville, Grenada. The talk will conclude with a brief look at the global significance of Australia’s temperate bays and estuaries that are less well known internationally than the tropical systems.

### **Quantifying New South Wales Inundation and Erosion Risk**

Hanslow Dave, Bradley Morris, Michael Kinsela, Edwina Foulsham,

*NSW Office of Environment and Heritage*

Global mean sea levels are rising and this rise is expected to continue for centuries, even if greenhouse gas emissions are curbed and their atmospheric concentrations stabilised.

Communities and infrastructure in the coastal zone of NSW are highly vulnerable to climate change. In this study we quantify current and potential future exposure to ocean inundation and erosion associated with projected future sea level rise.

For inundation we use a mid-level approach to the modelling and mapping of water levels within estuaries. The approach allows for variation in tidal levels both between and along estuaries. We utilise tide gauge data for 56 estuaries for current estuarine water levels. This data is also used to derive average tidal planes for different estuary types for application to non-gauged estuaries. The water surface mapping method applies interpolated tidal planes created from gauge data or berm heights for intermittently open and close lakes and lagoons. Tidal planes are overlain on digital elevation models derived from high resolution data.

For erosion we use both the proximity method and detailed hazard mapping from council hazard definition studies, which incorporate allowances for existing processes and future sea level rise.

We present results for overall exposure and regional variability for a range of different sea level rise scenarios. The results suggest that the NSW coast has considerable exposure to severe coastal storms and projected future sea level rise, with inundation of estuarine foreshores contributing most to the overall exposure.

### **The influence and efficacy of waste management policies on coastal marine debris in Australia**

Hardesty Britta Denise, Chris Wilcox, TJ Lawson, Clementine Maureaud  
*CSIRO*

CSIRO has carried out a national coastal marine debris survey in which we've surveyed 175 sites around the country to record the amounts and types of anthropogenic debris approximately every 100km. One of our main goals is to understand potential drivers of debris hotspots and to determine the efficacy of waste management policies on coastal marine debris. To reach this goal we compared waste management policies in 40 regions where we carried out surveys, focusing on survey sites within each state/territory where we observed higher or lower concentrations of rubbish. Specifically, we looked at coastal debris around the country and we compared waste management legislation and policies to look at correlates between resources, population density, coastline length and quantity and types of debris observed on beaches. We also carried out phone surveys to learn about perceptions as well as waste policies (such as bins, recycling, river waste traps, waste facilities, etc) that were in place within the regions sampled. We discuss our results with a focus on cost efficiency and effectiveness of waste management policies at local, regional and national scales.

### **WA PestWatch – Using location-based crowdsourcing in the fight against aquatic pests**

Harrison Brett  
*Department of Fisheries*

Access to, and the use of, accurate location-based information is crucial to underpin natural resource management decisions. The Department of Fisheries (Department) heavily relies on geospatial information to guide compliance, management, and research decisions.

As a specific example, the Department's Biosecurity Program uses location-based information and interactive mapping tools when responding to biosecurity incidents and investigating potential threats. The Program depends on the early detection of aquatic pests so they can be effectively and efficiently eradicated before they become established in the aquatic environment. The community is



an essential part of the Program, reporting sightings and locations of pests and other suspicious species.

To assist the public in providing this valuable information, WA PestWatch, a free location-based crowdsourcing application, was launched. Brett Harrison, Manager of the Department's Geospatial Services, will present a paper on how location-based information has been used in the development of this innovative tool, and how community interaction with the app has provided critical information in the battle to protect the State's precious waters from invasive aquatic pests.

### **Coastal Management in Australia: Twenty years of Coast to Coast conferences**

Harvey, Nick  
*University of Adelaide*

The first Coast to Coast conference in 1994 was held against a backdrop of global concern about coastal vulnerability following the IPCC's First Assessment Report (1990) on climate change, the Rio Earth Summit (1992) and the first world conference on coasts (1994). The latter two also called for an integrated approach to coastal management. Australian federal action at that time had produced the Resource Commission Coastal Inquiry (1993) and its imminent Coastal Action Plan. Twenty years later, the IPCC has completed its Fifth Assessment Report on global climate change, giving no grounds for complacency on coastal vulnerability. In Australia, there has also been a comprehensive government report on national coastal vulnerability (2009) and a compelling bi-partisan parliamentary report (2009) on the need for integration and national leadership to manage our coast in a changing climate. However, Australian public and political attitudes to climate change have changed between 2007-2012 and new governments have brought different ideologies on environment and development along with changes in mechanisms for coordination between federal and state governments. This sets a new national context for the 2014 Coast to Coast conference requiring a re-assessment of pathways toward an integrated and sustainable approach to Australian coastal management.

### **Stakes, Issues and Boundary Organisation: Addressing and Improving Science Uptake in the Coastal Zone.**

Haward Marcus, Peat Leith, Chris Rees, Brian Coffey & Kevin O'Toole  
*University of Tasmania, Deakin University*

This paper argues that the key to improving science uptake is to identify the structure of the problem and to establish appropriate design elements, including boundary spanning organisations. Coastal zone management involves the relationships and interactions between biophysical, ecological and socio-political processes. The coastal zone is the interface between terrestrial, estuarine and marine environments and subject to multiple pressures from a variety of uses and users, with multiple agents and institutions involved in its management. Commonly the available scientific research is expected to provide evidence and analysis to enhance coastal management by providing the basis for addressing complex environmental problems, yet there is little agreement on how this should be achieved. Recent scholarship has re-focused attention on boundary organisation, in simple terms the relationship between science and management. The paper outlines a framework

addressing science uptake based on research undertaken within the Coastal Collaboration Cluster, and evidence drawn from this research is presented. The paper suggests that while there are no silver bullets in improving coastal zone management, a focus on the processes leading to the establishment and operation of boundary organisations as key components in shaping institutional arrangements can improve science uptake in the coastal zone.

### **Sediment compartment characterisation of the Australian Coast**

Hazelwood Martyn, Martine Woolf, Duncan Moore  
*Geoscience Australia*

Geoscience Australia collaborated with a panel of independent coastal science experts to define the spatial extent of sediment compartments around the entire Australian continent. The approach implemented a conceptual framework based on recognition of the sediment systems and the geomorphologic processes that operate in the coastal zone. The resulting National Classification of Coastal Sediment Compartments captures information on compartment extents based on geology, geomorphology, topography and shoreline aspect around the entire continent. The Classification is hierarchical, such that secondary compartments fall within the extent of the primary compartments.

The resulting National Classification of Coastal Sediment Compartments supports regional and site-specific coastal management and can guide the selection of approaches to modeling shoreline response. This information is fundamental for predicting how the shoreline responds to the processes that act on it, both in the current and future climate.

This project was the result of collaboration between Geoscience Australia and the Department of Industry. The presentation will provide a brief overview of the classification methodology, the spatial data created and discuss the potential uses of this conceptual framework to support of policy development in the coast zone.

### **Financing the Coast**

Hickman Jon  
*Chair, Victorian Coastal Council*

The discussion around funding infrastructure in Australia has to date largely focussed on ‘hard’ infrastructure, particularly additions and improvements to roads and public transport. There has been relatively little discussion around the challenges involved in financing the protection and enhancement of our natural infrastructure – our parks and our coast particularly – in the face the impacts of climate change and of increasing population and visitor numbers,

We have, as a community, appreciated the importance of sustaining ‘liveable’ cities, and our parks and our urban and peri-urban coastline make as much, and arguably more, of a contribution to our liveability as our ‘hard’ infrastructure, our roads, public transport, communications (and other utility) infrastructure.

However the principles behind good financing arrangements for ‘hard’ and ‘natural’ infrastructure are the same.

On the coast a particular intervention might protect private land from the impact of sea level rise, protect local streets and parks for the local community and also protect the beaches the broader coastal environment used and enjoyed by the metropolitan community. Allocating capital and maintenance costs fairly, across the range of beneficiaries, and collecting contributions will be a challenge, but a challenge that will need to be addressed in the face of competing demands on public sector budgets.

The paper will discuss, and raise awareness of, the challenges of financing coastal assets and adaptation and identify potential means of generating funding.

### **Connecting to community through next generation visualisations and information sharing**

Hodge Jonathan, Jamie Vleeshouwer, Toni Cannard, Andy Steven, Donald Mackenzie  
*CSIRO, Logan City Council*

The general public increasingly expects that information collected by, or funded by governments should be available and usable. This has resulted in open data initiatives at many levels of government and there are now numerous web-based systems where users can download public datasets. This may not, however, result in real use of data or any substantial community benefit. The data needs to be delivered in the right way.

The Logan Flood visualisation project, funded through the Terrestrial Ecosystem Research Network (TERN) and CSIRO, is demonstrating how data and information can be brought together to tell a story which is relevant to local communities. The project has utilised data and information related to flooding in the Logan River catchment in a way which allows users to connect pieces of information to build knowledge and create an understanding of flood impacts and recovery.

Integrated visualisations of real-time data, routine monitoring and model outputs better capture episodic events and can provide predictive knowledge to enhance emergency preparedness. Historical photos, videos, research articles, monitoring data, flood heights and other forms of information are presented in an online map-based system to deliver an enduring narrative. This system provides a demonstration of how we can use data better, how we can bridge the gap between data and understanding and how we can connect to communities by delivering rich, information-driven narratives.

### **Development of a fluorogenic detection process of faecal indicator bacteria in recreational waters**

Jonns Jodi, Dr James Chapman  
*Central Queensland University, School of Medical & Applied Sciences*

Testing for the detection of human faecal indicator bacteria upon beaches and other bathing waters occurs routinely across Europe and the United States. Australia does not, as of yet, carry out this sampling protocol. With the prospect of inevitable population growth and influx of tourists to beachside destinations, testing could become a requirement to prevent the outbreak of potentially fatal gastrointestinal illnesses. Current *E. coli* detection methods are laborious, laboratory-based processes requiring up to 48 hours for results. The use of biochemical detection of enzymes occurring in *E. coli* is a rapid detection method using fluorescence for revealing the presence of *E.*

coli in a sample. This work will demonstrate the biochemical method development stages toward the progress of an affordable, portable and rapid detection method (beyond state-of-the-art) with potential for use in recreational waters.

### **Understanding Wave Resource within Wave Energy development**

Kolbusz Jessica

*Carnegie Wave Energy*

The understanding of wave resource and its driving factors is vital for wave energy technologies such as the CETO device. Carnegie Wave Energy has been developing the CETO wave energy technology for the past 10 years and the Perth Wave Energy Project is currently being constructed and due for commissioning in 2014. Measured and modelled waves as well as their inter-annual and seasonal variability has its impact on wave energy extraction, efficiency and economically and is therefore a focus of Carnegies. Recent improvements in weather prediction and hindcasts by NOAA in conjunction with NCEP and within Australia the CAWCR, have used WAVEWATCH III numerical wave modelling to generate long term wave hindcast datasets. Use, and hence validation of these wave hindcasts are necessary in coastal zones and oceans around the globe whereby no long-term datasets are available. The wave hindcasts were validated here for Garden Island, Rottnest Island and Cape Naturaliste for March to December 2009 using qualitative and quantitative methods. The CAWCR wave hindcast provides an extensive list of hourly wave parameters as opposed to 3-hourly major wave parameter set (Hs, Tp and Dp) provided by NOAA and overall performed better. For this reason, the complete 30-year dataset (1979 – 2009) from CAWCR was used to look at seasonal sea states for Carnegie Wave Energy's Perth Wave Energy Project location at Garden Island. This could contribute to a future investigation into wave climate changes and is relevant in both academic and real world applications.

### **A Large Scale Geomorphological and Surficial Cover Map of Nearshore Reefs in the Kimberley Coast, WA**

Kordi Moataz, Lindsay Collins, Alexandra Stevens

*Department of Applied Geology, Curtin University*

Coral reefs occur extensively along the north-western coast of Australia in the Kimberley Bioregion (KIM), forming major geomorphic features (landforms) along and just off the coast. These reefs have not been studied in as much detail as the offshore reefs and are poorly known. Geomorphological and surficial cover substrates and habitats maps of coral reefs provide significant information to both researchers and managers about the distribution and extent of reef landforms. This study aims to produce a large scale dynamic map in order to study reef spatial distribution patterns and to provide more information on geomorphological and surficial cover on reefs. Remotely sensed images were used to extract information. Also other multiple data sources were integrated using Geographic Information System (GIS) to verify results as well as to add value to the data in order to produce consistent, accurate, and useful geomorphic maps. The outcomes will facilitate better understanding of reefs in this region to develop a reef geomorphic classification scheme which describes reef evolution, classification and distribution of reefs by type. Moreover, they will provide a robust foundation to foster further studies in various disciplines beyond the scope of this study.

## **A Recipe for Coastal Community Engagement**

Leahy Peta, Naomi Edwards  
*Griffith Centre for Coastal Management*

Success and excellence are desirable outcomes when engaging with communities along the coast. Though, multiple engagement barriers present a challenging situation as coastal community engagement is commonly initiated due to a need to address a coastal issue. This begs the question, how can we engage the community? The truth is that there is no one recipe, rather a list of essential ingredients that must not be left out of the engagement process.

Coastal community engagement experts from the Griffith Centre for Coastal Management relate the process similar to baking a cake. Although anyone can attempt to bake a cake, it takes practice, experience and testing to perfect skills to drive success and reach excellence. For over a decade, the Centre has been opening coastal community engagement opportunities from issues with four essential ingredients: awareness, involvement, education and celebration. This has developed a streamline process for communities to want to buy into and address issues, create trusting relationships and reach excellence that has since sprawled from beach to beach.

The Recipe for Coastal Community Engagement workshop will teach you the tricks and tips of coastal community engagement to ensure you achieve success on your beach. Further, allowing you to tap into the list of secret ingredients based on your community's unique make-up to ensure you bake an engagement experience you will want to share. The workshop will also ensure you don't forget to add a tad of trustworthiness and a heap of hard work for the best coastal community engagement outcome.

