Coastal News

Te Hunga Takutai o Aotearoa

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Image credit: Maritime New Zealand

Grounding of the *Rena* – Unfolding of an Environmental Disaster

In the early hours of 5 October 2011 the *Rena* grounded on Astrolabe Reef near Tauranga Harbour. Maritime New Zealand's (MNZ) Marine Pollution Response Team and members of the National Oiled Wildlife Response Team immediately mobilised following the incident. At the same time MNZ activated its Maritime Incident Response Team.

In the coming months and years there will be many questions that need to be answered ranging from how did the grounding happen in the first place, to were proper protocols in place for responding to a clean up, to what the full financial implications will be especially in light of New Zealand having not ratified key International Maritime Organisation liability conventions. What's clear is that this incident will define how New Zealand prepares for future environmental maritime disasters.

Responding to the disaster

Twenty-four hours into the response it was hoped that a dispersant could be used on the leaking oil, but by the evening of 6 October 2011 MNZ's National On Scene Commander Rob Service announced the response needed to be escalated.

Despite early indications that dispersant testing had proved effective, an observation flight earlier that day confirmed that a significant oil slick that stretched about 2,000 m from the vessel remained. At that point On Scene Commander Service said that other dispersant options were being considered, but the response team would also need to prepare for an on-water recovery operation and a shoreline clean-up.

Preparations were made for the double-hulled tanker *Awanuia* to begin pumping oil from the *Rena*. The *Awanuia* was chosen because it can hold 3,000 tonnes of oil, which meant the oil could all be taken by one vessel. Actual pumping did not get underway until 8.30 pm on 9 October and was initially hampered by severe storms.

Up to 800 people are in the oil spill response team (the number varies based on when and how people's skills are needed), including members of the Incident Command Centre and people in the field. Beyond that, Bay of Plenty Regional Council has established "Operation Beach Clean" which includes 6,000 volunteers who have registered to be involved with the clean up.

For wildlife, the National Oiled Wildlife Response Team (NOWRT) has 85 personnel in 14 teams working on the response and includes veterinarians, expert responders and ornithologists with experience in the capture and treatment of oiled birds. Department of Conservation staff are working alongside NOWRT. A wildlife treatment and rehabilitation facility has been established at Te Maunga where oiled animals are cared for, along with 60 rare New Zealand dotterels which were pre-emptively caught.

Regulatory framework – finding the balance

Law of the sea experts Robert Makgill, Joanna Mossop and Karen Scott say that the regulatory framework governing pollution in the marine environment primarily comprises the Maritime Transport Act 1994 (MTA) and the Resource Management Act 1991 (RMA).

"The cost of the environmental clean up associated with damage caused by the *Rena* can be recovered from the owners of the vessel by the Crown under section 344 of the MTA. However, the liability of the owners is limited under section 85 of the MTA. Limitation of liability is a standard international practice and is designed to encourage ship owners to operate in the high-risk venture of international shipping," Robert, Joanna and Karen say.

In addition to civil liability, criminal proceedings have been initiated against the Captain and Navigation Officer of the *Rena* under section 65 of the MTA. Moreover, criminal proceedings may also be taken under section 338(1B) of the RMA for discharging harmful substances or contaminants against both the master and the owner of the ship found to be in breach of section 15B of the RMA.

Robert Makgill, Joanna Mossop and Karen Scott recently submitted an article to *NZ Lawyer* (pending) noting that the *Rena* disaster has highlighted a tension between the philosophies and approaches of the RMA and the MTA with respect to marine pollution in the coastal marine area.

As they state, "The aim to minimise the need to prove fault and provide for full restoration of environmental damage under the RMA contrasts somewhat uncomfortably with the emphasis on limitation of liability under the MTA. The philosophical tension between these two approaches might (at least in the first instance) benefit from some consideration prior to enactment of the recently proposed EEZ (Environmental Effects) Bill 2011."

New Zealand Defence Force personnel continuing with clean-up operations on the northern side of Mount Maunganui on 23 October. Image credit: Maritime New Zealand.

Next steps

As experts wrangle with the implications of the grounding of the *Rena*, local communities and the response team are focused on the clean up. This includes continued salvage, water quality sampling and monitoring of the oil slick, and clearing beaches of oil and remaining container debris.

As local residents say, "it's going to be a long, hard summer".

In memory of ... Dr Alastair Kenneth Senior

NZCS Auckland Co-coordinator

3 February 1971 to 31 July 2011

by Sandie Hutchinson, Tonkin & Taylor

Saturday 13 August 2011 was about Alastair. It was very moving to see so many people on the cliff top above Bethells Beach, in perfect sunshine, who came to say their farewells.

Alastair was a man who followed his dreams and made them happen – he travelled South America, Antarctica, Philippines, Australia, kayaked in Europe (as his father said, often driving all night to compete the next day in a whitewater kayak competition), moved countries, piloted a microlite, built his hovercraft, and was looking at obtaining his helicopter pilot licence. He also loved horse riding along beaches, climbing, and tramping. And, as we know, he lived for his three children Talia, Evie and James.

Alastair was recruited from the UK by NIWA in 2002 to work as a coastal modeller. After working for NIWA, he also worked at DHI Water and Environment Group and, more recently, with environmental and engineering consultants Tonkin & Taylor. Amongst his colleagues Alastair was known for his intelligence, his "can-do" attitude, and his incredible passion for life.

At his memorial, Alastair's sister, Fiona and his parents, Robert and Margaret all spoke affectionately about the brother and son who had meant so much to them. Rick Liefting, John Duder, Richard Reinen-Hamill, Andrew Swales (NIWA), Sue (his partner) and close friends gave tributes. It was moving and humbling to listen to how much Alastair achieved in his 40 years of life and how many lives he touched.

"Live each day as though there is no tomorrow" is exactly what he did. Go in peace Alastair.

Measuring Suspended Sediment in Coastal Waters

By Carole Guggenheim, Aysha Hohaia, and Kay Vopel, Marine Research Group, School of Applied Sciences, Auckland University of Technology

Figure 1: Aerial photograph of the Motueka River outflow into Tasman Bay, South Island, showing a large plume of suspended sediment. Credit: Landcare Research.

Recent days have seen an increase in the frequency of extreme rainfall boosting the supply of land-derived sediment (soil) to coastal waters of New Zealand. Extreme rainfall is of particular concern when vegetation removal and coastal urbanisation mobilise sediment (soil) at large scale, and when steep topography supports rapid transport of sediment suspensions from land to sea. Once washed into the sea, these suspensions decrease the clarity of coastal waters altering water column functions such as primary production (Figure 1). Also, as suspended sediment eventually settles at some distance from the shore, it disturbs the seafloor and its organisms.

Despite our growing understanding of the effects of land-derived sediments on coastal ecosystem functioning, coastal managers have not yet implemented analyses of suspended sediment loading in routine environmental monitoring. One reason for this lies in the laborious nature of such analyses; mapping the concentration of suspended sediment at sufficient temporal and spatial resolution was, until recently, almost impractical.

To solve this problem, scientists have developed surrogates and new approaches. The efficacy of one approach is currently under investigation by the marine research group at Auckland University of Technology. In this approach, a small optical sensor illuminates a defined volume of water with near-infrared light to measure how much of this light is backscattered by suspended particles (Figure 2).

