Coastal News

Te Hunga Takutai o Aotearoa

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The NZCS committee wish to extend our thoughts and sympathies to members and friends affected by the events in Canterbury. While many affected members in Canterbury will be part of organisations that are able to cater for their immediate and future needs, the NZCS would like to offer support where it can through the network of members around NZ and the committee, especially through the next few weeks and months while people try to get back to normality. Please don't hesitate to contact any members of the committee if help is required.

www.coastalsociety.org.nz

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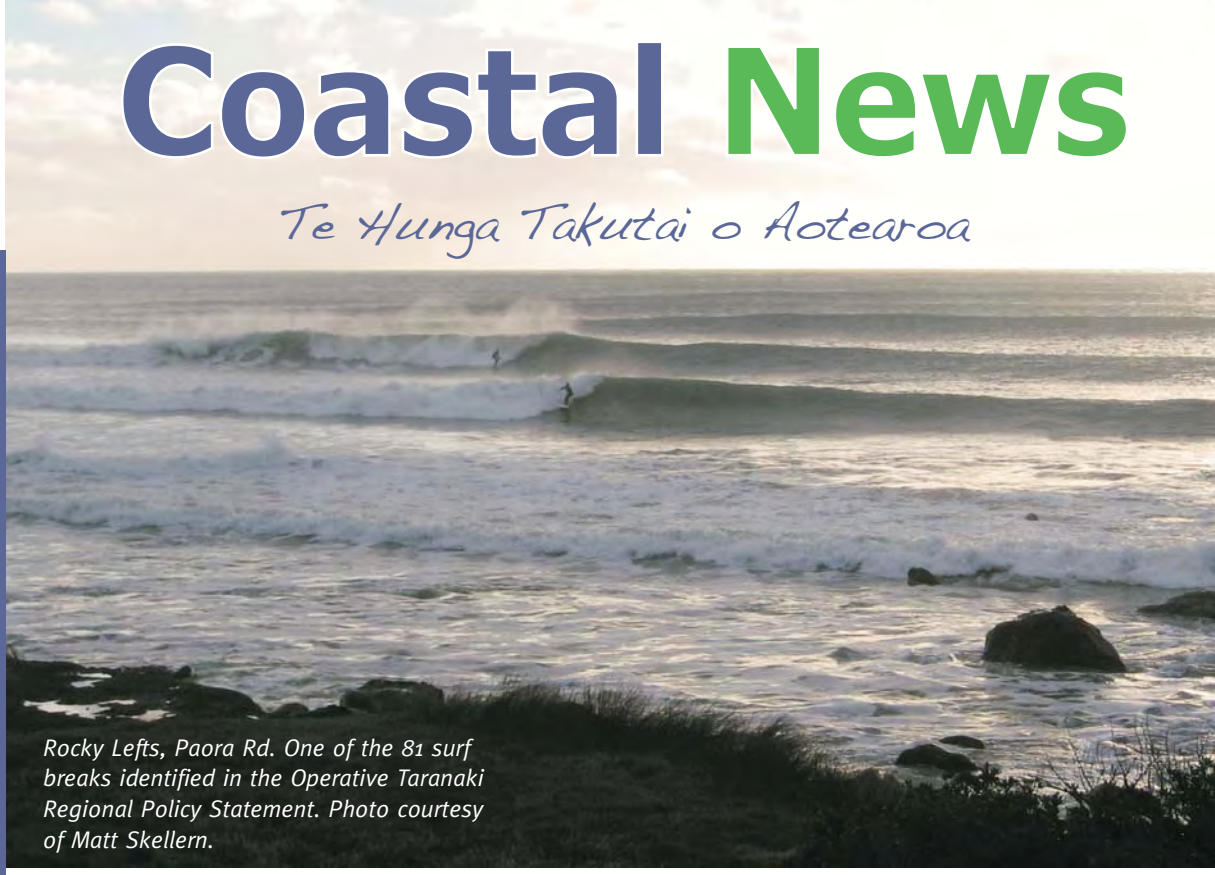

Rocky Lefts, Paora Rd. One of the 81 surf breaks identified in the Operative Taranaki Regional Policy Statement. Photo courtesy of Matt Skellern.

Planning Tools for Surf Breaks

by Bailey Peryman and Matt Skellern

Preservation of coastal areas valued for surf riding is gaining momentum through a variety of planning mechanisms. This has come about through the movement of surf communities, individuals and organisations toward proactively preserving surf breaks as finite, natural resources. This movement is, at least in part, in response to the many surf breaks that have been degraded both overseas, and along our coastlines.

Surfing areas can be degraded in many ways, including impacts on their wave quality, access to a break, and their water quality. An international example of a degraded surf break occurred in 2005 when the World Championship Tour at Mundaka, Spain was cancelled due to sub-standard wave quality during the event. The poor wave quality was the result of localised silt dredging.

Closer to home, surfers at Whangamata recently suffered ailments ranging from inflamed cuts to nausea to conjunctivitis after surfing Whangamata bar. This was the result of wastewater entering the surf zone after a heavy rainfall. Similar water quality issues were apparent during the Whangamata Billabong Pro, a six-star event on the Surfing New Zealand's elite circuit.

An international movement

Since 2006, Australia has established 11 National Surfing Reserves. In July 2010, the US state of Hawaii passed laws to protect the famed breaks around Waikiki and the North Shore on the island of Oahu. In New Zealand, the Taranaki region has recognised 81 surf breaks in its Regional Policy Statement. More recently, the New Zealand Coastal Policy Statement (NZCPS) has afforded protection to 17 of the country's top surf areas (see Schedule 1). Many other countries are preparing for the preservation of surf breaks using similar techniques.

On top of these national and regional approaches, the World Surfing Reserves programme was launched in 2009 by the Californian-based Save the Waves Coalition. With key partners, the International Surfing Association and National Surfing Reserves, the initiative aims to create a "UNESCO of surfing" to educate the world on the value of treasured surf sites and assist local communities with surf break protection[1].

Malibu's Surfrider Beach, California, USA, became the first dedicated World Surfing Reserve in October 2010. Further World Surfing Reserves at Manly Beach, Sydney, AU; Santa Cruz, California, USA; and Ericeira, Portugal have been confirmed.