### **Stay, Up or Away: Confronting the Socio-economic, Environmental and Legal Challenges of Adapting to Sea Level Rise**

Lester Charles  
*California Coastal Commission*

Global sea level rise raises the stakes in our on-going effort to manage development along eroding shorelines. We have significant experience with the strategies of protecting development from coastal erosion and flooding in place with shoreline protection, elevation of structures, and beach replenishment. But these strategies may be increasingly ineffective and expensive as sea level rise accelerates and extreme storm events become more intense. They also can entail significant adverse impacts to other important coastal resources, including public beach access and recreation and sensitive marine environments. More attention is thus being focused on strategies of planned retreat, such as using development setbacks and rolling easements to move development away from coastal hazards. However, there are many challenges to effective implementation of these planned retreat strategies as well. These include legal and political constraints related to private property rights; scientific uncertainty; the need to coordinate multiple property owners and stakeholders within complex existing conditions; the lack of physical space for planned retreat; and the high costs of relocating or removing existing development. Ultimately successful adaptation will require long-term sub-regional and community-based land use planning efforts capable of evaluating the social and environmental costs and benefits of potential development scenarios in specific contexts.

Effective adaptation will also require the use of enforceable regulatory policies and other land use programs and incentives to achieve the goals of adopted adaptation plans, supported by significant social and political commitment to and investment in the strategies of planned retreat.

### **Design Wave Analysis for Augusta Boat Harbour**

Li Fangjun

*Department of Transport*

The new Augusta Boat harbour is located at Flat Rock, 320 km south-west of Perth. This analysis reviewed the relevant wave and wind observations available in the area, developed an innovative method to significantly extend the wave data length without expensive wave modelling, conducted an extreme value analysis for wave height, and recommended the design wave height, period and direction for the Augusta boat harbour breakwater construction.

The Spectrum analysis of the Augusta AWAC measurement has been conducted to justify the separation of sea waves from swell waves. It was found that, in contrast to the west facing coast in the WA south-west region, the extreme waves at the Augusta boat harbour site occur in summer season. The local generated sea waves are significant larger than the longer period swell waves due to the east facing shoreline orientation of the site. Close correlation,  $R=0.9$ , between the sea wave heights and the direction-filtered wind speeds at Cape Leeuwin was revealed. This correlation enables the re-construction of 24 years storm wave events. The POT-GPD method and the Weibull and FT-I distribution fitting (conventional Goda method) has been conducted.

The analysis has also included the swell wave component based on their joint occurrence probability with extreme sea waves.

### **Adapting to Climate Change in the Coastal Zone of the Peron Naturaliste Region of Western Australia**

Ludbrook Joanne, Craig Perry

*Peron Naturaliste Partnership, Peron Naturaliste Partnership*

The Pern Naturaliste Partnership (PNP) was formed to create a regional effort between 9 local governments in SW Western Australia to reduce risk and optimise opportunities posed by climate change in the coastal zone. The PNP works with all council memebtrs to undertake coastal adaptation planning and implementation. This presentation will explore :

- What has been achieved? What does the monitoring data and other information sources tell us?
- So what? What can we learn from what's emerged?
- Now what? Where to, from here?

This presentation will highlight the following potential next steps:

- Understand community (including indigenous) and stakeholder concerns about significant social, economic, ecological and cultural assets in the coastal zone;

- Identify potential adaptation pathways for the coast including high-level strategic options, and
- options for coastal managers that assist in protecting natural and built environments;

### **The Australian Marine Debris Initiative Source Reduction Plans**

Mallison Leslie

*Tangaroa Blue Foundation*

Marine debris is a Key Threatening Process and impacts EPBC listed endangered/threatened species e.g. Southern Right Whales by entanglement or ingestion. The Australian Marine Debris Initiative (AMDI) was created by the Tangaroa Blue Foundation (TBF) in 2004. Over 2.5 million items have been removed from the Australian coastline and recorded in the AMDI database; including 940,000 items from WA.

TBF recognise that if all we do is clean-up that is all we will ever do; so a more sustainable approach was required. TBF's primary objective is to stop marine debris entering the environment, thereby reducing its occurrence long-term.

TBF created Source Reduction Plans (SRPs) to sustainably mitigate marine debris. SRPs are a step-by-step guide to target the source of debris before it enters the environment. An estimated 80% of marine debris comes from land based sources. The AMDI data and statistics are used to identify sources, and solutions are devised involving all stakeholders. This framework is applicable from local level community action, to federal level strategies.

More than 50 SRPs have been implemented around Australia. For example, during beach clean-ups TBF identified the reoccurrence of plastic packaging bands on WA beaches. The source was the WA rock lobster industry which used bands around bait boxes. TBF successfully gained legislation stipulating that all packaging bands must be removed from fishing vessels before leaving shore; reducing the potential danger of marine life entanglement.

SRPs are a vital tool to combat the issue of marine debris and ensure the sustainable preservation of the Australasian marine ecosystem.

### **Innovative solutions to beach erosion: lessons learnt from international case studies**

Mariani Alessio

*Former WRL, NSW*

The use and significance of the coastal zone has radically changed throughout history: from transportation, military and industrial of the early settlements to residential and recreational today. Nowadays, people turn to the coast for contact with a natural environment and for the quality of life that is associated with living on "Land's edge".

In this context, the development of innovative solutions to address beach erosion as an alternative to traditional coastal protection structures (seawalls, groynes and breakwaters) has become more important. In the last two decades, alternative approaches to manage beach erosion have been formulated and implemented both internationally and within Australia. These innovative

approaches are typically marketed as being characterised by lower environmental impacts, lower costs and easier implementation.

Despite the growing interest towards novel methods, few resources are available to coastal practitioners to assist with optimising coastal management in their environment. In his keynote address, Alessio will provide a synthesis and overview of two decades of international field experience with innovative solutions to the management of beach erosion, including artificial reefs, beach dewatering, artificial dunes and natural defences. Rational guidance will be provided to coastal managers and planners to assist in the evaluation of intervention options marketed as innovative.

**Fine tuning costs and benefits for coastal investment.**

McCristal Nick, Polly Matthews

*Corangamite Catchment Management Authority (CMA)*

The use of a market based instrument (MBI) for coastal conservation is generating impressive results in south western Victoria. The Corangamite CMA has partnered with both public and private land managers utilising approximately \$ 4M of Australian and Victorian Government investment to deliver conservation projects over the past five years.

Forty eight land managers have delivered works under contract, involving 87 sites across an area of 2057 ha ranging from the protection of two wetlands listed as internationally significant under the Ramsar Convention, to saltmarsh vegetation enhancement for a number of threatened species including the Orange-bellied Parrot.

The use of an MBI for large-scale coastal project delivery had not occurred previously in Australia. The approach presented some specific issues that needed to be effectively managed; in particular the issue of how to effectively deal with both private and public land managers in a fair and equitable manner presented some significant project design challenges. The CoastalTender project has incorporated features for improved investment decision making, including; providing an objective means of valuing multiple output parameters and also utilising the Department of Environment and Primary Industries (DEPI) environmental systems modelling platform (EnSym). Through modelling, EnSym enabled on ground environmental benefits to be understood and quantified, including complex biophysical parameters. A cost benefit curve was generated through an analysis tool with successful bids being those that offer the best value protection for bid price.

**Coastal adaptation planning in Australia – has progress stalled?**

McDonald Jan

*University of Tasmania*

Planning for the impacts of climate change on coastal communities has been a key focus for local and state governments in recent years. Progress towards more adaptive approaches to spatial planning has already been eroded or weakened in some jurisdictions, while others are still working towards more inclusive and enduring measures.

The decision pathways for deciding between retreat, accommodation or coastal armouring of existing communities are still evolving, and have yet to be rigorously tested and replicated. Market-



oriented tools such as risk disclosures and conditional approvals should play a critical role in mapping these pathways. Ensuring that these tools also facilitate the adaptation of important coastal ecosystems is a priority. This will require that conservation values have adequate representation and voice in adaptation planning processes. Conflicts over short- and long-term interests, and between public and private values are likely to continue, however, until the complex and fraught questions of funding and compensation are addressed.

### **Engaging Aboriginal groups and the broader community for water quality work in coastal and inland waters in South Australia**

McDowell Linda-Marie, Peter Pfennig, Stephen Packer  
*SA Environment Protection Authority (EPA)*

The Environment Protection Authority (EPA) have applied a variety of community engagement approaches for water quality work across South Australia to enhance cultural and heritage values for coastal and inland waters. Early engagement with Aboriginal groups to seek input on participatory process is a key part of community engagement undertaken for setting community agreed environmental values (EVs) for specific water bodies. It is also a feature of the implementation of a Catchment to coast focused water quality improvement project for Adelaide's coastal waters. This project is being supported through Australian Government Caring for Our Country funding as part of the implementation of the Adelaide Coastal Water Quality Improvement Plan. A successful part of this engagement with Aboriginal groups has included respectful communication and listening to the perspectives of local groups and individuals. EPA discussions have taken place with Aboriginal groups representing the people of the Adelaide plains and northern Adelaide region, the River Murray and Coorong region and South East. Key messages have covered the interconnectedness between land, water and sea and how these elements of 'country' are interlinked with the health of the people that live in an area. Experience with community and Aboriginal engagement for Adelaide's coastal waters, the Adelaide Mount Lofty Ranges, River Murray and Coorong and most recently work in setting EVs to improve water quality in Lake Bonney SE, would be of national interest to others working on protecting and enhancing cultural heritage values.

### **Coastal Character and Values Study**

Middle Garry  
*Curtin University*

Many of Australia's coastal communities face unprecedented changes caused by both rapid population growth and increased coastal erosion because of climate change induced sea level rise and increased storm activity. Communities are more likely to accept changes that acknowledge, respect and are consistent with existing coastal values and character. Curtin University, with funding from the National Sea Change Taskforce, has developed a methodology that explores coastal values and character and has applied that to a number of coastal communities in WA. The methodology involved two key data sources. First, a survey of beach users was carried out seeking information on the purposes and duration of beach visits, how the beach was valued, some basic demographic information, and views on what is the character of the coastal community. Second, a visual research methodology called photo-elicitation was applied, where photographs of typical landscapes, both

built and natural, of the settlement were shown to participants to help identify the existing character of the area. This paper presents the findings of research including: clarifying what the 'character' means for coastal settlements; what is important in defining the character of coastal settlements; and what are the key values that residents and users hold for the beaches they visit. Differences and similarities between the case studies will be discussed as well as implications for planning.

### **A decade of streamlined assessment of fisheries habitat interests in Queensland**

Moore Nikki G, Richard C Stewart, Nicole L McKirdy

*Fisheries Queensland, Department of Agriculture, Fisheries and Forestry*

Now operating under the Sustainable Planning Act 2009 and the Fisheries Act 1994, self assessable codes (SACs) for low risk development that would damage, destroy or remove marine plants; construct or raise waterway barriers; or were in a declared fish habitat area have been regularly broadened and improved.

In the 2013-14 financial year, about 80% of this development in Queensland was managed through SACs removing unnecessary procedure and costs and allowing regulators to focus case by case assessment on higher risk proposals. 2014 marks a decade of implementation of these codes and provides evidence of how SACs:

- guide what is to be achieved and how it can be achieved, increasing certainty of approval.
- have been consistently and increasingly utilised by developers.
- effectively manage development that could otherwise have localised and cumulative impacts.
- provide thresholds that avoid unnecessary case-by-case assessment.
- provide time and cost efficiencies for proponents and regulator.
- can be an incentive to encourage development in certain forms.
- improve compliance particularly in numerous smaller scale and lower risk developments.
- show that success is reliant on ongoing review, enhancement, extension and registration for effective compliance monitoring.
- can be enhanced by supporting tools such as GIS layers.

In striving for best practice, customer service could be improved through greater integration of self assessable and assessable development processes and this is currently being explored in Queensland.

## **Successful Adaptation to Coastal Climate Change: Framework and Lessons from Across the Seas**

Moser Susanne

*Susanne Moser Research & Consulting*

Climate change impacts are unfolding along our coasts and science tells us they will only magnify in the years and decades to come. Policy-makers, program and resource managers, funders - and coastal residents - increasingly ask the difficult and value-laden question: What would successful adaptation to climate change look like? This question has no simple answer. Australia, like many other nations, and communities around the globe, have woken up to the need to prepare for and manage the impacts of climate change, yet it remains difficult to move beyond adaptation planning and in fact decide on a particular course of action, to garner the necessary political and social support in budget-constrained times, and to implement concrete adaptation measures on the ground. It is a struggle to identify strategies and actions that meet current needs and take us in a positive direction in the future as well. How would we know we're making the right choices? At the same time, rapid environmental changes, extreme events, and growing stakeholder demands put pressure on decision-makers to take "real action" - now! In fact, many coastal communities already face difficult choices and trade-offs as climate change and sea-level rise impacts unfold with growing speed and fury and struggle to choose more stringent or novel strategies to strengthen and retain resilience which they know produce winners and losers. This presentation will offer a framework for thinking about adaptation success (based on science and practical experience gained in a 2-year project in California, USA), and offer some provocative thoughts on implications for coastal management that integrates the best available science with effective engagement of stakeholders to address the many and sometimes competing social values and interests we hold about our coasts .

### **Case Study Asian paddle crab - Incident management and the importance of community engagement**

Ngeh Jess, Marion Massam, Victoria Aitken

*Department of Fisheries*

In late 2012, three Asian paddle crabs were captured in the Swan River by recreational fishermen.

The Asian paddle crab is regarded as an international high risk marine pest species and listed by the Commonwealth as one of ten most likely invaders and one of ten potentially most damaging pest species and listed nationally. The paddle crab is an aggressive non-native crab that could spread devastating disease to prawns, crabs and lobsters. It can carry a disease that causes poisoning in humans, and could out-compete native crabs like our iconic blue swimmer. It not currently established in Australia, but has significant potential to do so and to become a major pest.

Following the discoveries, the Department of Fisheries brought together an incident management team undertook extensive trapping, netting and diving activities and embarked on a massive awareness-raising campaign. Despite the effort made by the Department, huge support from the community and great interest by the public with over 400 crab reports made, no further paddle crabs have been found.

The enormous interest and response from the public has been crucial to the response to this pest. It not only highlights the importance of community engagement, support and public awareness raising but opened the opportunity to educate the public about other similar pests.