The sensor's small size, low power requirement, and short (less than a second) sampling time permit *in situ* profiling of the water column with high spatial and temporal resolution. This approach, however,

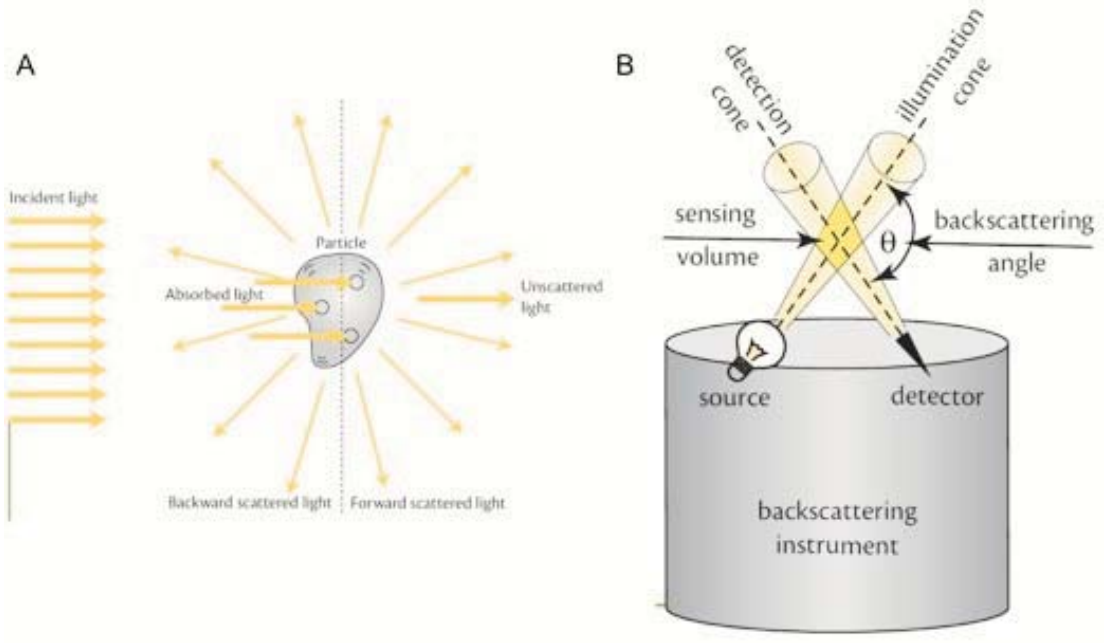

Figure 2: (A) Cartoon showing how attenuation of light occurs through absorption and scattering. Scattered light is divided into the light scattered in the backward and forward directions relative to the direction of the un-attenuated beam. The measurement of backscattering provides information on the abundance and distribution of suspended particles. (B) Schematic of a single-angle backscattering sensor with detector and source embedded within a flat-faced instrument. The light backscattered near the angle, θ, emanates from the volume created by the intersection of the illumination and detection cones. Adopted from Boss et al. (2004).

has its limitations. The necessary conversion between the amount of optical backscattering and the concentration of suspended particles is constrained by the observation that light scattering is a function of various particle properties (e.g., size, shape and internal structure). This complicates the application of this technique in coastal monitoring, in particular, the interpretation of optical backscattering data from time-series measurements and spatial surveys. For example, particles suspended in the water of an estuary may differ from particles suspended in the neighbouring estuary; in this case, establishing estuary-specific conversion factors becomes imperative. A similar problem arises if particles suspended during summer differ from those suspended during winter, or if tidal currents mix waters that contain particles with different physical properties.

We are investigating the relationship between optical backscattering by suspended particles and suspended particle concentration to gain greater insight into the effect particle properties have on their optical measurement. The pressing question is: Do we need region-specific factors to estimate the suspended sediment concentration from optical backscattering data? To begin to answer this question, we are currently studying suspended particles in the coastal waters of Auckland and along the east coast of the Coromandel Peninsula.

One particularly interesting project – funded by the Department of Conservation, Waikato Conservancy Office – saw the development of a new monitoring routine for the water column of Te Whanganui-A-Hei (Hahei) Marine Reserve, a reserve historically troubled by suspended sediment derived from multiple natural and man-made sources. We established a reliable factor to convert optical backscattering data to suspended particle concentration for this reserve. This conversion factor applies to particles suspended through the two processes that apparently contribute most to the Hahei water column problem, erosion of Hahei Beach and construction of residential waterways in nearby Whitianga Harbour (Figure 3).

Our next step will be to determine if this conversion holds for particles from other sources and in other coastal regions. It is early days, but the results so far give us confidence that, in the future, measurement of optical backscattering will be the approach of choice for routine monitoring of sediment suspended in New Zealand's coastal waters.