Recently, New Zealand's achievements with the NZCPS were commended by National Surfing Reserves, Australia and World Surfing Reserves as being a world first in protecting surf breaks at the highest level.

Surf breaks in the NZCPS

Surf-break protection policy came about due to the significant response from surfers and surfing-related organisations to the review of the NZCPS 1994. Around the time of the review New Zealand surfers were questioning what effect the

1 www.surfingreserves.org, retrieved 01/03/11.

The Whangamata bar over Anniversary weekend 2011. This day the bar was known as the 'Chocolate Bar'. Photo courtesy of COL/SURF2SURF.com.

Whangamata marina proposal would have on the world-class surf break located at the harbour's ebb-tidal delta. This proposal led to the formation of the Surfbreak Protection Society, which subsequently wrote the NZCPS an issues and options paper requesting that surf breaks be provided for. The proposed NZCPS was released in 2008 and included Policy 20 'Surf breaks of national significance', which stated:

> The surf breaks at Ahipara, Northland; Raglan, Waikato; Stent Road, Taranaki; White Rock, Wairarapa; Mangamaunu, Kaikoura; and Papatowai, Southland, which are of national significance for surfing, shall be protected from inappropriate use and development, including by:
>
> (a) ensuring that activities in the coastal marine area do not adversely affect the surf breaks; and
>
> (b) avoiding, remedying or mitigating adverse effects of other activities on access to, and use and enjoyment of the surf breaks[2].

After the board of inquiry process, the NZCPS 2010 was gazetted on 3 December 2010, including Policy 16 (replacing former policy 20), which states:

> Protect the surf breaks of national significance for surfing listed in Schedule 1, by:
>
> (a) ensuring that activities in the coastal environment do not adversely affect the surf breaks; and
>
> (b) avoiding adverse effects of other activities on access to, and use and enjoyment of the surf breaks[3].

Key expert witnesses for the Surfbreak Protection Society to the board of inquiry provided evidence on oceanography, coastal science, planning and perspectives from the surfing industry. This leading evidence should be referred to in developing resource management approaches toward surf-break preservation.

Further to Policy 16, the NZCPS 2010 also contains a definition of surf break that describes a 'surfable wave' and 'swell corridor'. Key changes to surf-break policy through the board of inquiry process addressed the lack of justification for the named breaks in Policy 20, removed reference to remediation and mitigation of adverse effects (which is not applicable to surf breaks), and most importantly replaced 'coastal marine area' with 'coastal environment'.

The landward component of the coastal environment is essential for dealing with the maintenance of water quality and access to surf breaks. This is an area where regional policy statements can provide guidance to district plans. Also catchment planning and coastal spatial planning can assist with managing landward aspects, as well as in the coastal marine area. In evidence produced by the Surfbreak Protection Society, the seaward component of the coastal environment was queried. This was in regard to activities in the swell corridor beyond the 12 nautical mile mark. There are potential activities in the swell corridor beyond this boundary that could adversely affect surf breaks. For example, large-scale ocean energy generation, marine farming or seabed mining. This raises questions on the ability of the RMA to address these issues, and the need for ocean policy.

2 Department of Conservation, 2008. *Proposed New Zealand Coastal Policy Statement 2008*. Retrieved 21/10/10 from www.doc.govt.nz/upload/documents/getting-involved/consultations/current-consultations/proposed-nzcps-2008-high-res.pdf.

3 Department of Conservation, 2010. *New Zealand Coastal Policy Statement 2010*. Retrieved November 21, 2010 from www.doc.govt.nz/upload/documents/conservation/marine-and-coastal/coastal-management/nz-coastal-policy-statement-2010.pdf.

Northland	Peaks – Shipwreck Bay; Peaks – Super tubes – Mukie 2 – Mukie 1
Waikato	Manu Bay – Raglan; Whale Bay – Raglan; Indicators – Raglan
Taranaki	Waiwhakaiho; Stent Road – Backdoor Stent – Farmhouse Stent
Gisborne	Makorori Point – Centres; Wainui – Stock Route – Pines – Whales; The Island
Coromandel	Whangamata Bar
Kaikoura	Mangamaunu; Meatworks
Otago	The Spit; Karitane; Murdering Bay; Papatowai

Schedule 1 – Surf Breaks of National Significance

Protecting a diversity of surf breaks

The board of inquiry in its findings made the following statement:

> "We conclude that there should be no criteria in the policy [NZCPS 2010] for selecting further surf breaks of national significance given that there could be developments in the methodology in identifying and rating natural surf breaks. For example, we note the strong plea by many submitters for ensuring diversity of surf breaks so that all surfing skill levels are provided for[4]."

This plea was accommodated by the Minister of Conservation by including surf breaks as part of the natural character of the coastal environment in Policy 13 of the NZCPS. Policy 15 is also relevant as surf breaks are natural features within the seascape. Councils are now tasked with considering how they will give effect to mapping and identifying natural character and natural features in regional policy statements and plans.

A regional perspective

At the regional level, work has been conducted on the methodology of identifying and rating natural surf breaks. This includes the formal process Taranaki went through to identify surf breaks. Also, the former Auckland Regional Council carried out work on the methodology for assessing surf breaks, although this has not resulted in any public policy to date.

During summer 2010-2011, the Bay of Plenty Regional Council and Gisborne District Council engaged Bailey as a summer student to complete a study on surf breaks for each region. While these studies build on existing approaches to surf-break identification and methodology for assessment, Bailey's work focused on engaging the public on surf-break preservation. A variety of local participants from the surfing community, surf industry, economic development, surf lifesaving, territorial authorities and tangata whenua were asked to provide input. This was via workshops, a series of interviews and other communications.

There are a number of variations between the studies as a result of different statutory demands in each of the study areas. The outcomes of the Gisborne District Council study are pending at the time of writing.

The Bay of Plenty Regional Council study identifies and describes regionally significant surf breaks. It then attributes a set of outstanding characteristics and values to each break, through a set of assessment criteria that were developed in consultation with the public. The study reveals that the community is strongly in favour of continuing a proactive approach to protecting surf breaks as regionally and locally significant natural resources.

4 Department of Conservation, 2009. *Proposed New Zealand Coastal Policy Statement 2008: Board of Inquiry Report and Recommendations*. Retrieved October 21, 2010 from www.doc.govt.nz/upload/documents/getting-involved/consultations/closed-consultations/nzcps.