### **Photo-monitoring training workshop using the smartphone app Photomon**

Payne Mic, Philippa Schmucker, Jasmine Rowe, Felicity Beswick,  
*Northern Agricultural Catchments Council*

“Photomon” is a new smartphone application that has been developed by the Northern Agricultural Catchments Council (NACC) with funding from Coastwest to improve data collected by environmental photo-monitoring programs. It incorporates a range of features that simplify the data management process and increase accuracy, including:

- Automatic labelling and uploading of photos to a database;
- Ghosted reference image overlay for consistent field-of-views;
- Reminder function to prompt regular photos.

The app has been developed in conjunction with a dedicated database that allows project coordinators to;

- Quickly add, remove or edit monitoring sites;
- Manage and monitor photos and user accounts;
- Search and export specified photo-sets;
- Upload monitoring photos taken on digital cameras.

Flexible design means that Photomon can be used by a range of organisations, from community groups up to large organisations.

This workshop is intended as an opportunity for potential users to learn more about the capability and applicability of this app. The workshop will cover:

- Use of Photomon in stand-alone “Demo” mode (for community groups);
- Database set-up and management;
- Using Photomon in conjunction with a database;
- Potential uses of Photomon for environmental monitoring.

It is recommended that participants wishing to participate in the “Demo” exercise download Photomon prior to the workshop. NACC staff will be on hand to assist participants with app operations.

This workshop could be combined with one of the organised field tours that includes a coastal monitoring component. Site selection process could be discussed by NACC or Dept of Transport staff on this tour and the use of Photomon demonstrated for a selected site.

### **Coastal Governance in South Australia - A Case Study**

Pelton Nicole

*University of Adelaide*

This research explores coastal governance arrangements in South Australia by comparing the varying perspectives of local government, natural resource management bodies and the state government in order to better understand how the coastal governance system influences an integrated approach to coastal management. The results are based on 30 in-depth, semi-structured interviews with stakeholders from each sphere of government across three South Australian NRM regions: Eyre Peninsula, the South East and Adelaide & Mt Lofty Ranges. The presentation will discuss the institutional arrangements for coastal management in South Australia, detailing the main issues arising from these governance arrangements according to the stakeholders interviewed. Preliminary results on the role of inter-governmental relations and their impact on vertical integration within these case study areas will also be presented.

### **Cockburn Sound Coastal Vulnerability Values & Risk Assessment**

Perry Craig

*City of Cockburn*

The Cockburn Sound Coastal Alliance (CSCA) comprises the Cities of Fremantle, Cockburn, Kwinana and Rockingham and Perth Region NRM. The CSCA are in the process of delivering an innovative and best-practice approach to identify and manage coastal risks. The Alliance via its Cockburn Sound Coastal Vulnerability and Flexible Adaptation Pathways Project is undertaking coastal hazard risk management and adaptation planning, a key objective and requirement of the WA Governments' updated State Planning Policy 2.6, at a large scale, being applied for the coast from Fremantle to Point Peron. The CSCA Project comprises four stages, commencing with a Climate Change Vulnerability Assessment of the coastal zone which identified areas susceptible to erosion and inundation hazards as a result of storm events and sea level rise. Stage 2, the subject of the presentation and paper, quantified the 'value at risk', from an economic, social/cultural and ecosystem services perspective, of coastal natural and constructed assets potentially impacted by current and future coastal processes. This phase adopted a risk management approach to rate the risk level presented by the hazards, evaluate these risks and current controls and propose 'first pass' adaptation options to treat the risks to those assets and the services and values those assets provide. Stage 3, which is currently underway, engages with the broader community and stakeholders to re-assess the values and risk ratings and further develop the Adaptation Plans to treat the identified risks resulting from coastal hazards. The final stage of the project is the implementation and review stage.

## **A catchment to coast conceptual stormwater model for Adelaide**

Pfennig Peter, Linda-Marie McDowell

*Environment Protection Authority South Australia*

The Adelaide Coastal Water Quality Improvement Plan is the SA government response to the findings of the Adelaide Coastal Waters Study. Adelaide's coast needs improvement in both point source nitrogen discharges and stormwater to achieve recovery of seagrass. The work has attracted co-investment from the Australian Government to develop community capacity to implement Water Sensitive Urban Design across the metropolitan Adelaide catchment. Part of this strategy is to undertake demonstration projects. The monitoring of the effectiveness of these and other works across the catchment will be guided by a conceptual model.

The model process has been undertaken by integrating input from a range of experts in stormwater and coastal related disciplines including technical, management and policy expertise. Integrity of this process is of utmost importance as much of the input is not able to be tested in a scientifically robust fashion. We need to be realistic about how far we can rely on such a model to provide direction. However, the process of developing such a model is persuasive in itself - influencing the thinking of key individuals who advise the management of stormwater. We expect that the conceptual model will pose focussed questions and stimulate debate about the management of our stormwater in coming years and aim for it being seen as a work of guidance in process, rather than providing definitive answers in many cases.

## **Coastal erosion and protection in Europe**

Pranzini Enzo

*Earth Science Department, University of Florence, 5012, Italy,*

Coastal erosion has affected European countries since the second half of the 19th century, and this process is now accelerated by sea level rise. Although each country is affected by a unique set of natural processes and land use practices, common causes of erosion are deforestation, river damming and river bed quarrying, together with the construction of harbours, particularly affecting sandy coasts.

European countries have developed a variety of solutions to prevent beach erosion, some more effective than others. Only in recent years has increased collaboration between countries led to the development and adoption of standardised design and project approaches. This paper provides an overview of the variety of beach erosion solutions that are found along Europe's coast, from traditional designs adopted in most countries, to structures tailored to specific needs as well as innovative and experimental solutions, some of which still under evaluation.

This paper discusses how in some countries, beach nourishment is increasingly preferred to hard engineering solutions, and groynes and detached breakwaters are being removed or lowered. "Working with nature" is a catch phrase increasingly used in Europe to indicate a new approach to shore protection in which man allows natural processes to take their course instead of heavily opposing them. In saying that, shore protection strategies are still highly influenced by cultural, economic and political factors, for example in the ex Soviet Union countries where the coast is heavily defended by hard protection structures and where low socio-economic conditions don't

always allow for asset replacement, repair of damaged structures or rehabilitation to a more natural state.

### **Assessing change: From Beach Surveying to Beach Monitoring.**

Pranzini Enzo, Chiara Danese, Karl Illich

*Earth Science Department, University of Florence, 5012, Italy, Curtin University Sustainability & Policy Institute (CUSP), Coastal Infrastructure, Department of Transport*

The shoreline is the set of points where land, water and atmosphere are in contact: easy to say but almost impossible to identify. Shoreline position changes with time, due to variations in water levels (induced by tides, atmospheric pressure, wind and waves) and to cross-shore and long-shore migration of sediment. Sediment can remain within the area of interest or exit without being replaced. It is only in the latter case that we have a reduction in the beach sediment budget and this process is generically named “beach erosion”. Some beaches perform consistent short-term changes without significant long-term shift of their average position, and are classified as stable; others, while alternating erosion and accretion phases, see their average position shifting landward (eroding) or seaward (accreting). Shoreline position, which is accepted as a reliable indicator of the beach status, is generally measured by public administrations and researchers, however many techniques exist depending on data availability, expertise, equipment and resources. In this paper, after a preliminary discussion on the rationale of beach surveys, two main procedures used to identify beach status (eroding, relatively stable, accreting) are described: the Transect Based Analysis (TBA) and the Surface Based Analysis (SBA). The SVA and TBA derived data is tested in two stretches of the Tuscany coast using different analysis scales, i.e. sector length and transect spacing. This paper also provides a comparison with shoreline monitoring techniques used in Western Australia in coastal hazard risk management to hopefully share new insights, best practise techniques and lessons learnt.

### **Knowledge to support adaptation to climate change in coastal New South Wales**

Pritchard Tim

*NSW Office of Environment and Heritage*

A knowledge strategy developed by the Office of Environment and Heritage (OEH) prioritises knowledge acquisition and identifies new research required for management of climate adaptation in coastal New South Wales (NSW). This paper outlines collaborative coastal research programs and highlights recent research findings from specific projects developed under OEH’s Knowledge Strategy including:

- Collaborative analysis of Australian sea level data to determine historic sea level trends, regional variability and influencing factors
- Assessment of inundation risk exposure within and between different NSW estuaries under existing and possible future sea level rise scenarios
- Evaluation and development of shoreline monitoring and predictive tools for coastal erosion risks

- Fine-scale climate change projections that are being delivered through the NSW and ACT Regional Climate Model (NARClIM) project, with core model outputs to help understand potential climate change impacts in coastal NSW and to assess adaptation and risk mitigation strategies
- Development of a wave modelling capability that will be used to estimate NSW near-shore wave climates based on NARClIM projections of possible future wind fields
- Improved catchment-estuary response models to assess estuarine responses to catchment exports of nutrients associated with new rainfall projections.

Collaborative coastal research programs will continue to be developed through the Coastal Node of the recently established NSW Adaptation Research Hub which brings together multi-disciplinary researcher teams from three Sydney universities and researchers and practitioners from the Office of Environment and Heritage.

### **Good leadership in Coastal Management – the opportunities at all levels of the game**

Rees Chris

*IMAS UTAS & Impact Solutions International Pty*

A review of coastal planning and management across Australia at all levels, from Ministers and senior bureaucrats, local councils, research organisations, consultants, businesses and community members, reveals a 'curate's egg' of stories about projects, programs, policies and other initiatives. Some have been extraordinarily successful, others so-so, and many failed. Some have been very long term and been able to evolve and improve, others have been 'cut off at the knees' through changes in government or governance and funding withdrawal.

We lurch through the political, policy and economic cycles, and the goal of sustainability sometimes seems ever harder to achieve.

In all this, numerous people are in positions where they can demonstrate leadership, and successful initiatives big and small require good leadership. What then can leadership development theory offer integrated coastal zone management, and what is the importance of leaders who can display IQ + EQ + SQ – ego (Intellectual, emotional and spiritual intelligence – ego) in moving towards sustainability.

This paper will draw on current leadership development theory, illustrated with examples particularly from Tasmania.



**Burgeoning coastal populations, economic development and a climate of increasing variability are adversely affecting essential coastal area ecosystems**

Reid Julian

*Central Queensland University*

Burgeoning coastal populations, economic development and a climate of increasing variability are adversely affecting essential coastal area ecosystems.

In response, the Australian government calls on voluntary coastal environmental organisations (CEOs) to share responsibility for coastal natural resource management (NRM). CEOs typically participate in small-scale activities such as restoring sand dunes, monitoring sea grass and educational interpretation. Activities require sustained volunteer participation. Limited research indicates CEO volunteer recruitment and retention is difficult. CEOs role in coastal NRM is likely to increase, if marine ecosystems continue to degrade, as is forecasted.

Research was framed by a review of literature that exposed gaps in knowledge concerning CEO operations and volunteer participation. The main aim of this research is to explore the characteristics, structure and functions of CEOs. Document and artifact analysis, an online volunteer survey and interviews with leaders and volunteers are used to address the aim. Analysis of data commences in June 2014. Case studies of four CEOs will commence in August 2014 to provide a real life context to this complex problem.

Research outcomes include the development of:

- A framework for use by coastal NRM practitioners and CEOs to deliver coastal NRM strategies that will conserve and protect coastal area biodiversity.
- A set of principles and practices that can be used to guide CEOs to maximise the potential and sustainability of CEOs, including satisfying volunteer expectations and improving volunteer recruitment and retention rates.
- Methods to increase coastal communities' participation in coastal NRM biodiversity projects and activities.

**Understanding the cumulative impacts of coastal development on marine ecosystems: land-use change scenarios and Bayesian networks.**

Reid Benjamin, Amélie Augé, Owen Woodberry, Robert Pressey, Jon Brodie

*ARC Centre of Excellence for Coral Reef Studies, James Cook University*

Increased coastal development has led to degradation or loss of coastal ecosystems, increase in run-off, and reduced water quality. It is no longer acceptable to assess just the immediate impacts of coastal development. The cumulative impacts of developments in time and space, and in combination with other anthropogenic pressures such as increased sediments and nutrients from catchments, result in the reduced resilience of the marine environment. With increasing development of the coastal zone in the coming decades in the form of shipping, intensive agriculture, urban development, and tourism, it is necessary to assess potential scenarios of coastal

development and their cumulative impacts to inform management. To understand the cumulative impacts on the marine environment we use the Great Barrier Reef (GBR) coastal zone as a case study. Along the 2000 km length of the GBR coastal zone, we apply a combination of spatially-explicit scenarios of coastal development for 2035, covering land uses and related marine activities, and Bayesian belief networks with expert elicitation. Our range of spatially-explicit 2035 scenarios incorporates uncertainty around demand for food, mineral resources, tourism, and environmental services, and takes into account technical advances, preference for coastal living, and governance. Our Bayesian modelling captures both data and expert opinion on the related factors linking land-use changes in the coastal zone to impacts on specific marine species and ecosystems. We propose an extension of our approach as a tool for large-scale planning and decision-support for managers and policy-makers to minimise the impacts of coastal development.

### **Developing a framework for managing coastal climate risk in Australia**

Rissik David, Jean Palutikof

*National Climate Change Adaptation Research Facility (NCCARF)*

Australia has almost 200 coastal local governments, and all of these face dealing with the risks associated with a changing climate. There is an ever-increasing volume of advice, information and tools being made available, but little of this is integrated or delivered in a way that supports use by Councils, particularly those that are poorly resourced.

The National Climate Change Adaptation Research Facility has received Commonwealth funding for an additional three years. A major focus is to be the development of a framework for understanding coastal climate risk, particularly from sea-level rise and storm surge. The framework will be designed to help stakeholders take practical actions to prepare for and manage that risk. The framework will make use of national data sets and research outputs that have been developed over the past 5 years by various organisations. It will include clear guidance on good practice and links to case studies. The Framework will be delivered as an internet-based Wizard, which will ensure that guidance is comprehensive, integrated and easily accessible, but most importantly can be shared within and between organisations, and not gather dust on shelves.

Developing a Framework and ensuring that it matches the requirements of stakeholders requires substantial stakeholder engagement throughout the process. At this interactive workshop we will outline the approach we are taking for the task and seek responses, ideas, challenges and advice.