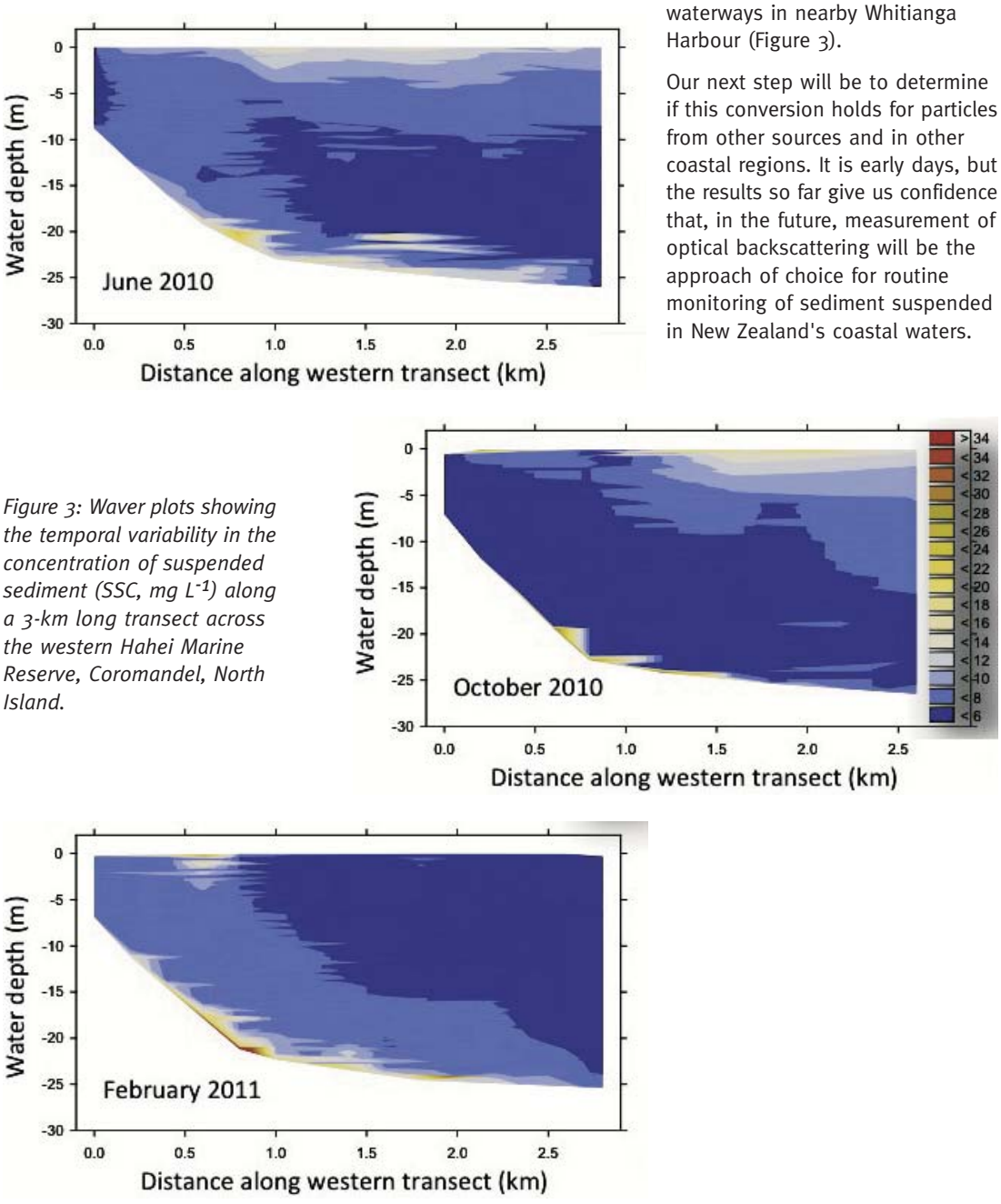

Figure 3: Waver plots showing the temporal variability in the concentration of suspended sediment (SSC, mg L^{-1}) along a 3-km long transect across the western Hahei Marine Reserve, Coromandel, North Island.

The Atmospheric Impacts of Large Tsunamis – Case Study in Java, Indonesia

Christopher Gomez, Natural Hazards Research Centre, Department of Geography, College of Science, University of Canterbury; Iman Soltanzadeh, University Centre for Atmospheric Research, University of Canterbury; and Deirdre E Hart, Department of Geography, University of Canterbury

With the exception of volcanic eruptions, geomorphic events are not commonly thought of as triggering changes in the atmosphere. This perception could be described as an underestimation of the linkages across Earth systems, since geo-events such as large tsunamis can produce significant hydrological and biological effects that, in turn, have the potential to alter local atmospheric dynamics. In *USA Today* (February 1, 2007), meteorologist Bob Swanson was asked if tsunamis could affect the weather. He explained that "apart from a short-lived increase in evaporation in flooded coastal areas, perhaps resulting in a brief period of enhanced rainfall, there would be very little impact of a tsunami on the local weather". In the present contribution, the authors challenge this idea, in order to show that the connections between coastal and atmospheric processes can be far more important than typically assumed.

The aftermath of large tsunamis often includes the presence of shallow saltwater ponding across coastal land for days to months. Such inundation features were observed after the December 2004 tsunami in North Sumatra (Borrero, 2005a; Lavigne et al., 2008), and after the March 2011 event along the Tohoku coast of Japan (Gomez and Wassmer, 2011; Koketsu, 2011; Sato et al., 2011). The persistence of inland saltwater ponding can be exacerbated by the occurrence of tectonic subsidence (Borrero, 2005b), which makes coastal land more prone to inundation at high tide, as observed by the authors, around river mouths in particular, after the 2010 Canterbury earthquakes.

Coastal erosion is another feature of tsunami events which encourages saltwater ponding (Gomez et al., submitted), with tsunami waves having the energy to shave coastal sand dunes down to their beach toe base (Gomez et al., 2008). In these coastal areas, vegetation and crops that have not been uprooted or destroyed by the tsunami waves usually die from soil and ground-water pollution by saltwater. The land is then left bare until halophytes establish or until the salinisation is reversed, which typically takes up to six years in areas where significant subsidence and erosion have not occurred. The present paper uses a numerical model simulation to demonstrate that such tsunami-induced land cover modifications could have strong impacts on local atmospheric processes for weeks to months after an event.

Study area and methods

The study area is the mid-southern coast of Java Island (Indonesia), chosen due to its vulnerability to tsunamis. Java Island is located 45 km above the Benioff discontinuity, at the limit of the Indo-Australian tectonic plate where it plunges below the Eurasian plate. This tectonic hotspot produces numerous earthquakes, which can be associated with submarine landslides occurring in the trench running parallel to the coastline of Java Island. This tectonic setting is very similar to that in Japan which produced the highly destructive March 2011 tsunami. The latest important tsunami produced in the region of Java Island occurred in 2006 and killed over 300 people (Lavigne et al., 2007).

Along the southern coast of Java Island, we simulated the effects of land-cover changes on the regional weather that would be produced by a large tsunami event, in the range of the March 2011 Tohoku tsunami. These changes have been driven by a sea-water flow penetration reaching approximately 10 km inland in low-lying coastal areas. The simulation was produced using the open-source, UNIX-based, mesoscale atmospheric model WRF (Weather Research and Forecasting) (Soltanzadeh et al., 2011).

The WRF model is a numerical weather prediction (NWP) and atmospheric simulation system designed for both research and operational applications. It is a fully compressible, non-hydrostatic model with a terrain-based coordinate system. The model can be used for weather forecasting research, regional climate analysis and for the analysis of the impacts of land-use change. The main purpose of the WRF model is the simulation of day-to-day weather, although it is possible to use the model to study long-term effects using a multi-decadal simulation of the evolution of land-cover patterns. The latter is supported by the input of dedicated boundary condition data created for WRF, the National Centre for Environmental Prediction (NCEP) re-analysis files, which cover the time frame since 1948 (Kistler et al., 2001).

Results

Figure 1 illustrates differences in the forecast rainfall for the Java Island coastal area between simulations with and without the vegetation removal effects of a large tsunami event. Results indicate that tsunami-triggered land-cover change can have a strong impact on local rainfall rates, with an increase up to 15 mm per day simulated for January and February 2006.

Comparisons between Figure 1 (a) and (b) show that the marked rainfall effects of the first month post-tsunami could be rapidly attenuated in a summer monsoon environment such as experienced in Java since the large amounts of rainfall experienced