The Banzai Pipeline, on Hawaii's North Shore, during 2009 Pipe Masters. Senator Fred Hemmings made this wave part of the Hawaiian Surfing Reserves, he also ran the first Pipe Masters event in 1971. Photo courtesy of Matt Skellern.

It also identified that surf breaks are important for many types of recreation. This can include the enjoyment from the passive onlooker, surfing, surf lifesavers, body surfing, kite surfing, paddle boarding and all other forms of surf riding.

The Bay of Plenty Regional Council study has demonstrated that surfing is a lifestyle for many, and is strongly embedded in the social fabric of many coastal communities. The study confirms that within the region surfing provides an economic benefit and generates tourism. Surf breaks were also identified as significant for cultural heritage, including the connection for Maori. It is understood that early Maori practised the art of wave riding out of necessity and for leisure. The Bay of Plenty Regional Council study further demonstrates that the values of surfing span the four well-beings – social, economic, cultural and environmental.

For planning and giving effect to the NZCPS 2010, early indications from both studies suggest a collaborative approach is most effective for policy development at the regional and district council levels. Both studies provide valuable insights for planners and others in applying this new area of resource management policy.

Bailey Peryman is a fourth-year Environmental Management student at Lincoln University interested in the development of surf-break policy provisions within the New Zealand resource management framework.

Matt Skellern is completing his Masters in Planning at the University of Auckland. He is carrying out a research thesis on international approaches to surf-break protection.

Coastal Impacts, Dynamics and Change: Insights from North Carolina to New Zealand

NZCS seminar by JP Walsh, Institute for Coastal Science and Policy, East Carolina University and NIWA Visiting Scientist. Reviewed by DE Hart.

On 20 December 2010 about 30 people attended an NZCS seminar featuring JP Walsh. The seminar was hosted by Canterbury regional coordinator Justin Cope, with lunch provided by Environment Canterbury. Dr Walsh delivered a dynamic and interesting overview of the geomorphic behaviour and management issues of river coasts from eastern North Carolina to the Mississippi Delta and Gulf of Mexico, and New Zealand's Waipaoa catchment. His research uncovers how materials from land are dispersed and accumulate in the ocean, including in estuaries. From November 2010 to January 2011, Walsh was serving as a visiting scientist at NIWA in Wellington, enabling him to visit Christchurch and speak.

Walsh is associated with several 'source to sink' coastal projects where he uses sediment characteristics, in combination with multiple types of high-tech geophysical and imaging methods, to understand the modern and ancient processes influencing the sedimentary records of continental margins. The results quantify rates of sedimentation and seabed reworking, highlight the fate of pollutants and runoff, quantify coastal hazard risks and natural resources such as land- and beach-nourishing sand, indicate the ecological ramifications of coastal erosion, and help to inform coastal managers and residents about the dynamics of their coastlines.

North Carolina, Walsh's home state, has about a million coastal plain residents and 16 000 km of estuarine and barrier island shore. This includes the second largest estuary in the United States, the Albemarle-Pamlico system, which is enclosed by sandy barrier islands formed during the Holocene and reworked by modern storm processes. Most of the coast is low-lying, with much of the estuarine shores characterised by salt-marsh habitat.

Accelerating sea-level rise, seasonal hurricanes and storms, and variable barrier sand volumes produce inundation, and episodic and chronic erosion. In some areas storm and hurricane events also re-work large volumes of estuarine bed sediments, meaning that historical pollutants buried in the sediments are continuously recycled through the ecosystem.

Across several North Carolina counties, an average of 7% of the estuarine shore has been hardened in response to erosion, but the ocean shoreline remains almost entirely devoid of structures because of strict state development regulations.

Barrier island roll-back through overwash and intermittent inlet openings occur regularly along the developed and undeveloped areas of the Outer Banks. Federal insurance limits compensation on properties damaged during such events to one-off claims up to US$250,000. Residents who wish to maintain properties in vulnerable areas must shoulder the financial costs of repeat disasters with limited redevelopment and private insurance options. In the absence of tighter planning controls, this post-Hurricane Katrina reality has ironically led to an increasing number of locally funded beach-nourishment projects, as well as requests for hard-engineering projects as communities fight to maintain hazard-prone coastal developments.

Walsh described a series of detailed mapping projects that have led to the production of public-access, user-friendly tools to quantify coastal hazards. These tools have been brought together in the form of the North Carolina Coastal Hazards Decision Portal or NC COHAZ website (see: http://coastal.geology.ecu.edu/NCCOHAZ/maps.html).

In New Zealand, Walsh is involved with the Margins project case study of the Waipaoa River delta. With support from the US National Science Foundation and in collaboration with Dr Alan Orpin at NIWA, Walsh's team is investigating the possibility of detecting individual catchment and ocean events in the sediments deposited offshore of the Waipaoa River system near Gisborne.

To foster more collaboration between sedimentologists and oceanographers, Walsh and Orpin are organising a meeting to be held in New Zealand (likely in 2011) that will bring together New Zealand and international scientists to discuss measurement and modelling methods and insights.

If you wish to help coordinate and/or participate in this meeting, please contact Walsh at walshj@ecu.edu. He is also happy to be contacted with questions about his research activities.

JP Walsh during an instrument repair effort in Albemarle Sound, North Carolina.

News from the Regions

Northland Regional News

Michael Day, Northland Member

Consents

Kaipara Harbour Tidal Turbines

Crest Energy Limited has been given the go ahead by the Environment Court to place up to 200 tidal turbines on the seafloor at the entrance of Kaipara Harbour. At time of writing, the proposal was awaiting the approval of the Minister of Conservation for the Restricted Coastal Activity elements of the proposal – the final step in the resource consent process. A number of consent conditions are attached to the resource consents including monitoring and review of environmental effects. Turbine installation will progress in stages, each stage being reviewed by the consent authority before being allowed to proceed to the next stage.

Paihia Waterfront Redevelopment

The proposed Paihia Waterfront Redevelopment is now moving into the construction phase following a favourable decision from the Environment Court. There are both commercial and public elements to the proposal, the main components are:

- an extension to a previous reclamation to provide improved public coastal access and improved and additional berthing facilities for craft;
- sites for three maritime related buildings, along with landscaped open space, seating and other public facilities;
- a wave attenuator, as well as a number of other structures to improve the overall facilities at Paihia; and
- a relocation of the navigation channel to the Paihia Wharf.