### **Exploring the legal feasibility of planning instruments for coastal adaptation planning in WA**

Robb Ashley, Chiara Danese, Laura Stocker

*Coastal Focus, Curtin University*

The WA State Planning Policy 2.6 (Coastal Planning Policy) is the key coastal planning document in WA and recognises the increasing risk that coastal communities face as a result of changing coastal processes, such as sea level rise. The policy recommends a process of coastal hazard risk management and adaptation planning (CHRMAP) to help communities identify and mitigate coastal hazard risk. This session will use presentations and a hypothetical scenario to achieve three broad aims: increase the WA coastal planning community's knowledge of planning instruments that are

being used by coastal planners nationally and internationally to adapt to coastal hazard risk; explore the usefulness of these instruments for WA local governments considering WA's planning framework; and, identify gaps in understanding to inform future research. This session is supported by Curtin University, Prof Jan MacDonald, Dr. Charles Lester, the WA Dept. of Planning, and the WA Dept. of Transport.

**Gingin Dandaragan Coastal Partnership: a collaborative approach to coastal hazard risk management**

Robb Ashley  
*Coastal Focus*

In 2012 the Shire of Dandaragan, Shire of Gingin and the Northern Agricultural Catchments Council formed a partnership to help communities from Guilderton to Jurien Bay prepare for coastal hazards such as inundation and long term erosion. The majority of settlements along this coastline are located on low lying sandy coastal landforms. Sections of this coastline have been identified in State government commissioned studies as being areas where coastal hazard risk may present a moderate to significant constraint to future coastal management. Recent changes to WA State Planning Policy 2.6 (Coastal Planning Policy) recognise the risks that may result from changing coastal processes (including winds, waves, storm surges and sea level variations) and encourage coastal managers to develop strategies for managing coastal hazard risk. This partnership has responded to scientific studies and policy initiatives by taking an integrated, informed and measured approach to coastal hazard risk management and adaptation planning (CHRMAP), which is a process recommended by the WA Department of Planning in the revised State Planning Policy 2.6 (Coastal Planning Policy). This presentation will discuss the outcomes achieved so far as well as next steps for the partnership, the benefits of taking a partnership approach to CHRMAP, and the challenges of undertaking CHRMAP as experienced by the partnership.

**First Pass fine-resolution coastal exposure estimation in NSW: Implications for coastal adaptation planning frameworks**

Roche Kevin, Keping Chen  
*Risk Frontiers, Macquarie University*

Risk Frontiers has been developing tools and processes to identify and assess the impacts of sea level rise, storm surge and coastal erosion as part of the NSW Office of Environment (OEH) Coastal Processes Node. These tools, combined with other OEH tools, will allow users in natural disaster risk assessments, emergency management, coastal management and climate adaptation planning to incorporate fine-resolution data into their own applications and analyses.

The first stage of this is to evaluate and analyse the latest and the most comprehensive LiDAR-derived coastal DEM data from NSW Land and Property Information (LPI) and to quantify detailed addresses exposure in relation to elevation thresholds and various distance ranges from the shoreline. This is a first pass assessment. The overwhelming majority of LiDAR-derived DEMs analysed are at 1m and 2m resolutions. A large-scale shoreline that is relative to any coastal waters directly connecting to open ocean, including rivers, lakes and lagoons, is adopted. The March 2014

version of Geocoded National Address File (G-NAF) database is used for exposure representation; there are a total of 3,933,301 addresses in NSW.

Approximately 25% of all NSW addresses are identified within 1km of the shoreline. About 25,000 addresses are located within 100m of the shoreline and in low-lying coastal areas within an elevation less than 3m. Results are reported at various administrative boundary levels, including Local Government Areas (LGA).

### **Sharing the Love for Victoria's MPAs**

Rodrigue Mark  
*Parks Victoria*

Supporting and facilitating community interactions with and stewardship of marine protected areas is a key challenge for protected area managers. Providing appropriate and meaningful opportunities for genuine partnerships have been a focus for Parks Victoria in engaging a wide range of community groups and organisations working to protect and promote MPA values in the state. This presentation will explore some of the key lessons learned and reflections of the positive outcomes from investing in these relationships.

### **Beyond Standard Practice – The Adaptation by Design Coastal Communities Workshop**

Roos Phillip, David Jones  
*Deakin University*

The fastest regional population growth in Victoria in recent years has been in coastal areas close to Melbourne, more specifically the coastal parts of the Greater Geelong Region and the Great Ocean Road Coastal Region. Migration to these non-metropolitan coastal areas by city dwellers happens due to the “Sea-change” phenomena, people seeking a change in lifestyle and environment, resulting in coastal sprawl. This coastline sprawl has devastating effects on the natural coastal environment, biodiversity and habitat loss, damage to wetlands, loss of indigenous vegetation, and the introduction of developments that have got no sense of place, detrimental to the place character of these historical coastal towns. Adding to these threats is the impacts of climate change and sea level rise. The aim of this paper is to identify possible planning and design options reflecting community views on how to address this problem.

Through a participative research process, collecting applicable knowledge from local residents, workshops were conducted along the coast to identify the adaptation options proposed by the community members. This paper reflects the analysis and research outcomes of the Coastal Climate Change and Great Ocean Road Region research project, facilitated by Deakin University, where an innovative Adaptation by Design Workshop process captures the views of the communities in this region, recommending future planning and design options that consider the principles of sustainable design as part of adaptive planning and resilient design, pushing the boundaries of coastal planning beyond the current policy regulations and statutory considerations to achieve a sustainable and resilient future.

## **Antarctic Mermaid Susie Seaweed presents on Biodiversity and Marine Debris**

Ross Susan, Susan Westcott

*SCAT, Private*

Susie has been working and living in Antarctic Waters watching the destruction of her habitat since a girl.

Now aged 62 with her wilderness home under threat Susie recognises the time is now to act.

Hobart airport is being prepared to pave a wave of tourists south to Antarctica, her wilderness homeland and Susie recognises the seriousness of the behaviour of those half her diversity.

Susie Seaweed has agreed to represent Antarctic Marine Creatures who tell her they need a voice for their fear and anger so Susie has been attending mainland events on Marine Debris and World Biodiversity and Environment Days.

Biodiversity Change Biologist Professor Bowman is referred to in her 5 minute presentation which takes a look at the struggle engaged in for Mermaids across the globe.

## **National Sea Change Taskforce and Peron Naturaliste Partnership update**

Sammels Barry

*City of Rockingham*

Barry will be giving an update on progress that has been made by the National Sea Change Taskforce and Peron Naturaliste Partnership. Barry has been very involved with these two initiatives. He will touch on the purpose of each of these two initiatives, progress that has been made, major projects. He will also share from his perspective what are the future challenges and opportunities that he sees with each of these initiatives.

## **Recognising and Recording Cultural Heritage on K’Gari (Fraser Island World Heritage Area)**

Sargent Sue, Glen Miller, Lillian Burke, Phil Fitzpatrick, Luke Fitzpatrick

*Fauna & Flora International Australia, Fraser Island World Heritage Area Indigenous Advisory Committee, Fraser Island World Heritage Area Indigenous Advisory Committee, South Pacific Strategic Solutions,*

The Traditional Owners for K’Gari (meaning ‘paradise’) are the Butchulla (Batjala) people. Sadly, since the arrival of Europeans in the area, connections to K’Gari have been difficult to maintain. In 1860, Fraser Island was gazetted as an Aboriginal reserve. The reserve was largely revoked two years later following the discovery of valuable stands of timber and completely revoked in 1906, with the removal of the Butchulla people from Fraser Island. In 1908, the central part of Fraser Island was declared a forestry reserve, and by 1925, most of the island was established as state forest. Fraser Island (Great Sandy National Park) was gazetted in 1971. In 1992, after considerable pressure from the community, Fraser Island (Great Sandy Region) was accepted as a World Heritage Site, on the basis of natural criteria (ii) and (iii). In 2013, the Fraser Island World Heritage Area Indigenous

Advisory Committee (FIWHA-IAC) initiated a project to enhance the community's recognition, assessment and mapping of cultural heritage (archaeological) sites on K'Gari. Funded through the Australian Government's Indigenous Heritage Program and supported by global conservation organisation Flora & Fauna International and Queensland Parks and Wildlife Service, the project also aimed to improve management and interpretation of cultural heritage sites (and future Indigenous eco-tourism opportunities for the Butchulla people). The project is seen as a significant step in the recognition of the significant interactions between the Butchulla people and their natural environment in the future recognition of K'Gari as a cultural landscape by UNESCO.

### **The luxury of time - building a lasting Shorebird Conservation Project for Bundaberg, Queensland**

Sargent Sue

*Burnett Mary Regional Group for NRM Ltd.*

In 2003, the Queensland Government commenced building Paradise Dam on the Burnett River, Queensland. As part of their offset arrangements with the Australian Government under the Environmental Protection and Biodiversity Conservation Act 1999, the proponent, Burnett Water, was required to undertake activities to enhance shorebird conservation in the Bundaberg area. In 2007, the Burnett Mary Regional Group for Natural Resource Management, one of 14 regional bodies in Queensland, entered into a five year project funded by Burnett Water to protect and enhance conservation of shorebirds in the estuary and adjacent areas which included roosts at the Port of Bundaberg (where over 1200 shorebirds had been recorded in the Port's dredge spoil pond), Skyringville and Barubbra Island areas (the latter providing nesting habitat for Little Terns). Given extensive flooding in the area in 2011 and 2013, the project was extended by mutual agreement to 2014. But what did seven years of funding support, capacity building and continued effort achieve? This paper will examine the management options that were undertaken in conjunction with land managers, local government, non-government and specialist interest groups as well as the local community. Activities included monitoring, out-foxing Freddy (red fox), reinstating flows in a tidal wetland, building a shorebird observation platform and lots of awareness building – through activities like Dog Walkers' Breakfasts. The group faced the challenges of land tenure and the result, ultimately a win: win for the partners and the future conservation of shorebirds.

### **Grey Nurse Shark Watch – diving into shark conservation**

Sargent Sue, Dr Carley Kilpatrick, Jennifer Loder,

*Fauna & Flora International Australia and Burnett Mary Regional Group for NRM Ltd., University of Queensland, Reef Check Australia*

Grey Nurse Shark Watch (GNSW) is a citizen science, marine monitoring program that engages a broad cross-section of our community, filling data gaps and increasing knowledge of the Australian east coast population (estimated to be 1000-1500 sharks) of this Critically Endangered species. Launched in June 2011, the program is now supported by over 200 registered volunteers. Many volunteers also register as 'site custodians' adopting and regularly monitoring known grey nurse shark aggregation sites along Australia's east coast (between central Queensland and New South Wales). Volunteer divers and diver-photographers participate in biannual surveys, submitting their reports and photos on-line to the GNSW website. As each shark possesses a unique pattern of spots,

much like a human fingerprint, an individual shark can be identified, tracked as they migrate and monitored over time through repeat photographs. Volunteers have been engaged through our website and Facebook page, but also through posters on display in key dive shops and giveaways such as purpose-designed dive slates. Volunteers are also given the opportunity to name the sharks that they photograph. The project team are currently negotiating with partners in Western Australia to extend GNSW nationally to include the species' Vulnerable west coast population, where knowledge may actually be more limited than the east coast. GNSW is a collaborative project between Fauna & Flora International Australia, the University of Queensland, Burnett Mary Regional Group for NRM, Reef Check Australia and our volunteers. GNSW is currently funded by the Australian Government through a Community Environment Grant.

### **Ocean Grove Coastcare: our story and our partners**

Scally Jackie, Maddie Glynn

*Ocean Grove Coastcare and RM Consulting Group*

The story of Ocean Grove Coastcare (OGCC) began four years ago when a group of young women were united by their passion for the coast. A void of other Coastcare groups on Victoria's Bellarine Peninsula presented an opening for a new group dedicated to protecting and enhancing the local coastal environment. A movie night at the local Chicken Shop generated broader community interest and what ensued was an inaugural meeting, the election of a committee and the drafting of a mission statement. Simple! Navigating the minefield of incorporation documents, funding applications and the multiple layers of coastal governance was less simple. Central to overcoming this hurdle were the partnerships that were forged with the Department of Environment and Primary Industries (DEPI), Barwon Coast Committee of Management and the Bellarine Catchment Network. Today these partnerships serve as the backbone to OGCC, providing direction, a solid foundation for funding and ensuring that "we get things done" in alignment with broader land management objectives. Together we've achieved much in our short life including the ongoing removal of invasive weed species *Polygala myrtifolia* from the dunes; annual events such as the Habitat Gardens day and the Nippers environmental education program; information sharing through movie nights, an online newsletter and publications; and a new plastic bag free campaign. Indeed, the partnerships established in those formative stages now stand us in good stead; and hopefully the greatest beneficiary of these partnerships will be the coast.

### **Impact of the sea breeze on beach morphology in southwestern Australia**

Segura Laura, Ryan Lowe, Jeff Hansen, Graham Symonds, Stephanie Contardo

*The University of Western Australia, The Commonwealth Scientific and Industrial Research Organisation (CSIRO),*

*The Commonwealth Scientific and Industrial Research Organisation (CSIRO)*

The morphology of sandy beaches in southwestern Australia is affected by seasonal variations in the predominant SW swell and by the local wave climate generated by the strong sea-breeze cycle. In this study, a sandy beach with cusped morphology in Secret Harbour was investigated during several sea-breeze cycles to identify the morphological response under such conditions. The observations consisted of topographic surveys conducted every two hours during daylight and

ARGUS time-exposed images during eight days in which sea breeze reached up to 15 m/s. Additional instruments were deployed in the surf zone to record waves and currents within the survey area. Results indicate that during sea-breeze conditions, deposition occurred above the elevation of the beach cusp, while leaving the cusp morphology intact. The beach response after the sea-breeze event is more complex showing patterns of erosion at the top of the beach cusps and accretion at the foreshore. Ongoing analysis of the detailed observations of the waves and nearshore circulation will be used to understand the physical processes that resulted in the observed morphology changes during and following the sea-breeze events.