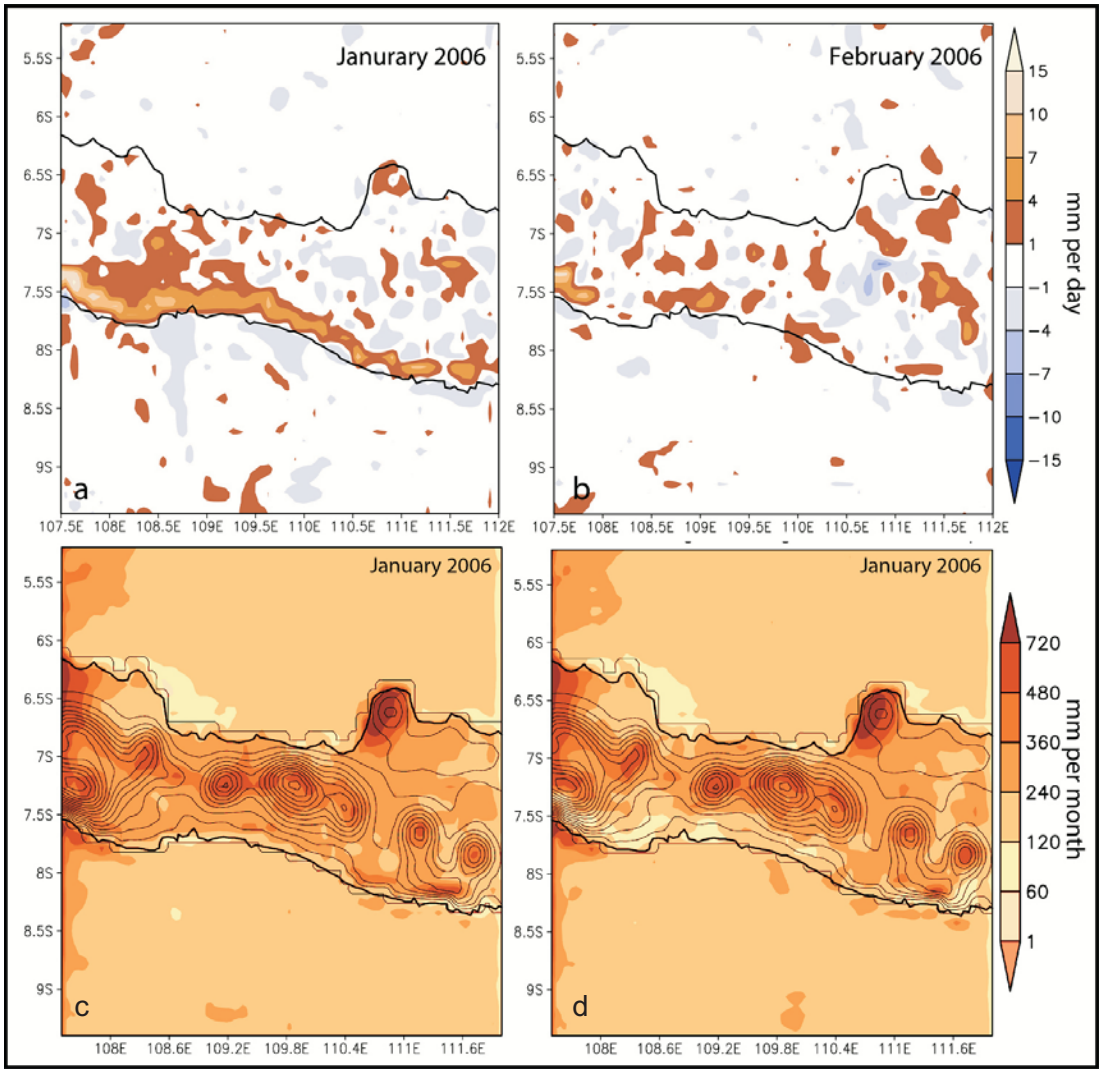

Figure 1: Differences in the forecast rainfall for the Java Island coastal area between simulations with and without the vegetation removal effects of a large tsunami event over average daily (a,b) and monthly (c,d) timescales.

would quickly act to balance the temporary lack of evapotranspired moisture induced by the vegetation destruction. It is also interesting to note that the simulated changes in precipitation concern not only coastal but also inland areas, including the basin of Bandung (7 S, 108.5 E). The simulated rainfall increases in west Java were accompanied by localised rainfall decreases of up to 7 mm per day in February east of Central Java.

Conclusion

Numerical simulations demonstrate how large tsunami events can induce rainfall increases and decreases along the coast that they strike and in climatically linked inland areas. This finding exemplifies the complex interactions that exist at the regional scale within the atmosphere, and between the biosphere, geosphere and atmosphere, resulting in effects on areas away from the tsunami. The changes are induced by temporal inundation and also by the long-term process of environmental resilience, which creates a "new-normal".

References

Borrero, J C 2005a. Field Data and Satellite Imagery of Tsunami Effects in Banda Aceh. *Science* 308-5728, 1596.

Borrero, J C 2005b. Field Survey of Northern Sumatra and Banda Aceh, Indonesia after the Tsunami and Earthquake of 26 December 2004. *Seismological Research Letters* 76-3, 312.

Gomez, C; Wassmer, P; 2011. A New Insight on the 2004 Boxing Day Tsunami in North Sumatra through the Analysis of Videos of the 2011 Tohoku Tsunami: Preliminary Results. Vienna, Austria: European Geophysical Union General Assembly, April 2011.

Gomez, C; Lavigne, F; and Lespinasse, N; 2008. New insights of geomorphologic impacts of the December 2004 tsunami through GPR investigation. In Lavigne F, Paris R, Hadmoko D S (Ed.), *The 2004 Tsunami in North Sumatra*. (300 p.). Jakarta: EFEO.

Gomez, C; Wassmer, P; Kain C L; De Villiers M; Campbell, K; Ward, S; and Moghaddam, A; 2011. Improving the resilience of Japanese Coastal Communities: (1) GIS Evaluation of the Impacts of the 11 March 2011 Tsunami (Rikuzentakata, Iwate Prefecture, Japan) on the Built and the 'Natural' Environment. *Journal of Environmental Management*, (submitted July 2011).

Kistler R; Collins W; Saha S; White G; Woollen J; Kalnay E; et al., 2001. The NCEP–NCAR 50-Year Reanalysis: Monthly Means CD–ROM and

Documentation. *Bulletin of the American Meteorological Society*, 82: 247-267.

Koketsu, K, 2011. Review of the rupture process and ground motions of the 2011 Tohoku earthquake, Japan. Vienna, Austria: European Geophysical Union General Assembly, April 2011.

Lavigne, F; Gomez, C; Giffo, M; Wassmer, P; Hoebreck, C; Mardiatno, D; Priyono, J; and Paris, R; 2007. Field observations of the 17 July 2006 Tsunami in Java. *Natural Hazards and Earth System Sciences*, 7, 177-183.

Lavigne, F; Paris, R; Grancher, D; Wassmer, P; Brunstein, D; Vautier, F; Leone, F; Flohic, F; De Coster, B; Gunawan, T; Gomez, C; Setiawan, A; Cahyadi, R; and Fachrizal; 2008. Reconstruction of Tsunami Inland Propagation on December 26, 2004 in Banda Aceh, Indonesia, through Field Investigations. *Pure and Applied Geophysics*, 166(1-2), 259-281.

Sato, H; Ishiyama, T; Sakai S; Obara, K; Iwasaki, T; Hirata, N; 2011. Geological background and earthquake sequence of the 2011 Tohoku earthquake, Japan. Vienna, Austria: European Geophysical Union General Assembly, April 2011.

Soltanzadeh, I; Azizi, G H; Yousefi, Y; Soltani, M; Mofidi, A; Zarrin, A; Masompour, J; 2011. The Exceptional South Foehn Simulation over Leeward of Alburz Mountain Range Using WRF Model, *Meteorology and Atmospheric Physics*, in press.

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Coastal News

News from the Chair

by Deirdre E Hart

It was great to see so many of you at our 19th annual NZCS conference in Nelson. The annual conference provides us with an opportunity to come together, network and exchange information and best practice ideas and solutions for improving the state and management of New Zealand's coastal environments.

Again this year there were many great presentations and discussions throughout.