A key public feature of the proposal is the renourishment of Horotutu Beach, which is adjacent to the Paihia township centre. The renourished beach is to be protected by two reef-type breakwaters. These breakwaters were among the issues in contention throughout the resource consenting process.

Policy Development

The regional council has given effect to Policy 29 of the New Zealand Coastal Policy Statement 2010 by removing all references to restricted coastal activities from the Northland Regional Coastal Plan.

The development of a new Northland Regional Policy Statement is progressing. The regional council produced a discussion document which was released for public comment in October last year. This discussion document generated a high level of interest with 158 submissions received. Staff have prepared a summary of feedback and are currently working on developing a draft Regional Policy Statement (which is expected to be released for public comment by August 2011).

A link to this work can be found here: www.nrc.govt.nz/Your-Council/Council-Projects/New-Regional-Policy-Statement-/Project-overview.

Coastal Updates

Vehicles on Beaches

This has been the fifth summer for the Northland Safe Beach Driving Education Programme, coordinated by Northland Regional Council and supported by the Police, the Department of Conservation, the district councils and the NZ Transport Agency. Multi-agency patrols were organised for key Northland beaches including Bream Bay and Ninety Mile Beach. Other events were attended by agency staff to promote safe beach driving messages. New signage has been developed and erected on the roads to beaches where vehicles are driven. These signs each contain one key message for less harmful beach driving, such as “keep off the dunes”.

Baylys Beach Bonanza, Waitangi Day 2011. Credit: Laura Shaft, Coast Care Coordinator, Northland Regional Council.

Mangrove Management

The Mangrove Management Support Programme (MMSP) was launched in September 2010 with a call for expressions of interest from community groups. Having reviewed all of the expressions of interest, the regional council resolved at its January 2011 public meeting to support 10 proposals through the programme. In determining which proposals to progress, consideration was given to a range of criteria including; the consistency of each proposal with the relevant Regional Coastal Plan provisions; the group’s ability to complete the associated physical works; the ecological values of the areas affected; and the level of wider community support for each proposal.

To date, MMSP has assisted with the processing costs for two limited-notified consent applications occurring in the Mangawhai and Kaipara harbours and consent has now been granted for these relatively small-scale projects. Work commenced in February for a further seven of the selected proposals with

Mangrove Management work being done in Mangawhai Harbour. The Mangrove Management Support Programme is helping to fund this work. Credit: Ricky Eyre, Coastal Monitoring Officer at Northland Regional Council.

a view to submitting resource consent applications in June 2011. Northland Regional Council appointed Beca to assist with this work, principally the preparation of the resource consent applications and supporting environmental effects assessments. The latest step in the process has been the onsite meetings between the council, Beca and the community representatives to discuss and refine the mangrove management boundaries to ensure that realistic and achievable proposals are progressed to consent lodgement.

Those community groups with successful consent applications will be legally and financially responsible for undertaking the associated works and any long-term management requirements. The council hopes that the MMSP programme will be a catalyst for further estuary and catchment management initiatives in the areas of concern.

Monitoring and Science

Dredging and beach renourishment in the outer Mangawhai and Whangarei harbours were monitored in February. Sand used in the Mangawhai intertidal area was good quality and well graded. Unfortunately the sand at Marsden Cove was not adequate for beach renourishment and needed to be removed.

Sedimentation rates were measured at several sites in Kerikeri Inlet, Ruakaka, Whangarei Harbour and the Kaipara Harbour. This was undertaken to investigate the effects of cyclone Wilma on sediment deposition in estuaries.

Auckland Regional News

Waterview Connection Project
Alastair Senior, Regional Coordinator

The Waterview Connection Project is the last link in the Western Ring Route around Auckland and is the largest roading project in New Zealand. This 'Road of National Significance' joins SH20 to SH16 and includes major upgrades to the SH16 Causeway. These upgrades include widening the causeway and lifting the final road level to account for sea-level rise predictions.

Consent applications for this project were submitted to the Environmental Protection Authority (EPA) in September 2010. The EPA Board of Enquiry is currently at the hearings stage within the Environment Court.

The New Auckland Council
Kath Coombes, Auckland Region and Membership Coordinator

The city, district and regional councils in Auckland were amalgamated to form the new Auckland Council on 1 November 2011. As a unitary authority, the council has coastal responsibilities for the land and coastal marine area.

One of the priorities for the council is to prepare the Auckland Spatial Plan, a requirement of the legislation that established the council. The spatial plan will guide the future growth and development of the Auckland region over the next 20 to 30 years. Specifically, it will deal with: key infrastructure needs; the future location and mix of residential, business and industrial activities in specific areas; significant recreational, open space and ecological areas; the social, economic, environmental and cultural well-being of the region; and protection and enhancement of the built and natural environment. Many of these elements will have implications for the region's coastal areas. It is expected that the plan will be completed by the end of 2011. A discussion document will be released for public comment over March and April 2011.

The council is also working on a unitary plan to replace the current regional and district plans. The unitary plan will be one of the ways the spatial plan is implemented. This work is currently in an early scoping phase and it is yet to be determined whether all or some of the regional coastal plan will be incorporated into the unitary plan. It is hoped that a draft unitary plan will be prepared by late 2012.

A new feature of the Auckland Council is the creation of 21 local boards with 149 elected members. The boards were established to enable local representation and decision-making on behalf of local communities. They have responsibility for budgets totalling $488 million (for 2011 – 2012) and manage the funding of a wide range of community services, facilities and activities in their local area. The boards are currently working on their local board plans to set out their aspirations and priorities for the next three years. Numerous coastal projects have been identified for possible inclusion, including foreshore and estuarine enhancements, beach re-sanding, erosion works, walkways, ecological restoration and mangrove management.

Development of the Auckland city CBD waterfront is now the responsibility of Waterfront Auckland, an Auckland Council organisation. The agency is a landowner or leaseholder for significant areas of land but also leads the development and delivery of the waterfront master plan for the wider waterfront area. The agency applies to the council for resource consents and plan changes. Physical works are currently underway in transforming the North Wharf and Gateway Plaza area of Wynyard Quarter into

a public space. The waterfront agency's website at www.waterfrontauckland.co.nz has details on when the different stages of development are planned.