**Climate Change Science: increasing community knowledge with collaboration, credibility, and co-production**

Shaw Jenny, Laura Stocker  
*Curtin University Sustainable Policy Institute*

Climate change science can be complex, inaccessible, confusing and contentious. To maximise opportunities for adaptation, increased knowledge and understanding of climate change is essential. In coastal fishing communities around Australia, changes to the coastal and marine environment have been observed and recorded. Despite this, anecdotal evidence suggests that there is low acceptance, limited knowledge and little interest in climate change science. This paper discusses a number of communication methods that were used in 3 communities around Australia to build knowledge of climate change. The coastal communities of: St Helen's in Tasmania, Bowen in Queensland, and Geraldton in Western Australia are traditionally referred to as 'fishing towns.' These communities and particularly members of the fishing industry were the focus of this study. Collaboration across agencies and organisations produced extensive communication materials such as brochures and DVDs. Direct, face to face engagement was initially considered the most effective method of delivery of material; however success was dependent on the salience of the material and credibility of the 'presenter'. Co-production of a community exhibition, using fisher photographs to tell their story of significant change, was particularly effective. The climate change message in the exhibition was subtle and presented in multiple formats and levels of complexity: it enabled participants to reach conclusions in their own way. The exhibitions engaged fishers, the local community and visitors from around Australia and overseas and appeared to be successful in building knowledge of climate change in coastal communities.

**Jurien Bay Artificial Reef and Snorkel Trail**

Sheppard Michael  
NA

Jurien Bay, situated approximately 200 km north of Perth, lies on a flat, sandy coast with limited on-shore snorkelling opportunities. This constraint led the Jurien Bay Progress Association (JBPA) to approach the Shire of Dandaragan and the local community with the idea of constructing an artificial reef/snorkel trail.

The objectives of the project were to develop a tourism asset, provide an ongoing educational experience and provide an accessible area for scientific study. In 2011, JBPA and project partners the



West Midlands Group were successful in securing funding from the Department of Sport and Recreation's Trails Grant and Royalties for Regions.

An area was selected from the end of a partially demolished timber jetty extending 50m to 100m off shore in 2.5m to 6.0m of water. The artificial reef was constructed using concrete "Reef Balls" manufactured by Jurien Men's Shed under licence from Reef Balls Australia. Seventy eight reef balls, 150kg to 750kg in weight and 900mm to 1500mm in diameter, were installed in October 2013 using local divers, a charter boat and local Sea Search and Rescue boats. Onshore interpretive signage was also installed.

Regular reef monitoring has shown that colonisation was very rapid, with 48 fish species recorded at May 2014. The trail is also proving very popular with visitors. Ongoing monitoring will be conducted, and a similar reef for recreational fishing is also being considered. A "Rest in Reef" service enables the internment of deceased ashes in manufactured Reef Balls.

### **Reef Geomorphology and Holocene Growth History of Cockatoo Island, Inshore Kimberley Bioregion, Northwest Australia**

Solihuddin Tubagus, Lindsay B. Collins, David Blakeway, Michael J. O' Leary  
*Curtin University*

This study describes reef geomorphology and Holocene (last 12,000 years) growth history in a macrotidal, high turbidity setting at Cockatoo Island, in the inshore Kimberley Bioregion, including geomorphic and associated habitat, chronology, Holocene and modern reef communities, nature of foundations, and type of reef accretion. The Holloway current, driven by the Indonesian throughflow, plays a major role in delivering nutrients and planktic biota for reef development. Preliminary study using aerial photography delineated, moving seaward across the reef flat, substrate of sediment, low and medium density intertidal coral cover. Towed camera observations confirm that live *Porites* and *Faviids* along with *Sargassum* sparsely colonise the intertidal coral zone, whilst branching *Millepora* and *Porites* cylindrical, which increase seaward, are present in the medium density intertidal coral zone. The Holocene reef unit investigated is 13 m thick and of two distinct facies; domal and branching coral framestone units. Coral clasts are visually dominated by branching corals especially of the genus *Acropora* and massive corals including *Porites*. The contemporary live corals are not very common in the measured Holocene sections, suggesting that the Holocene reef communities lack reef flat habitat. The Holocene reflects mostly subtidal growth whereas the present reef is largely intertidal or very shallow subtidal. Compared to the same muddy-rich environment of the Great Barrier Reef (GBR), Cockatoo turbid reefs show broad similarities in terms of coral cover and accretion rates, but a contrast is between palaeoecological and contemporary reef communities, which are similar in the GBR but distinctly different at Cockatoo Island.

## **Local action on global problems – protecting Ramsar wetlands in Victoria**

Spry Steph, Shayne Annett, Andrew Morrison,

*RM Consulting Group, Port Phillip & Westernport Catchment Management Authority*

Ramsar sites are recognised internationally as ecologically complex and diverse wetland habitats. The Ramsar Convention provides the overarching framework for management and protection of these important wetlands.

This paper presents the findings from RM Consulting Group's review of the PPWCMA Ramsar Protection Program – 2010 to 2013 (the program). The main objective of the program was to conserve and protect the ecological character of two Ramsar sites in the region:

- Western Port Bay
- Port Phillip Bay (Western Shoreline) and Bellarine Peninsula

Despite their international status Ramsar wetlands are under increasing pressure from a complex set of interacting threats/factors. Those impacting the Ramsar sites in this program include: pest plants and animals, surrounding land use and complex governance arrangements. As a result the program faced many challenges, however there were also a number of key successes. Both of which are discussed in this paper.

Key successes included development of effective and enduring partnerships between delivery partners, a robust delivery model and the coordination role of the PPWCMA. In turn challenges were mainly related to demonstrating the linkages between actions on the ground and improving/maintaining ecological character, designing fit for purpose community engagement activities and monitoring the impacts of the project.

We conclude by highlighting practical options for addressing some of the challenges discussed. We found meaningful and early engagement of technical experts, undertaking a transparent and well documented prioritisation process and development of a strong project rationale (program logic) would help to address some of the challenges faced in this program.

## **Aboriginal experience with coastal climate change: Nyungar Wardan Katitjin Bidi**

Stocker Laura, Leonard Collard, Angela Rooney

*Curtin University Sustainability Policy Institute, UWA*

In this paper, we aim to show how the long cultural memories of Nyungar, the Aboriginal people in the Southwest of Australia, are still alive and being recounted in stories up to the present day. The stories we present relate to the latest ice age and the end of it, 8000 years ago, when sea levels began to rise, drowning land. Stories also show how Nyungar coped with and made meaning of sea level rise. Our analysis is based within Collard's theoretical framework or trilogy of: boodjar (country), moort (family) and katitjin (knowledge). Our analysis shows that, despite the geological time-frame of sea level rise and the impact of colonisation, Nyungar cultural treatments of sea level rise are alive and dynamic. They are being reclaimed and re-energised through contemporary and traditional research and practice. This occurs through the inter-dependent relationships among

stories, places and their names, and family relations. Case examples are provided from the reflexive activities of Nyungar Traditional Owners. We also suggest that Nyungar experiences and relational worldviews may provide lessons on how to respond sustainably to current and future anthropogenic climate change. The paper builds on a website we recently produced called Nyungar Wardan Katitjin Bidi – Derbal Nara or the People’s Ocean Knowledge Trail – Cockburn Sound and Districts which can be viewed at [www.derbalnara.org.au](http://www.derbalnara.org.au)

### **Participatory Google Earth Mapping: Raising Community Awareness of Coastal Adaptation to Climate Change in the City of Busselton**

Stocker Laura, Gary Burke, Paul Needham

*Curtin University Sustainability Policy Institute, City of Busselton*

A ‘Community Awareness of Coastal Adaptation to Climate Change’ workshop was organised in partnership between the City of Busselton, Peron Naturaliste Partnership, Curtin University and CSIRO Coastal Collaboration Cluster. The workshop was the first in a series of adaptation awareness exercises designed to help build literacy and resilience in relation to the climate change and sea level rise issues that challenge the city’s future planning. The key objective of this workshop was to develop a shared understanding about the impacts of climate change on Busselton’s coast and waterways, and to propose pathways forward. Invited speakers presented coastal and climate science, as well as engineering, governance and other information. Models point to a potential future loss of much of the City of Busselton’s populated coastal strip due to inundation and erosion. Google Earth was used as an engagement tool to: map participants’ values about the coast, including identifying sustainability hotspots; identify participants’ areas of concern; and capture their ideas for adaptive pathways. Results showed that participants’ concerns include social, economic, ecological and cultural aspects of the coast. Participants had a strong sense of place, belonging and identity for the sustainability hotspots identified in the mapping process. They had a corresponding sense of overwhelming potential loss when considering the fate of their jetty, CBD and residential areas. Participants discussed a diversity of adaptation pathways.

### **Coastal Collaboration Cluster: The Knowledge - Governance Conversation in ICZM**

Stocker Laura, Richard Kenchington & Nick Harvey

*Curtin University, University of Adelaide*

The Coastal Collaboration Cluster shares findings from its three year research program and seeks feedback. We look at boundary spanning individuals, processes and organisations that foster constructive conversations between knowledge providers, decision makers and other stakeholders. We also roadtest a typology for use by managers in diagnosing ICZM situations and deciding what types of research and methods are required. Finally we apply these ideas to specific case studies around coastal Australia.

## **Climate Change Response, moving from planning to implementation**

Strachin Karin

*City of Rockingham*

Karin will give an overview on the journey that the City of Rockingham has been on with regards to Climate Change events potentially impacting on the City. The City has been on a process of learning about Climate change from a base of almost zero knowledge of Climate Change issues a few years ago. Initial steps involved increasing the knowledge base, performing a high level risk assessment and identifying high level strategic actions. The City has over the past months identified and addressed its gaps in this knowledge base regarding future sea level trends for the City, and has put in place more specific actions in order to address its defence, adaptation, mitigation or retreat options.

## **Best practice planning on the coast – Challenges of bringing regional lessons home**

Struys Emma

*Kiama Municipal Council*

There have been some genuinely proactive efforts in coastal planning and management, with a long term view occurring in Australia over recent years. While there are some great examples of Coastal Zone Management and planning occurring locally, huge investments are being made at a regional level, working towards these longer-term efforts to enhance resilience and ensure safety and longevity of our coastal landscapes. With that in mind, we need to understand how the regional information becomes applicable at a community scale for these efforts to be translated into more resilient coastal communities for Australia. In the context of regionally dominating planning paradigms, regional understandings can be quite different to local realities. This is not to say one is more correct than the other, however to highlight the difference and the challenges presented under current planning practices, this paper aims to highlight some of the difficulties of scaling down. Coastal Planning actions by local coastal governments in NSW are reviewed to grasp what is occurring at local scales and to consider where regional information is assisting (or not) local planning and policy development. This paper will examine the usefulness of regionally generated information from state government entities and work at local levels in light of the key challenges of contemporary coastal zone management.

## **Marine biodiversity trends through time and space – improving knowledge of the Australian marine environment through citizen science**

Stuart-Smith Rick D, GJ Edgar

*UTAS*

Over 6,400 underwater surveys of marine life by volunteer Reef Life Survey (RLS) divers from 2008-2013 have provided the most comprehensive picture of the distribution and abundance of marine life around Australia, and put this into a global context. New biodiversity patterns have been identified, such as hotspots of taxonomic and functional diversity and fish biomass, and RLS data have provided critical guidance for effective marine protected area design and management globally. Now that a comprehensive baseline and a range of important spatial biodiversity patterns

have been established, the RLS program is shifting the focus to ongoing assessment of biodiversity trends at key locations around Australia. With time series of up to 7 years already established for some locations, an initial 16 core coastal rocky and coral reef locations around the country have been identified for ongoing annual surveys, and the opportunity now exists to establish partnerships to expand and solidify core locations. Core monitoring will ideally be complemented by comprehensive Australia-wide surveys at 5-yearly intervals. Research on the most informative indicators of marine environmental condition and threats is currently underway, and initial trends in key biodiversity indicators relating to exploitation, climate change, invasive species and urbanisation will be presented in this talk.

### **Sediment Cells in Western Australia**

Stul Tanya, Ian Eliot, Bob Gozzard, Matt Eliot  
*Damara WA, Geological Survey of Western Australia*

Sediment cells are sections of the coast within which sediment transport processes are strongly related. They include areas of sediment supply (sources), sediment loss (sinks), and the sediment transport processes linking them (pathways). Each cell is a collection of marine and terrestrial landforms, inter-related by sediment transport between them. Sediment transport pathways include both alongshore and cross-shore processes, and therefore cells are best represented in two-dimensions.

Sediment cells provide a summary of coastal data in a simple format. Sediment cells can be used to: (1) Identify the spatial context for coastal evaluations; (2) Provide a visual framework for communicating about the coast with people of any background; (3) Support coastal management decision-making; and (4) Support a range of technical uses largely relating to coastal stability assessment. Sediment cells are natural management units with a physical basis, often crossing jurisdictional boundaries.

Cells have been mapped as a hierarchy of primary, secondary and tertiary levels to incorporate three spatio-temporal scales. At each scale, sediment cells have been defined in three steps through selection of: (1) points along the shoreline (beachface); (2) offshore and onshore boundaries; and (3) alongshore boundaries through the points to the offshore and onshore boundaries.

Sediment cells have been mapped for one third of the Western Australian coast from Cape Naturaliste to the Murchison River and from southern Exmouth Gulf to east of Port Hedland. The criteria for mapping the cells changes between regions because of differences in processes and geomorphology.

### **Partnership Paves the Way for the Recovery of Derwent Estuary in Hobart, Tasmania**

Taylor Ursula, Christine Coughanowr  
*Derwent Estuary Program*

The health of the Derwent Estuary in Hobart, Tasmania's equivalent to Sydney Harbour is benefitting from a partnership between local governments, the Tasmanian state government, commercial and

industrial enterprises, and community-based groups. Since 1999 this partnership known as the Derwent Estuary Program has focussed on the task of restoring and promoting the Derwent estuary.

The estuary is an important and productive ecosystem and was once a major breeding ground for the southern right whale. Areas of wetlands, underwater grasses, tidal flats and rocky reefs support a wide range of species, including black swans, wading birds, penguins, dolphins, platypus and seadragons, as well as the endangered spotted handfish however a number of environmental issues affect the Derwent estuary including:

- Heavy metal contamination of water, sediments and seafood
- Loss of estuarine habitat and species
- Introduced marine pests and weeds
- Altered river flow regimes and blocked fish migration routes
- Elevated levels of nutrients and organic matter, and low dissolved oxygen levels

This presentation will outline the history of the environmental legacy of the Derwent estuary, the formation of the partnership, how it has been of benefit the Derwent and our aspirations for the future including matching community and stakeholder interests and furthering community engagement through an art and science partnership with the Museum of Old and New Art (MONA).