Special thanks to our conference sponsors NIWA, Department of Conservation, Tonkin & Taylor, Port Nelson, Discovery Marine Ltd, Shore Processes and Management Ltd, MAF – Aquaculture Unit, and University of Canterbury.

Keeping with the conference theme of communication, and following on from our survey of member's professional identities and coastal interest areas, I'd like to highlight a few of the other avenues and sources of information available for those with an interest in the coast.

In New Zealand these include the following:

- NZ Planning Institute (NZPI – www.planning.org.nz): a professional organisation representing planners, resource managers, urban designers and environmental practitioners. NZPI provides planning related media, courses, events, awards and scholarships, and policy updates through the web and email.
- The Resource Management Law Association (RMLA – www.rmla.org.nz): a resource management and environment forum, which provides related seminars, annual conferences and a professional fellowship.
- Environmental Defence Society (EDS – www.eds.org.nz): involved in resource management capacity building and profiling key environmental issues through seminars, conferences, litigation and publications. The website has some great e-resources.

And internationally:

- The Coastal List (www.coastal.udel.edu/coastal/coastal_list.html): a moderated email list of over 1,700 coastal engineers and scientists, providing a means to communicate jobs, conferences, new findings and calls for action by the group.

  I thoroughly recommend this as a forum in which to pose coastal questions and request information that is not accessible by other means – I have received great responses to posts asking, for example, for people's experiences of different equipment deployment options.
- Coastal News Today (http://coastalnewstoday.com): a US website featuring recent news relating to coastal engineering and environments, including subtopics: beaches, development, environment, oil spills, port and harbour, regulatory policy and waterways.
- Atlantic Coastal Zone Information Steering Committee (ACZISC – http://coinatlantic.ca/): provides information related to integrated coastal and ocean management, coastal mapping and geomatics, with both Canadian and international coverage.
- Australian Coastal Society (ACS – http://australiancoastalsociety.org/): holds annual conferences and provides media and other coastal related updates through their website.

If you have a coastal related website or other resource that you'd like to share with NZCS members, feel free to email me on deirdre.hart@canterbury.ac.nz

Back Issues

All issues of *Coastal News* are available on the NZCS website (www.coastalsociety.co.nz). You will need to log in to access the latest issue, but back issues (from Issue Number 6, April 1996) are freely available.

NZCS Mission Statement

The New Zealand Coastal Society was inaugurated in 1992 "to promote and advance sustainable management of the coastal environment". The society provides a forum for those with a genuine interest in the coastal zone to communicate amongst themselves and with the public.

The society currently has 400 members, including representatives from a wide range of coastal science, engineering and planning disciplines, employed in the engineering industry; local, regional and central government; research centres; and universities.

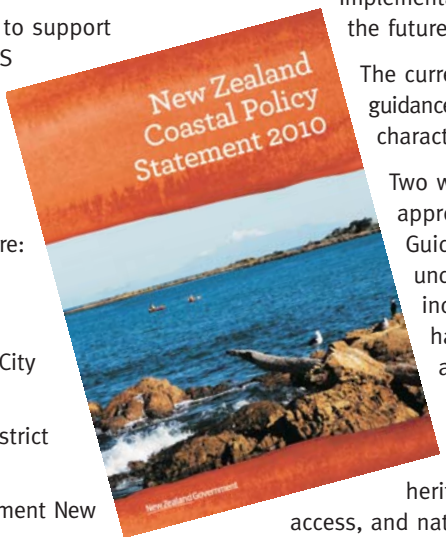
Applications for membership should be sent to NZCS Administrator Hannah Hopkins (email: nzcoastalsociety@xtra.co.nz).

New Zealand Coastal Policy Statement 2010

by Sarah McRae, Department of Conservation

The New Zealand Coastal Policy Statement 2010 (NZCPS 2010) was approved by the Minister of Conservation late last year. Its purpose is to state the policies in order to achieve the purpose of the Resource Management Act 1991 (RMA) in relation to the coastal environment of New Zealand.

A work programme is underway to support the implementation of the NZCPS 2010 with close support from councils through a Local Government – Department of Conservation (DOC) Implementation Steering Group. The local government members are:



- Dominic McCarthy, Auckland Regional Council;
- Campbell Larking, Tauranga City Council;
- Pere Hawes, Marlborough District Council; and
- Clare Wooding, Local Government New Zealand.

A further local government member will be appointed to fill the vacancy left with Justine Brennan's move from Bay of Plenty Regional Council to Smart Growth. The implementation work programme is supported by a small secretariat based at DOC National Office in Wellington.

A National Implementation Plan (NIP) has been developed by the steering group with the aim of ensuring that councils are well informed about the requirements and statutory obligations of the NZCPS 2010 and are supported to implement its policies. The plan recognises that local authorities are the principal implementers of the NZCPS and proposes targeted work streams to support councils in their work.

There are four work streams identified in the plan:

1. Engagement – to build awareness of the NZCPS 2010 and to engage coastal planning practitioners and decision-makers.
2. Guidance and supporting measures – to provide web-based guidance and other resources councils will find helpful to their role of implementing the NZCPS 2010. Initial guidance material covering transitional issues is already available on the DOC website. Further guidance is in development and will be online late this year.
3. Implementation – to secure recognition of the NZCPS 2010 through the process of policy and statement plan reviews. This work stream will be particularly informed by the steering group and other feedback on priority issues or projects where national implementation advice and support would be beneficial.
4. Monitoring – to support monitoring and evaluation of the NZCPS 2010 implementation. The results of this work will be used to adjust implementation priorities as well as inform the future NZCPS reviews.

The current focus is on engagement, guidance and progressing work on natural character methodologies.

Two workshops have been held on approaches to natural character. Guidance development is currently underway on a range of policy areas including natural character, coastal hazards risk, water quality, aquaculture, biodiversity, characteristics of the coastal environment, tangata whenua and Maori heritage, historic heritage, public open space and access, and nationally significant surf breaks.

For further information on the NZCPS please visit www.doc.govt.nz/coastalpolicy or contact Sarah McRae at smcrae@doc.govt.nz.

Kaikoura Coast. Credit B. Smith, DOC.

Driftwood, Opoutere Beach, Coromandel Peninsula. Credit: DOC.

Aquaculture – Looking to the Future

by Dan Lees, Director, Aquaculture Unit, MAF

On 1 October the new aquaculture legislative regime came into effect. The legislation is a consents-based regime that is intended to level the playing field for aquaculture development. At the same time, the new legislation puts safeguards in place to better manage coastal space and ensure development can only occur within environmental limits.

Why aquaculture?

By 2020, aquaculture is expected to make up 58% of worldwide seafood production. Here in New Zealand, aquaculture is already the fastest growing sector of our seafood industry. In 2010 aquaculture sales totalled $380 million and accounted for almost 20% of total seafood export earnings.

With its relatively clean waters and strong environmental record, New Zealand is well placed to help meet global demands for high-quality seafood products farmed in an environmentally sustainable way. An essential part of this is making sure the development of marine farming takes place within acceptable environmental limits and fits in with the way others want to use the coastal marine area.