Many council staff have changed roles and/or location with the new council. The various teams with coastal responsibilities are spread around the region: policy and planning, research and monitoring are in Takapuna; resource consents are in the Auckland CBD; and environmental services are in Mt Roskill and Orewa. Council officers are working on mechanisms to ensure coastal management is integrated across the council.

Further information about the Auckland Council is available at www.aucklandcouncil.govt.nz.

Waikato Regional News

Aquaculture in Waikato
Graeme Silver, Waikato Member

There are big changes afoot for aquaculture and nowhere is this truer than in Waikato.

While the proposed removal of the requirement for marine farming to occur within an aquaculture management area will have little effect due to a broad prohibition on aquaculture in the Waikato Regional Coastal Plan, the Aquaculture Legislation Amendment Bill (No 3) (the Bill) proposes to directly amend the plan.

A 'deemed' plan change inserted by the Bill will allow consent applications for fish farming within the Wilsons Bay Zone and other existing farms, and will allow small extensions (about 1 to 2 ha) to the pre-RMA farms outside the zone. Fish farming in the Wilsons Bay Zone will be limited to about 4000 tonnes per year based on a nutrient discharge cap of 300 tonnes per year.

In a parallel process, the Minister of Aquaculture appointed a Ministerial Advisory Panel to hear submissions on a proposal to create a new marine farming zone near Coromandel Harbour. This 300-ha zone would be primarily intended for fish farming and could cater for about 8000 tonnes of annual production. The panel, consisting of Sir Doug Kidd, Mark Farnsworth and Justine Inns, heard submitters during the second week of February and is expected to report back to the Minister in early March.

There are several options if the zone proceeds including insertion into the Waikato Regional Coastal Plan by the Bill, through the new regulation-making powers that the Bill proposes to grant the Minister, or a normal RMA plan change process.

Once the new laws are in place and transitional matters are dealt with, Environment Waikato will be preparing a regional Aquaculture Development Strategy in partnership with stakeholders.

This strategy will identify the opportunities for sustainable growth of marine farming, the infrastructure required to support it, and identify specific areas from which aquaculture should be excluded. The strategy will then inform the upcoming review of the regional coastal plan and the excluded areas will be included as part of a broad zoning approach to our second generation coastal plan.

Ministerial Advisory Panel on a site visit to the proposed Coromandel marine farming zone. Photos courtesy Ministerial Advisory Panel Member.

Coastal News

Nearshore Currents and Sediment Transport Mechanisms in Pocket Beach Environments

Arash E. Moghaddam and Deirdre E. Hart,

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Sediment transport, one of the most common subjects in coastal engineering, is the process of the movement of sands in bedload and suspended forms. Although this movement occurs under different wave, wind and tidal conditions, the planform topography of the coast plays a major role in determining the circulation system and consequently sediment transport mechanisms.

Beaches can be divided into three types based on their planform morphology and degree of exchanges with adjacent coastlines: open, embayed, and pocket beaches (Short, 1999). About 80% of coastal areas worldwide are formed along the fringes of mountains and exposed rocks, resulting in an abundance of the sheltered beach types: embayed and pocket beaches (Ojeda and Guillen, 2008). Despite such ubiquity, our knowledge of the nearshore currents and sediment transport mechanisms operating in these specific environments, especially in pocket beaches, is very poor compared to our understanding of these processes on open coast beaches (Dehouck et al., 2009).

Over the last few decades much literature has focused on the stability of sheltered beach shorelines (Dehouck et al., 2009; Klein et at., 2002b), but few studies have quantified the nearshore processes influencing this stability (Ojeda and Guillen, 2008). Further, artificial pocket beaches are a common feature of built coastal environments, such as port cities. The creation of pocket beach morphologies has been recommended as a solution to erosion problems for some coastal areas (Ojeda and Guillen, 2008).

Sediment transport mechanisms in sheltered coastal areas are significantly affected by the length of both headlands and of the shoreline, and also by the distance between two headlands. In order to classify a sheltered beach and to define its dominant nearshore circulation system, a dimensionless embayment scaling parameter can be applied (δ') (Short 1999, 2010):

$$\delta' = S_1^2/(100 C_1 H_b)$$

where S_1 is the length of the embayment shoreline (m); when the end points of S_1 are located at the outer ends of the surf zone, not the outer ends of the embayment. C_1 is the distance between two headlands (m) and H_b is the breaking wave height (m).

If $\delta' > 19$, the area is classified as an open coast and has normal beach circulation. If $8 < \delta' < 19$, the area is classified as an embayed beach and has transitional circulation (for example, crenulated bay is a subcategory of embayed beaches that are characterised by a long spiral planform shape, including an area sheltered from waves) (Figure 1). If $\delta' < 8$, the area is classified as a pocket beach (Prof A. Short, Coastal Scientist, University of Sydney, pers. comm., 09/05/2010) and is dominated by cellular circulation, with longshore currents limited inside the bay and megarip currents formed near headlands (Figure 2).

Observations indicate that pocket beaches are more sensitive to changes in the direction and magnitude of sediment transport, and that wind and tides could have potentially greater influence on these processes than on open beaches with similar offshore wave conditions (Dehouck et al., 2009). The net sediment transport in pocket beaches is limited by their longshore boundaries.

Along with catchment influences, this limited net transport affects the stability of the shoreline over annual time scales. The shoreline profile, however, is more sensitive over short-term periods (monthly) and changes quickly, with longshore rotation processes and cross-shore berm/bar profile changes commonly occurring. The occurrence of longshore rotations depends on longshore currents, which are controlled by the length and distance between headlands in pocket beaches.