### **Post Cyclone Yasi Geosynthetic Sand Containers Survivability Investigation**

Taylor Neil

*Geofabrics Australasia*

The start of 2011 bought with it a string of severe natural events that posed massive problems to the engineered world. One of these events, Cyclone Yasi in north Queensland, produced a damaging event that was a real test for engineered structures in the region, and in particular interest to this research, to geosynthetic sand filled containers.

Severe tropical Cyclone Yasi made landfall on the Queensland coast on the third February 2011. Yasi originated from a tropical low near Fiji, where it began tracking in a West-South-West direction and began intensifying. On the 31st of January it was classified a category 3 cyclone and intensified to a category 4 on the 1st of February and finally to a category 5 on the 2nd. The central core of the cyclone began crossing the Queensland coast between Cardwell and Innisfail just before midnight on the 2nd. At this point a 10 minute sustained wind speed of 215 km/h and a 3 second gust speed of 285 km/h was experienced.

Following the destructive events caused by Cyclone Yasi several investigations on the geotextile sand container structures were conducted that were previously installed in these areas. Information that was obtained on the worst hit areas has been analysed, including before and after information.

The presentation will present findings along with recommendations for future structures of this type.

## **Quinns Beach geotextile sand container undertaking**

Taylor Neil

*Geofabrics Australasia*

Perth experienced severe weather conditions during the latter part of 2013 and the City's coastline has been battered with damaging winds, high tides and large swells due to storms.

Quinns beach to the North of Perth in particular has been severely affected resulting in loss of foreshore along with almost total loss of the adjacent park. This park is considered a unique feature of Quinns beach with stunning views of the sunset.

The City of Wanneroo endorsed a \$2.813 million solution using geotextile sand filled containers to form a revetment. A limestone retaining wall was also included in the proposal to be constructed behind the top layer of the sand containers along with a significant sand renourishment project to the beach.

Work on the revetment wall including the filling and placing of 2,500 geotextile sand containers commenced in March 2014. Sand for the containers has been freighted in from a local sand pit and the work is envisaged to be completed in early July 2014 providing the foreshore much needed protection against further erosion.

### **Coastal evolution and sediment dynamics of the Geraldton embayments: implications for coastal management in regional Western Australia**

Tecchiato Sira, Lindsay Collins, Alexandra Stevens

*Curtin University*

Coastal erosion occurs along the Geraldton town beaches impacting many human-made structures and activities, similarly to other urban centres of regional Western Australia where maritime infrastructure and human use of the coast are analogous to the Geraldton situation. An integrated analysis of aerial photography, field surveys, hydrodynamics, sediments, and geomorphology data was required to identify coastal evolution and relate sediment dynamics to coastal stability and infrastructure. The system is complex with a number of limestone reefs sheltering the coast and influencing sediment deposition, together with other natural and artificial features. Northward oriented longshore sediment transport dominates the Western Australian coast, and this study has demonstrated that tombolos and cusped forelands, such as Point Moore at Geraldton, act as permeable barriers to sediment movement. A considerable sediment volume is transported from the south to the north of Point Moore, however this sediment supply is not obvious from coastal evolution trends. Whilst the southern embayment is characterised by beach stability, in the northern embayment coastal erosion is more significant and coastal infrastructure modifies sediment transport patterns. The results of this study support the understanding of shallow coastal processes, especially by quantifying and spatially locating littoral sediment transport pathways. This information is vital for managing the Geraldton coast as well as regional Western Australia. Future planning of coastal infrastructure in Western Australia, such as dredged channels, should take into account sediment bypassing around tombolos and cusped forelands, so that potential beach erosion and subsequent remediation costs can be minimised.

## **National Coastal Sediment Compartments Project**

Thom Bruce, Matthew Eliot, Martin Hazelwood  
*University of Sydney, Damara WA Pty Ltd, Geoscience Australia*

Geomorphic frameworks, when developed as a spatial hierarchy, offer potential to refine erosion hazard assessments. They provide capacity to improve representation of sediment supply distribution, which is the major cause of change over long time scales. This value is enhanced when considering adaptation to sea level rise, as they help identify local response to a region-wide driver. The case for increased complexity in long-term erosion assessment is prompted by limitations of a uniform allowance for sea level rise, apparent in observations of historic coastal change and interpretation of existing morphology.

Development of a spatial hierarchy, with behaviour linked between scales, forms a framework to upscale and downscale coastal assessments. This allows integration of sparse coastal information, such as local coastal studies, with coarse assessments, including regional sediment budgets. Coastal process relationships between time and space scales mean that long-term coastal change is best assessed within a framework extending to larger scales.

Geomorphic characteristics influencing how levels of a spatial hierarchy fit together also implicitly suggest how the framework may be used for coastal erosion assessment. This is demonstrated for the Southwest and Pilbara regions of WA, as distinct coastal environments in which to explore differences in framework identification. The importance of alongshore reef systems was highlighted in the Southwest, with consequent importance of alongshore transport. For the Pilbara coast, the roles of episodic river supply, floodplain storage and tides were important to the spatial framework. These characteristics were markedly different to those commonly assumed for spatial aggregation in coastal modelling.

## **Post-storm event monitoring; defining a major storm**

Thorne Katherine, Kellie Holloway, Michelle Carey  
*BMT Oceanica Pty Ltd, Chevron Australia Pty Ltd*

BMT Oceanica are advising on a shoreline monitoring and management plan ('the Plan'), for a major coastal infrastructure development, that specifies that monitoring must be undertaken after a 'major event' such as a storm or tropical cyclone, to assess the resultant changes in beach structure. The implementation of this Plan requires clear definition of a 'major event'. Wind and shoreline change records were analysed to investigate the type, size, severity and location of storm events that were likely to result in changes to beach morphology. This was then used to define a 'major event' trigger to enable a consistent and logical approach to instigating post-major event monitoring under the Plan.

Several years of shoreline monitoring under the Plan had identified quarterly periods of notable beach volume change (either accretion or erosion). After periods of volume change were identified, hourly wind speed and direction data for these time periods were investigated. The direction, duration, and threshold wind speed likely to cause shoreline changes was then defined, and this formed the trigger for instigating post-major event monitoring under the Plan.



Note that this abstract is undergoing Client approval – if accepted to the conference, and approved, further detail will be provided in the paper and extended abstract.

### **Managing Coastal Information: The Gold Coast Coastal Knowledge Hub**

Todd Derek, Rodger Tomlinson, Shannon Hunt, Kim Bowra,  
*Griffith Centre for Coastal Management, City of Gold Coast Council,*

Over the last 60 years there has been a high degree of management intervention on Gold Coast beaches due to the dynamic nature of the coastal processes, high human use of the beach environment, and extensive capital investment in the immediate coastal hinterland. As a result the Gold Coast is one of the most studied pieces of coastline in the world, with many of the data collection and management practices involving innovative and ground breaking techniques. However, much of the knowledge gained over this time is in danger of being lost due to the retirement of key personnel, and changes in the institutional arrangements of the council and government departments.

The purpose of the Coastal Knowledge Hub (CKH) is to preserve this vital knowledge and information in one location so that it is easily accessible and useable, so that the hard learnt lessons from the past are available to guide and inform the next generation of coastal managers on the Gold Coast.

This paper outlines the steps taken in preparing the CKH, the outputs from the project (600 reference data base, annotated bibliography of 300 key references, and literature reviews of major coastal process and management topic areas), and some examples of the key coastal process and management findings gained from the knowledge hub.

### **Marine Water Quality Dashboard: New generation tools for monitoring water quality**

Treleaven Jamie, Luke Garde, Edward King, Greg Stuart,  
*Bureau of Meteorology, CSIRO Marine and Atmospheric Research, CSIRO Wealth from Oceans  
Flagship*

Threats including water quality, climate change, shipping, fishing and coastal development, have the potential to detract from the Great Barrier Reef's natural, cultural and economic value. Although the GBR is recognised as one of the best managed reefs in the world, coral cover has continued to decline over the last decades at rates similar to less well managed reefs.

eReefs is a response by Australian and Queensland Government agencies plus private investors to mitigate risks to the GBR. eReefs will for the first time, provide a comprehensive picture of the reef in the past, present and future. It integrates existing efforts, and forms the first step in building a comprehensive coastal information system for the whole of Australia. By 2015, the eReefs project partners (BoM, CSIRO, AIMS, the Queensland Government and the Great Barrier Reef Foundation) will deliver a framework to explore and predict the impact of factors such as temperature, chlorophyll, nutrients, turbidity and pH, and provide an interactive visual picture of the reef.

This paper describes the marine water quality dashboard that delivers unprecedented access to information across the GBR. This dashboard enables access to near real-time data on sea surface temperatures, chlorophyll levels, sediments, coloured dissolved organic matter and light attenuation

for the entire Great Barrier Reef. The dashboard will provide access to over ten years of water quality information to identify changes over time, as well as up-to-date assessments of the likelihood of coral bleaching events or the impact of sediment plumes from large rainfall events.

**The Dilemma of When to Protect, How important is Green Space, and Who Pays? - CY O'Conner Beach - A Case Study**

Vickery Doug  
*City of Cockburn*

The coastline at C Y O'Connor Beach, situated at North Coogee in the southern Perth metropolitan area, is receding an average 2 metres per year, leading to a loss of the foredunes and vegetated reserve. In due course, if left unabated, the erosion will impact on built infrastructure of paths, roadway and the key rail line servicing Fremantle Port. The general area, an old industrial precinct, is to be transformed over the coming years as part of the major 'Cockburn Coast' medium density urban residential development, bringing many new residents into the area. Stakeholders with an interest in protecting the current and future infrastructure include the City of Cockburn, WAPC, PTA, Brookfield Rail and Landcorp (the Developer). Other affected parties are the beach goers themselves. Available protection options include beach replenishment, seawall, groynes or offshore breakwater(s). The nature of the threat suggests we can allow retreat as per SPP2.6 for a time, and defer the approx. \$4m cost till a future time, but at what cost in respect to the loss of the vegetated reserve and the current and future amenity it provides? Each form of protection measure has its pro's and cons – how to choose? And who should pay for the protection treatment when it is applied - the City (i.e. its ratepayers), the developer or the State? This paper and presentation deals with how the City of Cockburn worked through the issues of timing (i.e. when to protect), what treatments to adopt, and how it could be funded.

**The 4th Victorian Coastal Strategy: continuing to improve coastal planning and management in Victoria, now and into the future.**

Waldron Nicola  
*Victorian Coastal Council*

Established under the provisions of the Coastal Management Act 1995 (the Act), the Victorian Coastal Council is a statutory body tasked with providing strategic guidance and advice on the management of Victoria's coastline. The key mechanism for achieving this is through the Victorian Coastal Strategy (the Strategy). Under the Act the Strategy must be reviewed every 5 years.

Reflecting the aspirations of the broader community, the Strategy articulates a long-term vision for the State's well-loved and diverse coastline. Achieving the vision requires active and adaptive management and the Strategy provides policies and actions for implementation across the State.

The first Strategy endorsed by the Victorian Governments in 1997, set up a policy framework for managing the Victorian coast. It did this after consulting with planners, managers and users to create a single co-ordinated policy document with real statutory authority. The 2002 Strategy supported the introduction of Marine National Parks and Sanctuaries in Victoria. The 2008 Strategy introduced

a new planning benchmark for sea level rise under climate change, which became embedded in the State Planning Policy Framework.

Following public consultation on a Draft Strategy released in September 2013, the Victorian Government released the 4th iteration of the Strategy. This paper will discuss the new Strategy, key issues and their impact on coastal planning and management in Victoria.

### **Remote Imagery for Coastal Monitoring**

Walkley Vicky, Sarah Marshman, Bruce Hegge  
*BMT Oceanica*

There are many logistical difficulties associated with traditional coastal monitoring techniques, often leading to poor quality or missing data, which can limit the assessment of environmental impacts and coastal change. More reliable methods of coastal monitoring can incur considerable costs. Also, there are often time delays when communicating coastal monitoring data to stakeholders and regulators.

Remote imagery provides a cost-effective visual record of coastal environments through the combination of ground-based autonomous image capture with a secure web portal on which daily imagery can be viewed via a secure login. Two types of imagery units are presently in use: time-lapse cameras that capture still images of a fixed view at pre-determined intervals; and a webcam that can capture both stills and video, with full pan, tilt and zoom functionality that can be controlled via the web portal. These imagery units can be deployed in remote locations, reducing the need for monitoring by on-site staff.

Successful applications to date include monitoring of shoreline change, dredging plumes, tidal inundation extent, wrack movements and engineering works. Future applications currently being progressed include monitoring of coastal structure performance, beach usage, vessel movements and marine fauna. We are presently looking to expand the application of these systems through more quantitative analysis of imagery, to inform effective decision-making in the coastal environment.

### **OceanWatch Australia - Natural Resource Management for the Marine Environment**

Warren Brad  
*OceanWatch Australia*

The presentation will highlight a 25 year journey from small industry funded NGO, to recent recognition by the Australian government as the Natural Resource Management (NRM) organisation for the marine environment. We will also discuss the future role of OceanWatch Australia in delivering NRM for marine stakeholders, and how local government can be involved.

Case studies will highlight OceanWatch's holistic approach; linking environmental, social and economic outcomes for the marine environment.

OceanWatch Australia has been working with the Australian seafood sector since 1989. Key activities include:

- working with industry and local communities to minimise adverse environmental impacts;
- introducing industry and communities to sustainable technologies and behaviours; and
- enhancing fish habitats and improving water quality in estuaries and coastal environments.