Consents-based regime

The new legislation removes the requirement for an aquaculture management area (AMA) – a spatial planning tool – to be in place before marine farming consent applications can be made. This means applying for a marine farm now follows the same process as seeking a resource consent for any other activity in the coastal marine area.

To make the transition as smooth as possible, existing marine farms are no longer called "deemed AMAs" and are now considered farms with resource consents. Outstanding and frozen applications from previous regimes can now be processed in the order in which they were originally received. Regional councils tell us that some of these older consents are already working their way through the system.

Frozen applications in areas where aquaculture is prohibited in a regional coastal plan, however, are not able to proceed unless the prohibition is removed via a plan change. These applications will be cancelled on 31 December 2014 if a plan change has not been made.

Regional councils – mission critical

Under the legislation, regional councils and unitary authorities retain primary responsibility for aquaculture planning and consenting, including:

- allocating coastal space;
- administrating existing coastal permits, including all pre-RMA marine farming licences, leases and permits;

Members of the MAF Aquaculture Unit. From left to right: Paul Creswell, Dan Lees, Ann Sheridan, Richard Fraser, and Mat Bartholomew. Not pictured: Michelle Pawson and Michael Nielsen who are based in Dunedin.

- assessing the impact of a proposed aquaculture activity on fishing and fisheries resources.

Regional councils also have three new powers under the legislative reforms:

- they can request from the Minister of Conservation the use of an alternative allocation tool;
- they can request from the Minister responsible for Aquaculture a suspension on the receipt of new applications to occupy space for aquaculture activities;
- they can request from the Minister responsible for Aquaculture that aquaculture applications be processed and heard together.

Assisting local authorities to move to the new regime has been one of the Aquaculture Unit's top priorities. This has included being in regular contact with local authorities and developing resources that explain aspects of the new legislation. We've also set up a Regional Council Reference Group to ensure that the information we're giving to local authorities is exactly what they need.

Government's adviser

The Aquaculture Unit is also developing a plan that will include objectives and actions related to the implementation of the outcomes of the reforms and other government efforts that can foster aquaculture growth.

The plan is currently being developed and includes input from across the aquaculture industry, iwi, regional councils, science providers, and other stakeholders.

We're interested in hearing from stakeholders to provide their views on the plan. If you're interested in participating in this process, email aquaculture@fish.govt.nz.

Looking Outside In

Axford Fellows Offer Insights into Managing New Zealand's Marine Environment

Over seven months in 2011, Axford Fellows Ian Boisvert and David Wiley researched two issues that have important implications for New Zealand's marine environment: New Zealand's ocean renewable energy resources policies and how scientists can improve the influence of their research on decision-making for the management of marine protected areas.

The Ian Axford (New Zealand) Fellowships were established by the New Zealand Government to reinforce links between New Zealand and the US. For these two Axford Fellows that mission was easily accomplished with both Ian and David becoming acclimated to New Zealand and their host organisations within just a few days of their arrival.

Along with two other Axford Fellows, Ian and David reported their findings in August. The full reports are available to download from the Fulbright New Zealand website at www.fulbright.org.nz.

Offshore renewable energy – a New Zealand conundrum

Ian Boisvert is a renewable energy attorney based in San Francisco, California. While researching policy for the management of New Zealand's ocean renewable energy resources – wave power, tidal currents, and offshore wind – Ian was hosted by the Energy Efficiency and Conservation Authority (EECA).

In his report, *Lifting the Looking Glass: Tradable occupation could facilitate ocean renewable energy in New Zealand*, Ian found that while New Zealand has abundant ocean renewable energy resources, we are currently severely constrained in how we allocate coastal space for renewable energy development. At the crux of this issue is the Resource Management Act 1991, which he says suffers from "paradoxes, inconsistencies, and too much discretion for local authorities".

He says, "New Zealand's marine environment has many assets to lend itself to renewable energy development, but currently developers are reluctant to invest here because of what they perceive as an intractable spatial allocation regime".

While New Zealand has declared the national importance of renewable energy and addressed ocean renewable power development through the New Zealand Coastal Policy Statement, the New Zealand Energy Strategy, and the National Policy Statement for Renewable Energy Generation, developers face two significant challenges.

1) Renewable energy technology is much more expensive than proven renewable devices. The OECD estimates ocean renewable generating costs will average US$281 per megawatt-hour (MWh) over the next decade while onshore wind will average US$85 per MWh over the same period. Reversing this trend falls to developers to engineer more efficient designs, and operations and maintenance procedures.

2) Whereas coastal space is plentiful, gaining access for commercial activity is severely challenging and undependable. The only way developers can gain access is applying for a coastal permit. In his report Ian notes that "inevitably, conflict arises because regional councils can displace those existing users against their wishes". He says that as a tool "coastal permits tend to inflame rather than quell conflict".

2011 Ian Axford (New Zealand) Fellows in Public Policy: Ian Boisvert, Victoria Johnson, David Wiley, and Jonathan Karp with David Huebner, US Ambassador to New Zealand (centre). Credit: Fulbright New Zealand.

To tackle these challenges Ian has three major recommendations: that ocean renewable energy developers, as a group, build a nationwide rapport; that local authorities strengthen their processes and accountability; and that central government allows commercial and cultural coastal users the ability to privately trade occupation of coastal space.

Resolving coastal space conflict is the most critical solution because it will "increase efficiency and transparency, reduce economic waste, and build a new market for public revenues". He proposes creating a constrained regime of tradable occupation rights (TORs) which would allow users to allocate marine space between themselves contingent on not violating ecological thresholds set through coastal permits. Ian says there is also the opportunity to raise public revenues from the TOR model which is currently a lost opportunity for the government.

While not an easy solution, Ian says "this type of allocation method would encourage users to resolve issues across sectors rather than just within one sector as currently happens".

Coastal News

The role of science in decision-making processes

David Wiley from the US National Oceanic and Atmospheric Administration's Stellwagen Bank National Marine Sanctuary in Scituate, Massachusetts, was based at the Department of Conservation, where he researched how scientists can improve the influence of their research on decision-making for the management of marine protected areas.

By surveying the acceptance of information from various sources by different stakeholders in the marine environment, David disproved the traditional notion that scientific research is viewed as credible and unbiased because it is conducted in isolation from those impacted by its results. He found instead that such research can easily be discounted by other stakeholders because of preconceptions and perceived biases. His findings suggest that research that ignores social concerns will have less success in being considered for problem-solving and decision-making.

David terms the ability of information to influence stakeholder decisions "social power", with increased social power associated with increased positive influence. Results from stakeholder interviews and analysis indicate that one way scientists can reduce the social concerns that invalidate their findings is to increase the inclusive aspect of their research.

David identifies a "Ladder of Scientific Participation" in his paper to assist researchers with better understanding levels of stakeholder participation in research and the potential outcomes of that participation.

Rungs 1 to 3 of the ladder are "first-order" methods, which are typical of traditional forms of stakeholder participation. At this level stakeholder participation is limited to reading scientific information or listening to scientific information summarised by managers. First-order participation has low social power because the numerous barriers to accepting information as identified in David's study are ignored. The outcome of first-order participation is that stakeholders selectively accept information that bolsters their position and reject information that could undermine it.