Despite some studies conducted on sediment transport mechanisms and mostly on shoreline configurations in pocket beaches, more studies are needed in order to improve our knowledge of

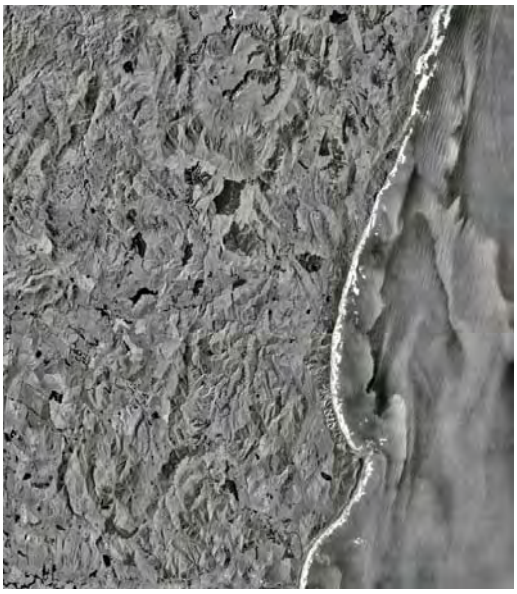

Figure 1: A crenulated bay located in the south east of the North Island, Castlepoint, New Zealand, (LINZ, 1998).

Figure 2: Examples of pocket beaches enclosed by rocky headlands on Banks Peninsula, Canterbury, New Zealand – 2a, Okains Bay; 2b, Lavericks Bay.

nearshore currents and, consequently, sediment transport mechanisms under differing wave, tide and wind regimes for pocket beach environments.

These studies should involve:

1) the behaviour of nearshore currents at different levels within the water column;
2) a proper evaluation of the influence of winds and tides on onshore and cross-shore currents inside pocket beaches and of longshore currents on sediment exchanges between pocket beaches and adjacent coastal areas;
3) examining the major mode of sediment transport (suspended load/bed-load); and
4) examining the role of periodic high-wave events, especially storms, and ensuing recovery periods.

As the part of a PhD project, we are planning to measure waves, winds, tides, currents and sediment transport inside the pocket beach of Okains Bay for one year. This field data will then be used to develop 2D Xbeach model simulations of processes and shoreline morphodynamics inside the bay. This model has been developed for hurricane and storm conditions. Figure 3 shows an initial example of the simulation of currents and suspended sediment transport with a theoretical 1.5 m swell wave height approaching the shoreline of Okains Bay at 45°.

As can be seen in Figure 3a, headlands shelter the bay from incoming waves, so that waves enter to the bay after diffraction and refraction, thereby decreasing the wave heights.

Figure 3b indicates that the swell wave-generated cross-shore currents are stronger close to the headlands compared to other areas. Currents very close to the headlands flow in the offshore direction, while those in the central majority of the bay move towards the shoreline direction on this incoming tide. The bed return flow is also shown in Figure 3c.

This type of current dominates areas close to the shoreline and headlands and it becomes more significant at the end of headlands exposed to the swell waves.

The cross-shore suspended sediment transport inside the bay appears to be limited as a result, which is consistent with most pocket beach literature (Figure 3d). This process, however, increases close to the headlands where the cross-shore currents are stronger. Sediment tends to be exchanged with adjacent coasts as headland sand bypassing. Generally, it seems that there is a good agreement between the results of this model at Okains Bay and pocket beach literature, but the model has not yet been validated using field data. The next stage of this project involves validating the Xbeach model for Okains and Lavericks bays, and exploring the adjustments in physical parameters needed to modify the model for use in pocket beach environments.

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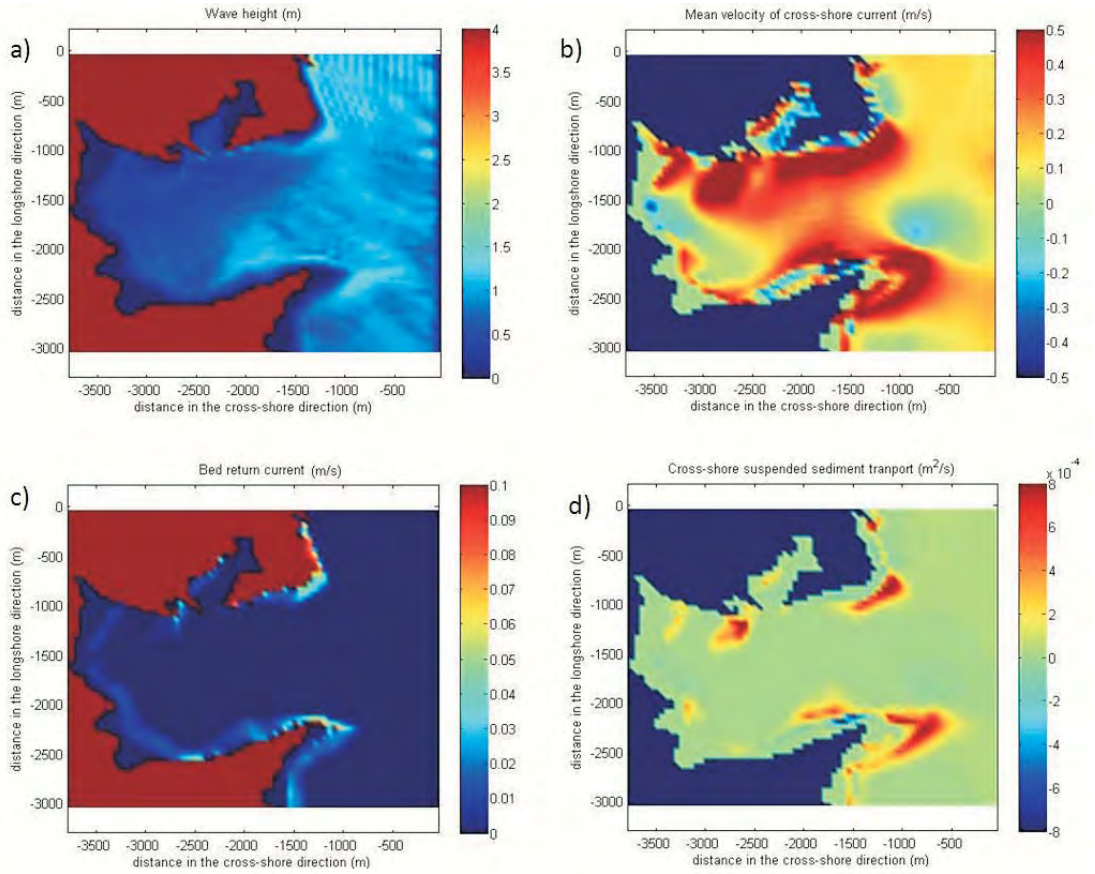

Figure 3: Modelled wave height (a) cross-shore mean velocity; (b) red colour indicates onshore, blue colour indicates offshore, bed return flow; (c) cross-shore suspended sediment transport; (d) red colour indicates onshore, blue colour indicates offshore in Okains Bay generated using a one-hour incoming-tide simulation of Xbeach.