**Towards best practise Council-based coastal planning - valuing local knowledge and shared responsibility**

Watson Phil  
*Clarence City Council*

With some 250 km of coastline featuring many popular coastal reserves Clarence City Council has developed a progressive strategic approach to coastal planning. Using an overarching, regional strategic framework Clarence Bushland and Coastal Strategy, the Coastal Reserve Activity Plans (RAPs) are founded on local knowledge obtained from extensive two stages, community and coast care group engagement program including "walk and talks", 1:1 stakeholder discussions, social media and innovative application of "old school-like" Report Cards. RAP reports are drafted from management issues which integrate local knowledge with environmental, recreational and social values and impacts degrading them. Key research aspects include Aboriginal and cultural heritage, flora communities and habitat they provide, coastal erosion and inundation, Birdlife Australia standardised bird surveys, track corridors within and linking to the reserves, track and signage plans, recreational facilities, fire and weed management, revegetation and promoting shared responsibility towards caring for both the reserve and the adjoining biodiversity corridors and buffering private properties that link the reserve to the landscape. These draft RAPs which feature a 5 year costed and prioritised implementation plans are released for community feedback to ensure all management issues have been thoroughly taken into account. Attractive Coastal Reserve Report Cards are posted to all local community (average 1000) to promote their availability for feedback from the Council website. The final adopted RAPs drive all on-ground works and not only attracted significant Council investment and grant funding, but have also mainstreamed coastal management with Council.

**Community Use and Attitudes towards the Coast and Coastal Management – 20 years of data.**

Wescott Geoff, Rebecca Koss  
*Deakin University*

Every five years the Victorian Coastal Council commissions a study of community use and attitudes towards the Victorian coast as a lead-in to the preparation of the draft Victorian Coastal Strategy (VCS). These surveys provide the Victorian Coastal Council an understanding from the community perspective of the many changes, challenges and opportunities to achieve sustainable use, management and development of the Victorian coast.

These surveys, performed in 1996, 2001, 2006 and 2012, are prepared by an independent consultant (TGA / IPSOS) and seek the views of a random cross section of the Victorian Community as to their use of the coast, their views on the issues confronting the coast and their attitudes and views on how well the coast is being currently managed. The Council uses the results of the survey to scope their draft Coastal Strategy which is then released for public comment. The submissions received are

then considered with the community survey to provide a final draft to the Victorian Government who then publishes the final VCS.

The survey provides invaluable information on what ordinary Victorians think of the coast. With four successive surveys over the past 18 years it also gives some interesting insights to changes in views over time and the public's assessment of coastal management practices in the state.

This paper will present some of the key data collected over this longitudinal period and discuss the implications of those outcomes for coastal managers not only in Victoria but across the nation.

### **A national survey of marine debris along Australia's coast, patterns and implications for local managers and policy makers**

Wilcox Chris, Denise Hardesty, Matt Lansdell, Tonya Van der Veldt, T.J. Lawson  
*CSIRO Marine and Atmospheric Research / CSIRO Wealth from Oceans Flagship*

*CSIRO land and Water / CSIRO Wealth from Oceans Flagship*

Over the preceding two years CSIRO has been conducting a national survey of marine debris along Australia's coastline. We report on the analysis of the survey dataset, covering a survey site every 100 km along the entire coastline of the mainland and Tasmania. Our analysis separated out likely land and sea contributions to marine debris along the coast. We explored a range of explanatory factors including population density, access, coastal drainages, ocean currents, and prevailing winds. We identified three coastal debris hotspots, one on the southeast coast of the mainland, one on the southwest coast, and a third on the west coast of Tasmania. These patterns correspond to the forces driving the accumulation of coastal debris, with prevailing onshore winds and waves delivering debris from marine sources in some contexts, and local population providing the primary source in other contexts. We also found both positive and negative effects on debris from populations at different distances from the coast, suggesting a mix of custodianship by local residents and illegal dumping by those living further from coastal sites. We conclude with implications for local government policies of the patterns we found in our survey data.

### **GB responses to coastal erosion & floods.**

Williams Allan  
*University of Wales Trinity St David*

Recent - Dec, 2013-Jan. 2014, coastal erosion and flooding caused a public outcry regarding coastal protection and defence strategies. They gave rise to flood claims (£446m), from 9,000 home owners, 5,400 for flood damaged vehicles, 3,100 for businesses; and for storm damage (£606m), 361,000 homes, 15,200 vehicles, 44,700 businesses. However, severe flooding in 2007 cost >£3 bn as against current estimates for >£1 bn. Strategies and policies come from the UK Department of the Environment, Food and Rural Affairs (Defra), delivered to the local level via the Environmental Agency, England, Natural Resources, Wales, and the Scottish Natural Heritage, Scotland. These are responsible for taking a strategic management overview of all sources of flooding and coastal erosion. Historically, the Pitt report, 2008, prompted by the 2007 floods, has resulted, amongst others, in the Flood and Water Management Act 2010, National Flood and Coastal Erosion Risk Management Strategy, 2011, and a plethora of regulations are now associated with the coastline,

e.g. Integrated Coastal Management, Marine Spatial Planning, Water Framework Directive, Habitats Directive. Counteracting coastal erosion and flooding usually involves three options: Defend (hard/soft engineering, usually very costly), sacrifice (let nature take its course – very emotional with property rights/compensation issues), or managed retreat, common in only a few areas (circa 450 ha at present), but which could be the future norm. Options will be determined by factors, such as, funding, legislation, property rights, severity and urgency of impacts, aesthetics, etc.

### **Coastcare and the corporate world: A Perth perspective.**

Wilson Craig  
*Perth Region NRM*

Community based Coastcare restoration is reliant on a number of factors including experienced coastal facilitators, supportive Local Governments, motivated community members and project funding.

To diversify funding sources, Perth Region NRM's Coastal and Marine Program has successfully developed partnerships with a range of corporate businesses (Alcoa, BHP Billiton, BP, Synergy) to deliver on-ground coastal rehabilitation outcomes, educate students in coastal ecology, engage corporate staff and build capacity of community groups.

However, there are important aspects of working with the corporate partners that need to be understood if partnerships are to be maintained over the longer term. The factors for successful corporate relationships will be discussed and case studies of working partnerships presented to provide guidance for others interested in entering the world of corporate sponsorship

### **Complex flow patterns in limestone reef-fringed beach systems**

Winter Gundula, Ryan Lowe, Jeff Hansen, Graham Symonds,  
*The University of Western Australia | Oceans Institute*

Hydrodynamics in the nearshore zone are the key driver of transport and exchange of material, including sediment, pollutants, nutrients and larvae, between the coastal zone and the inner shelf. Understanding and predicting these dynamics have large implications for coastal management, including assessing pollution from point sources, ecosystem health and shoreline management. A recent field experiment investigated the hydrodynamics in a limestone reef system adjacent to a sandy beach on the western side of Garden Island (Western Australia), which has the typical characteristics of limestone reef-fringed beaches that occupy large parts of the southwestern Australian coastline. A dense array of 30 instruments was deployed within and offshore of the reef system. The instruments measured wave transformation over the reef as well as currents generated on the reef and in adjacent channels. Spatial flow patterns were measured with GPS tracked drifters that were regularly released in clusters and left to float freely. During the experiments various regimes have been observed including: full retention of the drifters within the reef system; ejection of all drifters into deeper shelf water and a combination of both. The drifter tracks were strongly correlated with the prevalent wind and wave observations and to the temporal dynamics of the

currents measured by the in situ instruments. The combined in situ and drifter observations obtained in this experiment provide a valuable insight into processes controlling transport and dispersion in limestone reef environments.

### **Coastal Adaptation Pathways: A CBA Approach**

Witte Ellen, Andrew McDougall  
*SGS Economics and Planning*

In exploring adaptation options for areas that are currently or expected to be at risk in the future, there are multiple options available in terms of how and when to adapt. Adaptation pathways explore how an area may adapt over time on the basis of complementary and mutually reinforcing adaptation options.

Pathways are equally valid and possible ways to respond to the changing levels of risk, but the implications in terms of implementation costs, community values, natural values, economic impacts and infrastructure and services provision vary significantly.

Pathways will help decision makers, the community and other stakeholders to explore how the area at risk may change over time according to each pathway; how will things be different, how would it work, is it doable and/or even acceptable to the community and stakeholders?

In order to have a fruitful dialogue between decision makers, stakeholders and importantly the community the pathways need to be accompanied by an analysis of the relative costs and benefits of each pathway. The costs and benefits comprise monetised and non-monetised impacts of each pathway and include retention/loss of private property, recreation values, ecosystem services, infrastructure and services, economic activity and the changing character of beaches and communities.

This paper presents an overview of the development of the narrative of pathways, as well as how the costs and benefits are identified and quantified. The paper also describes how this analysis is then applied in community engagement processes on the basis of recent experiences in various coastal areas.

### **Status and conservation of migratory shorebirds in Tasmania.**

Woehler Eric  
*BirdLife Tasmania*

Tasmania is the southernmost destination for migratory shorebirds (waders) in Australia using the East Asian – Australasian Flyway (EAAF), which extends from Siberia and Alaska to Australia and New Zealand. Approximately 30 species of migratory shorebirds in Tasmania have been monitored during ongoing summer and winter months since the early 1960s. The counts are coordinated and undertaken at fixed sites used by the birds to roost (rest) during high tides. At least seven sites in Tasmania meet the criteria for international significance, based on the numbers of shorebirds present during the year. Analyses of these data indicate decreases in the numbers present in Tasmania for most species at the major roosts around the state. Numbers of Eastern Curlew, the largest migratory shorebird in the EAAF, have decreased by approximately 75%, while numbers of

Curlew Sandpipers, one of the smaller migratory species have decreased by more than 95%. In addition, the species diversity at roosts around Tasmania is decreasing. The observed decreases in Tasmania are also being observed elsewhere in Australia, but the Tasmanian data have typically been of greater magnitude and earlier than elsewhere, suggesting Tasmania is serving as an early warning indicator for migratory shorebirds in Australia and the EAAF.

### **Status and conservation of resident shorebirds in Tasmania**

Woehler Eric, Valeria Ruoppolo  
*BirdLife Tasmania*

Extensive surveys of beach-nesting shorebirds (for example Hooded Plovers and Pied Oystercatchers) on sandy beaches around Tasmania have been undertaken over the past decade. These surveys have mapped more than 4000 nest sites and breeding territories on more than 250 beaches in Tasmania. Early surveys in the 1980s provide baseline data for comparison with contemporary data. Analyses of breeding population data of resident shorebirds in Tasmania suggest decreases for Hooded and Red-capped Plovers around the state, with substantial losses in the southeast and east. Human activities such as 4WDs, dogs and horses disturb nesting birds and result in breeding failure by them. Breeding by shorebirds inside National Parks and other reserves does not afford greater protection, as population decreases inside reserves are similar to those outside reserves. The surveys have enabled estimates of state-wide populations, and the break-down by NRM regions and by coastal Councils. Conservation efforts directed towards resident species could contribute to an improvement in the conservation status of migratory shorebirds, given the extensive overlap of habitat use. Sea-level rises and concurrent habitat loss with exacerbate existing threats to coastal shorebirds.

### **WATCHING BIG BROTHER: What the US can teach us about the behavioural and economic dimensions of coastal management**

Young Allan  
*NSW Department of Planning and Environment*

After several years of attending coastal conferences, and hearing about all the fantastic advances in engineering, technology, planning and science, it occurred to Allan Young that there was a pattern emerging. There were lots of clever ideas about how people should adapt to future hazards, but very few people actually adapting in the rational and orderly ways suggested by the experts. It was almost as if some invisible force was impeding the implementation of those great ideas.

To investigate the issue, Allan Young travelled to the US on a prestigious Fulbright Scholarship in 2013. He worked on coastal planning in the New York City Mayor's Office, and did research and teaching at Harvard and MIT.

The key has been to look at the problem a little differently. For all of the compelling logic of the science, engineering and legal components, we inevitably come up against the realities of human behaviour. That's the invisible force.

Coastal managers ... meet behavioural economics.



Learning from the US experience in coastal management might just help us avoid some of the pitfalls – and, yes, there are some big ones! The presentation will illustrate the mad, the bad and the just plain weird situations on the US coast.

It is an entertaining and instructive story. But, hey, don't laugh! It could happen in your town soon. Look for the insights and ideas for application locally.

All public policy is about behaviour. Coastal planning is no different.

### **Performance of Operational Wave Models at Australian Coast**

Zhong Aihong  
*Bureau of Meteorology*

The Australian wave model (AUSWAVE), based on the WAVEWATCH III® model has been the operational sea-state model run by the Bureau National Operations Centre (BNOC) since August 2010 ([http://www.bom.gov.au/australia/charts/bulletins/nmoc\\_bulletin.shtml](http://www.bom.gov.au/australia/charts/bulletins/nmoc_bulletin.shtml) - Bulletin No 84). The AUSWAVE system is forced by the Australian Community Climate and Earth-System Simulator (ACCESS) Numerical Weather Prediction (NWP) system ([http://www.bom.gov.au/australia/charts/bulletins/nmoc\\_bulletin.shtml](http://www.bom.gov.au/australia/charts/bulletins/nmoc_bulletin.shtml) - Bulletin Nos 93 & 98).

The operational wave models run at two different domains: global model at 40km resolution and regional model at 10km resolution. This presentation covers the evaluation of the performance of global and regional wave models at the Australian Coast. Around 30 wave rider buoys data is used to verify model forecasts accuracy.

To improve the wave model performance along the coast, a wave OCF (Operational Consensus Forecasting) system was developed, which optimally combines the direct model outputs from a number of wave models and produces wave forecasts for the selected wave buoy sites around the Australian coasts. It produces forecasts of significant wave height, peak wave period, wind direction and wind speed up to 5 days ahead. Wave OCF is simpler methods that tend to outperform more expensive computational methods. The combined forecast is proved to be often the best forecasts for the Australian coast.

### **Correlation between East Australian Current and Fort Denison Sea Level**

Ziaeyan Bahri Fatemeh Mona, Jason Sharples, Xiao Hua Wang  
*School of Physical, Environmental and Mathematical Sciences, The University of New South Wales  
Canberra, Australian Defence Force Academy*

Understanding of the relationships between changes in regional ocean dynamics and sea level variability is one of the keys to understand the causes of coastal Sea Level Rise (SLR). The impact of the East Australian Currents (EAC) on sea level changes along the east coast of Australia due to climate change is still not well understood.