Rungs 4 to 6 of the ladder consist of "second-order" methods, demonstrating increased participation. Second-order techniques would consist of scientists presenting their research design to stakeholders prior to initiating an investigation, providing stakeholders with updates on research as it is being conducted, and providing stakeholders with the opportunity to visit and observe the research as it is being conducted. The outcome of second-order participation is that scientists and stakeholders are educated about the research and the conditions under which it will occur. Second-order methods add social power to research by increasing stakeholder confidence that their concerns are being understood and addressed.

Rungs 7 to 9 of the ladder are "third-order" methods, incorporating maximum levels of participation. Rung 7 involves stakeholders participating in the selection of scientists conducting the research, allowing the research to be conducted by scientists with whom opposing interests have confidence. Increased participation (rung 8) would involve stakeholders contributing to the selection of the scientists conducting the research and the research design that they would use. The top rung of the ladder (rung 9) would have stakeholders or stakeholder scientists directly participating in the research. This would assure that the greatest diversity of interests and perspectives were included in the research and that the concerns of all were being addressed. As a word of caution, David says these third-order methods can sometimes become expensive, logistically difficult, and paralysed by infighting, but if done well they have the greatest potential for successful outcomes.

Overall, David's findings suggest that inclusive research involving a "team of rivals" is most likely to be accepted by all parties and enacted into policy, and recommends a multi-stakeholder approach to research in order to maximise its acceptance.

Upcoming Event – Getting to Know Groundwater

Getting to know groundwater course – practical training in hydrology for non-specialists who work with groundwater.

Scheduled for 12 and 13 December 2011 in Wellington, this course is aimed at non-specialists who require a basic understanding of groundwater processes, behaviour, and management. The course will be led by Prof Jenny Webster Brown, Director, Waterways Centre for Freshwater Management, University of Canterbury/Lincoln University, and Dr Ryan Vogwill, Department for Environment and Conservation, Western Australia. A selection of local presenters from industry, government and universities will also be presenting, including Chris Daughey, Vince Bidwell and Howard Williams.

Visit http://waterways.ac.nz/events.shtml to learn more.

About *Coastal News*

Coastal News is published 3x each year. We welcome contributions for each issue. Please contact *Coastal News* editor Shelly Biswell at shelly@biswell.net if you'd like to submit a news brief or article. The submission deadline for the next issue is 10 February 2012.

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News from the Regions

Northland Regional News

Michael Day, Regional Co-ordinator

Regional policy statement

The draft new regional policy statement (RPS) for Northland is due to be released in November 2011. In the RPS, management of the coastal environment will be addressed in the Land and Water, Regional Form and Infrastructure, Natural Hazards, and Special Places sections. More information on Northland's new draft RPS can be found at www.nrc.govt.nz/newrps.

Plan Change 4

The purpose of Plan Change 4 to the Northland Regional Coastal Plan was to provide a framework for creating aquaculture management areas (AMAs). It was notified in October 2006 and is currently in the Environment Court (12 appeals). None of the appeals have been resolved. Negotiations have been put on hold since mid 2010, with the agreement of the court and parties, awaiting the new aquaculture law coming into force.

At its September 2011 meeting, Northland Regional Council (NRC) considered whether it should withdraw the plan change given that the original reason for starting it (AMAs) no longer exists. The council decided that there was still value in the plan change and decided not to withdraw it. Now that the new law has been enacted, negotiations on the appeals will continue.

Maritime updates

In preparation for the busy season ahead, several navigational safety improvements have been made in our harbours. In the Bay of Islands, these include the installation of new lights on the Kerikeri Inlet beacons, a new port hand buoy off Waitangi Wharf to assist cruise ship tenders, and a newly designed cardinal buoy off Whale Rock which is expected to handle exposure to the open ocean better.

Te Ti Beach in Waitangi has been made safer for swimmers with a new reserved area set aside for commercial jet ski operations.

Consents

Opua Marina – Far North Holdings Limited has applied for a number of consents to extend Opua Marina. A number of submissions have been received and the applicant is considering the contents of the submissions before deciding its next step.

Kaipara Harbour tidal turbines – The Minister of Conservation has issued her decision (confirming the Environment Court's recommendation that consents be issued) on the restricted coastal activity elements of the proposal for up to 200 tidal turbines on the seafloor at the entrance to the Kaipara Harbour.

Mangrove removal consents – In 2010 the NRC established a Mangrove Management Support Programme and 10 community-based projects were supported through the programme. Six of the applications for resource consent were lodged and have been publicly notified with a range of submissions having been received.

A proposal to remove all mangroves from Mangawhai Harbour (87 ha of mangroves) was declined by an independent hearings panel. The applicant has appealed the decision and a hearing is due to take place in the Environment Court in early 2012.

Review of deemed coastal permits for aquaculture – The NRC undertook a review of the oyster farm leases that became deemed coastal permits under the Aquaculture Reform (Repeals and Transitional Provisions) Act 2004. The review resulted in conditions which were consistent with the Resource Management Act 1991 and included the requirement for a bond to be paid to cover the costs of clean up in the event of abandonment of the farms, being set at $9,000 per developed hectare or $6.95 per metre.

The reviewed consents also provided for an alternative to a bond (e.g., a fidelity fund) to be set up provided the particulars were agreeable to the NRC. A number of the deemed permit holders objected to the decision – mainly the matter of the bond – and the NRC held a further hearing for these objectors. An independent commissioner heard the objections and issued his decision which upholds the NRC's initial decision but includes a new condition which would allow individual permit holders to have a lesser bond if they could show that a lesser amount would be needed to clean up their individual farm. The deemed permit holders now have the opportunity to appeal the commissioner's decision to the Environment Court.

CoastCare/Safe Beach Driving Programme

During winter 2011, CoastCare planting days were held at Ruakaka, Waipu Cove, Tapeka, Long Beach (Russell), Taipa, Tauranga Bay, Rangiputa, and Waipapakuri Ramp (Te Oneroa A Tohe) with plants provided through NRC's Environment Fund.

The Northland Safe Beach Driving Programme will be running again this summer for the sixth consecutive year due to concern about dune damage and risk to the safety of beach users from inappropriate vehicle use. The programme is led by the NRC with support from DOC, Northland's three district councils, the Police, other stakeholder groups, and the community.

Auckland Regional News

Hugh Leersnyder, Regional Coordinator

Auckland planning

The Draft Auckland Plan and three of its key supporting plans were released by the Auckland Council for public input on 20 September 2011, with the submission period closing on 25 October 2011. These plans will guide Auckland's development over the next 20 to 30 years and are fundamental to

achieving Auckland Mayor Len Brown's vision "to make Auckland the most liveable city in the world".

The overarching Draft Auckland Plan sets out long-term social, economic, environmental and cultural objectives for the region. It describes existing land-use patterns and how Auckland will grow and develop in the future. The future locations of critical infrastructure facilities such as transport, water supply, wastewater and stormwater, open space and social infrastructure have been identified. Areas of national and regional significance for ecology, recreation and open space, landscapes, heritage, natural features and environmental importance are shown in the plan along with the policies, priorities, land allocations and investments that will be needed to achieve the Auckland Plan's strategies.