Profile: Denise Young

We welcome Denise Young to our Management Committee. Denise will be the committee's Central Government Liaison.

Denise is a Senior Planner in the Policy Group at the Department of Conservation's (DOC) national office in Wellington. She has worked for DOC since 2001.

Apart from a secondment to prepare the Mount Aspiring National Park Management Plan, Denise has worked almost exclusively on coastal issues, including helping Dr Jo Rosier undertake the independent review of the New Zealand Coastal Policy Statement, the aquaculture review, and the review of the Foreshore and Seabed Act.

Prior to working for DOC, Denise worked for Te Puni Kokiri, the Otago Regional Council and the New Plymouth District Council. She has a Masters in Resource and Environmental Planning from Massey University.

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 over 300 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).

Marram Grass Seed Bank and Dispersal

By Daniel Lim, Department of Geography, University of Otago, Dunedin

Supervisors: Dr Mike Hilton, Department of Geography, University of Otago, Dunedin and Dr Janice Lord, Department of Botany, University of Otago, Dunedin

Marram grass (*Ammophila arenaria*) has come to dominate the coastal dune systems of the lower North Island and most of the South Island. This has occurred through a combination of natural, long-distance, dispersal and human-facilitated spread (Figure 1).

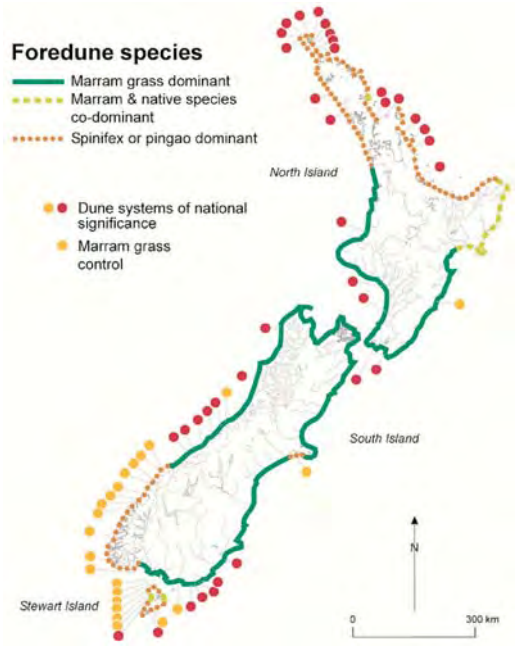

Figure 1: A map highlighting the extent of Ammophila arenaria distribution along the coastal dune environments and the distribution of nationally and internationally significant dune systems.

Although marram grass has some utility in coastal protection, its spread into New Zealand's relatively pristine dune systems has been ecologically catastrophic. The focus of this study has been to investigate the nature of the marram grass seed bank and the dispersal of seed in the dune systems of southern New Zealand.

Marram grass seed ecology

For this study, marram grass seed ecology was investigated using a variety of techniques including germination and greenhouse experiments, viability testing of seed, seed bank sampling and field observations. We took advantage of situations where the age of strata was known to age individual seeds. The ability of seed to germinate at different burial depths and light conditions was tested in order to imitate natural conditions.

Marram grass seed is highly sensitive to light during germination, and only emerges from burial at very shallow burial depths of between 0 and 5 cm. This suggests that marram grass seed is well adapted to the continuous movement of sand, where burial depths can change over a short period of time. A relatively fast germination response to a shallower burial depth is important for marram grass seed, to avoid desiccation of the seed as a result of exposure by wind erosion and to quickly establish at a new site.

Temporal separation

Ageing the seed bank was deemed to be the most challenging aspect of this study and two novel methods of temporal separation were used. First, a set of aerial photographs of Allans Beach, Otago Peninsula, taken between 1982 and 2009, were used to trace the formation of four parallel dune ridges over time. Seed gathered from each of these dune ridges was therefore assumed to be of a specific age corresponding to the age of each dune ridge.

The possession of a set of dune profiles collected over the course of 21 years at St Kilda Beach, Dunedin, provided the second opportunity for temporal separation. From these dune profiles (Figure 2) it was expected that seed collected from specific depths would correlate to the date of each dune

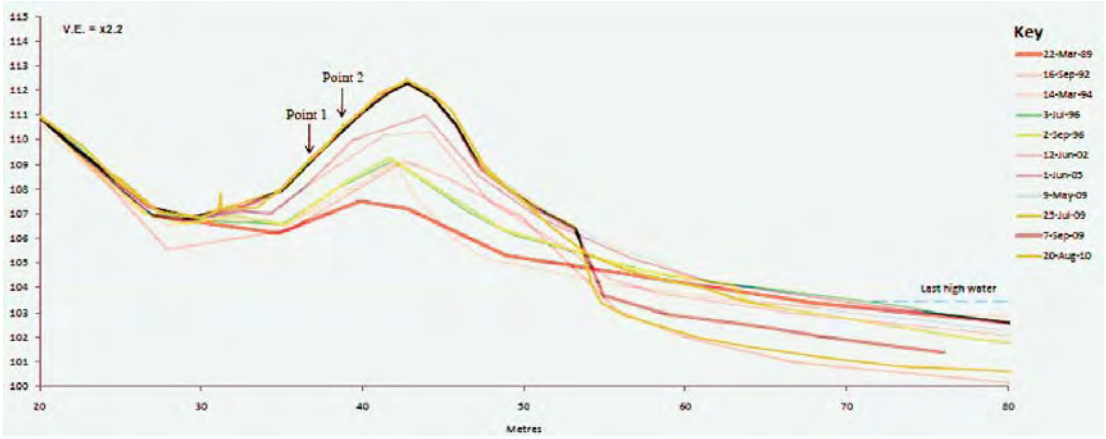

Figure 2: The 21-year dune profile record of St Kilda Beach, Dunedin, used to approximate seed bank ages. Points 1 and 2 indicate coring positions.

profile. This provided relatively robust temporal separation for ageing the seed bank. This approach proved to be a faster method of investigating seed bank nature compared to other methods.