## **Poster Abstracts**

### **Horizontal Falls Marine Park – a joint management partnership**

Goater Roanna, Sarah Bignell, Anna Smith & Michael Higgins

*Department of Parks and Wildlife*

In January 2013 the Western Australian government announced a commitment to establish the Horizontal Falls Marine Park as part of the Kimberley Science and Conservation Strategy. The proposed marine park is located within the traditional lands of the Dambimangari people and falls within the Kimberley region listed on the Australian National Heritage List because of the area's natural, indigenous and historical values. In addition to protecting and conserving marine biodiversity and providing for on-going sustainable use, the proposed jointly managed marine park is being designed to protect and conserve the value of the land to the culture and heritage of the Dambimangari people. Under traditional law the Dambimangari people have an obligation to care for the environment and ensure their culture is kept alive and passed on to future generations. Recent changes to government policy and legislation now provides for the joint management of conservation estate and for ongoing customary use and activities, including fishing and hunting. The proposed Horizontal Falls Marine Park is being developed in partnership with Dambimangari Traditional Owners and takes into account key information from Dambimangari Healthy Country planning processes, as well as traditional ecological knowledge provided by Traditional Owners. Through this case study we will share the outcomes and identify key challenges in integrating indigenous knowledge and aspirations with scientific reserve design methodologies for marine park development in the Kimberley.

### **Home River Ocean: Urban Nutrient Behaviour Change**

Molly Sarah, Peta Kelsey

*South West Catchments Council, Department of Water*

The Home River Ocean (HRO) urban nutrient behaviour change program is aimed at reducing the amount of nutrients entering South West waterways from urban development. The first campaign, 'Save the Crabs, Then eat Them', encourages urban residents and professional gardeners not to fertilise lawns and gardens in winter. The campaign uses humour and the iconic Blue Swimmer Crab to highlight the impact nutrient runoff can have on the waterways, estuaries and marine environment. This broad-reaching advertising campaign uses television, newspaper, radio, online and printed material.

The use of fertilisers in urban areas is an increasing nutrient pollution source to waterways and the ocean. Currently in the Peel, urban development occupies only 6% of land use and yet it contributes nearly 20% of phosphorus entering the Peel-Harvey Estuary 9 (EPA, 2008).

A comprehensive evaluation of HRO's first campaign is currently underway (with preliminary results to be released before the C2C Conference).

The Urban Nutrient Survey (Kelsey, 2010) of households in Western Australia found that that 11 to 13% (by type) of household garden nutrient inputs (by weight) occur in winter. This figure is verified in formative research commissioned by SWCC in Meadow Springs, Mandurah (Beckwith Environmental, 2011). This behaviour contributes 10% of the urban nutrient load to waterways. Therefore by addressing winter fertilising, this campaign has the potential to reduce nutrient export to South West coastal waterways by over 10 tonnes per annum.

Home River Ocean is an initiative from South West Catchments Council supported by GeoCatch, Peel-Harvey Catchment Council, Department of Fisheries, Department of Water, Water Corporation, Swan River Trust and Murdoch University. The program is funded by the Australian Government and Government of Western Australia.

## **A PHOTO-MONITORING PROGRAM MODEL USING SMARTPHONE TECHNOLOGY**

Payne Mic

*Northern Agricultural Catchments Council*

In late 2010, Coastwest supported the Northern Agricultural Catchments Council (NACC) to establish a beach photo-monitoring program in Geraldton, WA. A team of community volunteers was recruited to take regular monitoring photos using digital cameras and then manually label and upload them to a database. This program highlighted a number of tedious or complicated procedures that if improved, would result in a more user-friendly program. In 2013, further funding was obtained from Coastwest to extend the current program to include the entire Northern Agricultural Region's coastline, whilst also developing a photo-monitoring program model using smartphone technology. Key to this project was the development of the smartphone application "Photomon" and associated database, which incorporate the following features:

- reminders for prompting users that the next monitoring photo is due;
- date and location of each photo recorded by the database using metadata;
- photo direction and text notes added manually to each photo;
- ghosted reference image overlays to ensure standardised field-of-views; and
- on-line instruction manual and in-app donation option.

Flexible design of the app ensures that it can be incorporated into a range of photo-monitoring programs. Community groups can benefit from all of the features of the app without the need to connect to an online databases by operating in "Demo" mode. For larger photo-monitoring programs, coordinators can opt to use the existing database or complete a simple License Agreement with NACC to alter the app code to allow connection to a different database.

## **Developing Flexible Adaptation Pathways for the Peron Naturaliste Coastal Region of Western Australia**

Perry Craig, Joanne Ludbrook  
*Peron Naturaliste Partnership*

The Peron-Naturaliste Partnership Project, Developing Flexible Adaptation Pathways for the Peron Naturaliste Coastal Region of Western Australia assessed potential adaptation strategies to respond to coastal hazards arising from climate change induced sea level rise in the region. The results showed the potential extent of coastal hazards and associated risks from Cape Peron to Cape Naturaliste. In summary, the Project identified that until 2110 in the Peron Naturaliste Region:

- erosion is a far more pervasive issue than flooding;
- approximately 800 hectares of urban and commercial land may be subject to an increase in flooding risk;
- approximately 200 metre wide strip is at risk from erosion along the majority of the coastline;
- approximately 3,410 ha of parks, recreational & conservation areas and beaches is at risk of erosion and inundation;
- the value at risk of the affected assets along this section of coastline is approximately \$1.2 billion which includes an indicative value for parks, recreational & conservation areas and beaches of \$81,523; and
- approximately \$1.1 billion of assets can be saved, at a cost of around \$120 million.

There were a number of lessons learnt which may be of benefit to other local governments, organisations and collaborations undertaking similar works including;

- the methodology utilized for the hazard mapping and economic analysis is innovative and further analysis is required before any 'on-ground' work may occur;
- social and environmental variables need to be further considered; and
- partnership approaches that include all levels of government are advantageous.

### **Under Pressure - balancing needs along the Stirling coastline**

Ridgewell Justin, Murray Woods  
*BMT JFA Consultants, City of Stirling*

The City of Stirling manages over 8kms of coastline in the heart of Perth's northern suburbs. The entire coastal strip is an amenity hot-spot, with numerous sandy beaches, snorkelling reefs and surf breaks. Historically, significant development has occurred along the alignment of the primary sand dune, creating present-day risks for infrastructure from storms and erosion.

Sediment supply to the frontage is fundamental. Beaches are perched over limestone with shallow reefs creating a complex nearshore sediment transport system. A lack of previous investigation has historically hindered coastal managers, leaving them with nothing but a 'best guess' of how beaches

may respond under certain conditions. Strategically therefore, the longer-term objective is to identify the primary natural sediment pathways and assess how historical management interventions have influenced and altered the natural regime.

Monitoring programmes (managed by the City together with the support of WA's Department of Transport and BMT JFA Consultants) and analysis of beach profiles, bathymetric lidar and aerial photography are providing the basis for developing this long-term understanding. However, there are many current coastal management problems which the City addresses at numerous discrete locations, with coastal squeeze already dictating a requirement for the implementation of protection measures. Maintaining safe beach access for the community, whilst also ensuring the coast can still respond naturally to metocean conditions, is a priority.

This paper presents the collaborative approach to strategic analysis of this coastline, whilst also providing examples of discrete engineered solutions aimed at both protecting infrastructure and enhancing the ecological and aesthetic values of the foreshore. Examples include the use of geo-cellular containment to stabilise coastal slopes at Hamersley Pool, an approach new to WA

### **Coastal Weed Management in the Northern Agricultural Region, WA**

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*Northern Agricultural Catchments Council*

Infestations of non-native plants are a major threat to coastal dune system stability, biodiversity and ecosystem services. Within the Northern Agricultural Region (NAR) of Western Australia, two weed species in particular challenge land managers who are fighting to preserve the biological integrity and recreational values of our stunning coastal landscape.

Pyp Grass (*Ehrharta villosa*) is recognised as one of the top ten environmental weeds of the south-west WA coast. After performing controlled field tests in April/May 2013, the Northern Agricultural Catchments Council (NACC) found that Verdict® 520 at 1L/Ha sprayed once during the active growing season is an effective treatment. NACC has since been using this application successfully for controlling mats of Pyp Grass in the towns of Cervantes, Ledge Point and Jurien Bay.

Thickets of African Boxthorn (*Lycium ferocissimum*), a listed Weed of National Significance, were mechanically removed in Jurien Bay by NACC using a Ditch-witch in March 2014. The machine was utilised to physically pull up individual plants and was particularly beneficial in reducing damage to neighbouring native plants. We have found that this equipment was ideal for treating light to moderate infestations of African Boxthorn, before employing other follow-up techniques to treat regrowth.

To protect, maintain and improve coastal ecosystem services and lifestyle there is a need for strategic weed eradication whereby techniques and results are communicated between land managers. NACC is working with local communities in the NAR on follow-up activities to maintain control of these invasive species.

## **Influence of turbulent bursting based sediment entrainment in the Swan estuarine system**

Salim Sarik, Charitha Pattiaratchi  
*University of Western Australia*

This research intends to develop a better understanding of the role of intermittent turbulence in transporting sediments along the bottom boundary layer of the Swan estuary of Western Australia. The proposed study will examine the mechanisms underlying sediment re-suspension and improve our understanding of how the ‘bursting phenomenon’ generates as well as providing a more refined parameterisation of essential sediment transport processes in estuarine flow environment.

Primarily, high spatial and temporal resolution data have been collected employing Acoustic Doppler Velocimeter (ADV) and Optical Backscatter Sensor (OBS) instruments at 8Hz sampling rate at Swan estuary during the neap tide conditions ranging from 1-1.5 meters water depth. Prominently, the collected field was post processed using quadrant analysis and wavelet transform method to understand the role of turbulent coherent structure on sediment threshold. Moreover, this analysis provided a more refined parameterisation through comparing sediment transport processes to understand the importance of turbulence bursting events and their percentage of contribution in sediment re-suspending and transporting. The contributions made by different turbulent events in momentum and sediment fluxes were also investigated in depth.

## **ReefKIM, an integrated geodatabase of nearshore reefs of the Kimberley coast, WA**

Stevens Alexandra, Lindsay Collins, Moataz Kordi  
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The Kimberley coast, in the north west of Australia, is bordered by an extensive area of coral reefs. These vital ecosystems are poorly studied and in need of detailed understanding to aid and improve conservation and management. The remoteness and macrotidal regime of the area play significant roles in making study and management of this coast a challenging task. The aim of this work is to construct a geodatabase of the Kimberley reefs (ReefKIM) based on data fusion utilising GIS. Data inputs into this geodatabase were varied and included bathymetric charts, remotely sensed images, georeferenced fieldwork photos, ground truth and data from other sources. The data inputs also include information on environmental, geological, geomorphological, biological, chemical, physical, oceanographic and climatic factors. Compiling these factors and conditions into one consistent georeferenced database facilitates presenting them as features on a dynamic map associated with an attribute table. The outcomes present how the geodatabase can improve the process of studying and managing the reefs of the Kimberley region. ReefKIM provides essential information on geological and ecological characteristics such as mapping, representation, connectivity and biodiversity of the Kimberley coral reefs. Furthermore it permits a comparison of these reefs with other reef systems in the world, such as the Great Barrier Reef, to gain a better understanding of reef growth in this region.

## **Clarence City Council's Adaptation Pathway - Challenges and highlights**

Watson Phil

*Clarence City Council*

Clarence City Council has become national leader in the coastal climate change arena, having developed and actively promoted around Australia, a state of the art Coastal Climate Change Vulnerability Assessment Case Study 2009 commissioned by Australian Government's Dept. of Climate Change and Energy Efficiency (DCCEE). With an endorsed Implementation plan the Vulnerability Assessment has enable Clarence to move from a policy setting into practical on ground adaptive management responses and planning scheme initiatives.

This has proven to be extraordinarily challenging requiring the probing of many new boundaries. Major successes include new Planning Scheme overlays ie Coastal Erosion Hazard and Coastal Inundation overlays, the main streaming of Climate Change across all business sectors within the Clarence City Council which culminated in the appointment of a CC Officer and the implementation of a series of no regret and win- win strategic approaches to on ground coastal adaptation projects. These projects included beach scrapping and dune building, sand biodiversity assessments, sand supply assessments, annual high resolution aerial beach monitoring of all vulnerable beaches, beach profile surveys, community beach monitoring, photogrammetric assessments to understand past erosion trends of highly vulnerable beaches and refining of hazard lines using more advanced wave and wind climate models to improve hazard mapping in the planning scheme overlays.

In order to develop an agreed strategic approach (community, stakeholders and Council) to long term on ground adaptation at Clarence's most vulnerable coastal beach, Lauderdale, Council was awarded funding as part of the DCCEE's funded Tasmanian Coastal Adaptation Decision Pathway Project. The outcome of this project's extensive community consultation and scientific assessments resulted in a strong community desire to protect property from erosion whilst maintaining the beach in an unmodified form for as long as possible. In the undeveloped regions, the community preferred that natural coastal processes were allowed to take precedence by giving both beaches and salt marshes room to move under rising sea levels and coastal recession scenarios. This endorsed strategic pathway has enabled Council to progress with confidence on planning and implementing major adaptation projects. After exploring a number of coastal defence options, the Council has been progressing with a multi-million dollar 160 metre trial groyne structure which has already been given both a technical and social licences following exhaustive consultation. However we still have many challenges to overcome, particularly on the question of "who pays?", and the acquisition of legal, political, and insurance licences.

### **The 'mobile' value of beaches**

Witte Ellen, Clive Attwater

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In developing adaptation plans for coastal areas at risk due to climate change, there is a need to assess the impacts of various coastal management and protection works. The implications of sea level rise and adaptation options may involve the loss of existing beaches or transformation of a natural beach into an artificial beach altering its character.

To assess the values of beaches, adaptation planners can use a range of valuation methods. Primary research methods can determine the value of beaches according to usage by visitors and residents in the study area. However budgets for adaptation plans do generally not allow for such a costly approach. Planners often have to rely on other methods that provide more indicative valuations. The most affordable is the benefit transfer method, which transfers values found in research elsewhere to the study area.

Existing research on the value of beaches shows that beaches near urban areas are often worth millions of dollars per section of beach. The magnitude of these values may overshadow other values such as private properties, infrastructure and open space.

This paper proposes a way forward on incorporating the high values of beaches into adaptation planning. It considers the marginal values of beaches: What happens if we sacrifice one beach while the remaining beaches can attract visitation diverted from the lost beach? This paper demonstrates that values of beaches can be 'mobile' and may move from one beach to the other depending on the availability of amenable and usable beaches.



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