While the values of Auckland's coastal environment permeate through the plan, Chapter 5, on Auckland's Environment, sets a priority to "treasure our coastline, harbours, islands and marine areas". Two directives under this priority set a path as to how this will be achieved. Firstly there is a directive to protect coastal areas, particularly those with high values, from the impacts of land-based development. Secondly, it is proposed to prepare a marine spatial plan for the Hauraki Gulf, Kaipara Harbour, and Manukau Harbour to ensure integrated and sustainable management of the region's marine areas.

The three supporting plans, the Draft Auckland City Centre Master Plan, Draft Economic Development Strategy, and Draft Waterfront Plan are prepared to work in harmony and complement the "mother ship" Auckland Plan. Of these three plans, the Draft Waterfront Plan has direct and far-reaching implications for the city's valued waterfront from Harbour Bridge Park in the west to TEAL Park in the east.

The Draft Waterfront Plan builds on previous plans and strategies prepared by the former Auckland City Council and Auckland Regional Council. It sets out concepts to draw people to the waterfront and improve access with public transport and pedestrian priorities. Improved facilities for cruise liners and ferry operations are proposed along with redevelopment of the previously industrial Wynyard Quarter. More open space and mixed-use development are planned for the western Westhaven Marina precinct, while Ports of Auckland Ltd continue their trend of consolidation to the east, releasing land, wharf and water space for more public activities.

The Draft Waterfront Plan builds on the value and interest of a "working waterfront" and encourages a diverse range of commercial, recreational and social activities to coexist in a vibrant and attractive community.

Taranaki Regional News

Erin Zydervelt, Regional Coordinator

Coastal structure maintenance and improvement

The New Plymouth District Council (NPDC) has been busy maintaining and improving some of our local coastal amenities.

Waitara River – The Waitara River has concrete training groynes at the mouth, these structures have been in place since 1885. A large chunk of concrete was lost from the top of one of the groynes into the channel of the river mouth. This large piece of concrete was posing a navigational hazard to boats, and needed to be removed. This posed some issues as it was a large and heavy piece of concrete sitting on soft substrate, in the middle of a large river mouth. This meant that heavy land-based machinery could not be used as it would be underwater, and the sediment would not support it. A crane from a boat was not an option due to the weight of the concrete. The solution was an unusual one. Commercial divers drilled holes into the offending slab, waited for all the right conditions and notified all the correct people, then filled these holes with explosives and blew it up! The operation was a success; the hazard has now been removed.

Waitara River mouth showing concrete training groynes and channel. Credit: Erin Zydervelt.

Urenui Beach – One of our most popular beach camps has serious erosion issues (quite possible end effects) along the stretch of foreshore that is not protected by the seawall, where the beachfront meets the river mouth. NPDC will be conducting a sand push up along this area to protect the numerous amenities behind the foreshore.

Urenui Beach showing erosion of foreshore. Credit: Erin Zydervelt.

Fitzroy Beach – The car park of one of our most popular beaches, Fitzroy Beach, is prone to flooding during periods of high rainfall. The engineers at NPDC have been hard at work to find the best solution for this flooding problem. The solution was to increase the size of the stormwater catchment and pipe feeding the outlet on the beach, to enable it to deal with the runoff from the large hill leading to the beach car park.

Canterbury River Mouths Seminar

by Bryan Jenkins, Waterways Centre for Freshwater Management

In late winter the Waterways Centre for Freshwater Management convened a seminar on Canterbury river mouths. The seminar brought together scientists who are conducting research in relation to river mouths and managers of Canterbury catchments and coastline.

In relation to coastal water bodies, Bob Kirk reminded us that 15 of the 23 major river mouths are hapua: river mouths displaced from the terrestrial river alignment through longshore drift with a lagoon and beach barrier. Of the other eight, four are waituna lakes (coastal processes close the exit to the sea for most of the time with coastal lakes forming behind coastal barriers), with only four being described as estuaries.

Ton Snelder briefly summarised the "controlling factors" classification of estuaries based on three factors: tidal forcing, river forcing, and basin morphometry. This presentation generated significant discussion on the need for refinement of the classification to address the significant longshore drift and river sediment movements influencing coastal water bodies in Canterbury.

Three presentations demonstrated the significance of different time scales on coastal processes. Deirdre Hart summarised some of her research findings on lagoon dynamics around the geomorphological processes of lagoon closure, barrier breaching, longshore transport, and storm wave wash-over. Murray Hicks described the different morphological states for littoral drift bypassing of river mouths and how these patterns are determined by river and coastal processes but can persist for long periods until broken by big floods, big coastal storms, or human intervention. Finally, Catherine Reid presented the findings of Steve Kitto's master thesis evaluating pollen and diatom assemblages from sediment cores from Te Waihora/Lake Ellesmere. This provided a summary of the 7,000 year history after the Kaitorete Barrier reached Banks Peninsula creating a freshwater lake.

Graeme Horrell indicated that instream flow incremental methodology (IFIM) techniques for setting environmental flows on main stems of rivers did not resolve the flow requirements for fish passage at river mouths.

Don Jellyman advised that 17 of the 38 native fish species are migratory and need access to the sea and two exotic species popular with anglers (Chinook salmon and brown trout) either need or like access to the sea. He also indicated that while there are seasonal fluctuations, fish passage through river mouths is relevant throughout the year. Mike Hickford reported on some of the findings in relation to whitebait of the marine ecology research group work on improved management of critical stage-specific coastal habitats for native fish, in particular, that most whitebaiting rivers now have no effective spawning habitat.

Hurunui River mouth. Image credit: Waterways Centre.

Ken Hughey presented on birdlife habitat related to coastal water bodies reminding us that Te Waihora/Lake Ellesmere is the single most species-diverse bird site in New Zealand. He noted that while there is recognition of the importance of the river-sea interface for birds as habitat and migration pathways, we do not have a conservation strategy for this important area.

In relation to water quality, John Zeldis discussed recent research into the effect on water quality from the removal of the wastewater outfall from the Avon Heathcote Ihutai Estuary. The research also shows the effects of the return of raw sewage and the effects of liquefaction as a result of the recent earthquakes.

Francine Smith presented part of her research on cyanobacteria in the Selwyn River and Te Waihora/Lake Ellesmere. She is interested in what causes toxic outbreaks of *nodularia* strains in the lake and *phormidium* strains in the river. Preliminary results indicate most toxin production occurs in the very early exponential growth phase and appears to be nitrogen limited.

On the management side, Justin Cope summarised the coastal monitoring data collected by the regional council to inform management decision making. Tim Davie indicated the difficulty of flow measurements at river mouths. Adrian Meredith outlined the water quality measurement programmes in lower river reaches. Ross Vesey indicated the increasing demand for gravel placing greater pressure on fluvial gravel extraction. He also discussed the triggers considered for artificial openings of river mouths: flooding in lower reaches, erosion, drainage, lagoon water quality, and fish passage.

Further seminars are proposed on issues raised during this seminar. The Waterways Centre is also compiling a database of references related to river mouth science and management. Seminar PPTs can be viewed at www.waterways.ac.nz.

The Waterways Centre is a joint initiative between the University of Canterbury and Lincoln University. It is a centre for both education and research. The centre is focused on improving knowledge-driven management of freshwater resources in Canterbury, and aims to address national and international water management issues.

Coastal News

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