Establishment of seedlings

Previous studies of marram grass seed suggest that the establishment success of seedlings is extremely limited, with the majority of established seedlings being found in moist, sheltered micro-sites such as a dune slack in the lee of a dune. Even in these micro-sites, however, the rate of the establishment of marram grass seedlings has been found to be extremely low (Huiskes, 1977; Laing, 1956). Low establishment rates would suggest a low risk of marram grass seed invasion in the dune environments of southern New Zealand.

Our field study at Stewart Island's Doughboy and Mason bays, however, contradicts these earlier findings and suggests that marram grass seed presents a real invasion and re-invasion threat to dune systems.

Field study at the foredune at Doughboy Bay showed seedling emergence for at least seven years after initial spraying. This seed bank had not previously been anticipated.

At Mason Bay, seedling surveys conducted in the central dune system showed the emergence of a large number of marram grass seedlings suggesting successful invasion of marram grass seed. At Mason Bay, seedlings also showed a greater tendency to emerge outside of moist, sheltered micro-sites.

Dune systems at risk

The findings of this study have shown that seed plays a key role in the invasion of marram grass into dune systems in southern New Zealand. This is especially true for the larger west coast dune systems, where the predominantly westerly wind provides ideal conditions for the dispersal of seed. The natural conditions within the marram grass foredune in southern New Zealand also appear to support the development of a viable seed bank, which provides a source for re-invasion.

Figure 4: Pingao (Ficinia spiralis) colonised dunes at Mason Bay, Stewart Island.

The investigation into seed bank age showed that marram grass seed remains viable up to and potentially beyond 21 years of age. This finding has implications for the duration of marram grass control programmes in specific dune systems, although other processes (increased sedimentation, for example) may shorten the effective life of the seed bank. Once a mature population of marram grass has been sprayed and dies off, monitoring and follow-up spraying will likely be required for an extended period of time. This period of time may be greater than the 10 years suggested previously. This is likely to be particularly the case in foredune environments where rapid accretion and progradation may assist seed accumulation and storage.

The final product of this study included a conceptual model of marram grass invasion at Mason Bay. Our findings suggest that control operations on Stewart

Figure 3: Dr Mike Hilton collecting a four-metre core at St Kilda Beach, Dunedin.

Figure 5: Conducting field work on the marram grass foredune.

Island will need to plan for a prolonged monitoring programme, with special attention on the foredune where the greatest threat of re-invasion exists.

In larger dune systems, systematic seedling surveys should also be carried out every two to five years in order to prevent the establishment of any new populations of marram grass.

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NZCS Management Committee

For any enquiries regarding *Coastal News* articles, please contact NZCS Editor **Shelly Biswell (shelly@biswell.net)**.

NZCS Regional Coordinators

Every region has a NZCS Regional Coordinator who is available to help you with any queries about NZCS activities or coastal issues in your local area.

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Contributing to Coastal News

Coastal News welcomes contributions for each issue. Please contact Shelly Biswell at shelly@biswell.net if you'd like to submit a news brief or article.

The submission deadline for the next issue of *Coastal News* is 1 June 2011.

Monitoring Organic Enrichment of Coastal Sediment

Peter Wilson and Kay Vopel, Auckland University of Technology

Organic enrichment of coastal sediment is of interest to coastal managers worldwide. It results from excess supply of organic carbon to coastal waters from both natural and anthropogenic sources such as, terrestrial runoff, eutrophication, and aquaculture.

A large fraction of this carbon is mineralised by sulfate reduction, a bacterially mediated reaction that leads to the production of hydrogen sulfide (H_2S). This is the culprit for the 'rotten egg' smell you encounter when digging up estuarine sediments. H_2S readily reacts with sedimentary iron compounds to form iron sulfides that contribute to the distinct black colouration of organic-rich sediment.

In the laboratory, we can convert the majority of these iron sulfides back into H_2S by adding acid to the sediment and so indirectly measure the concentration of the acid volatile sulfides (AVS). Although this concentration is well suited as an indicator of organic enrichment, its measurement has not been used in routine monitoring because of its laborious nature.

Almost 10 years ago, Bull and Williamson (2001) tested an easier approach to predict the sediment AVS concentration from sediment images taken in the laboratory. The authors analysed photographs of sediment sections and found a weak linear correlation ($r^2 = 0.67$) between sediment colour and AVS concentration. During the past 12 months, with the help of new technology, we improved and further developed this approach into a rapid technique for monitoring the in situ distribution of AVS.

Using H_2S microelectrodes, we established a strong linear correlation ($r^2 = 0.93$) between sediment colour and the concentration of AVS. This allows for the accurate prediction of the distribution of AVS from a sediment profile image. We also tested the suitability of a novel sediment profile imaging device (SPI-Scan, Benthic Science; Figure 1) to obtain high-resolution sediment profile images readily in the field. Our new image analysing procedure allows us to make two types of predictions from the acquired images with a simple mouse click. Firstly, the colour intensities of horizontally aligned pixels are averaged to obtain a vertical AVS concentration profile (Figure 2a). Secondly, individual pixel colour intensities are mapped to create a two dimensional distribution plot of AVS concentration (Figure 2b).

Both types of predictions provide parameters well suited to environmental monitoring, for example, an assessment of the environmental impact of marine farms. The maximum AVS concentration and the depth at which this occurs are readily visible on the vertical AVS concentration profile. The two dimensional AVS distribution plot can be used to assess spatial heterogeneity in this distribution and how this variability is affected by macrobenthic fauna. Most importantly, rapid surveys of the seafloor underneath marine farms with our sediment profile imaging device can now reveal the depth and the size of the farm AVS footprint and how these change over time.

Figure 1: The SPI-Scan instrument used to obtain high-resolution in situ sediment profile images.

Our new technique makes AVS an accessible parameter for rapid assessment of the effects of organic enrichment in marine sedimentary environments. To assess these effects, marine consultants have been using a number of techniques that deal with selected functions of the marine ecosystem.

We believe that the inclusion of AVS measurements into current monitoring practices will be an important step towards a more holistic and integrated approach to routine monitoring.

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Want Coastal News in colour?

While cost restricts our ability to print *Coastal News* in colour throughout, we would remind members that full-colour versions are available on the Coastal Society website. You will need to log in to access the latest issue, but back issues (from Issue 6, April 1996) are freely available.

Visit www.coastalsociety.org.nz and follow the 'Publications' link on the front page.

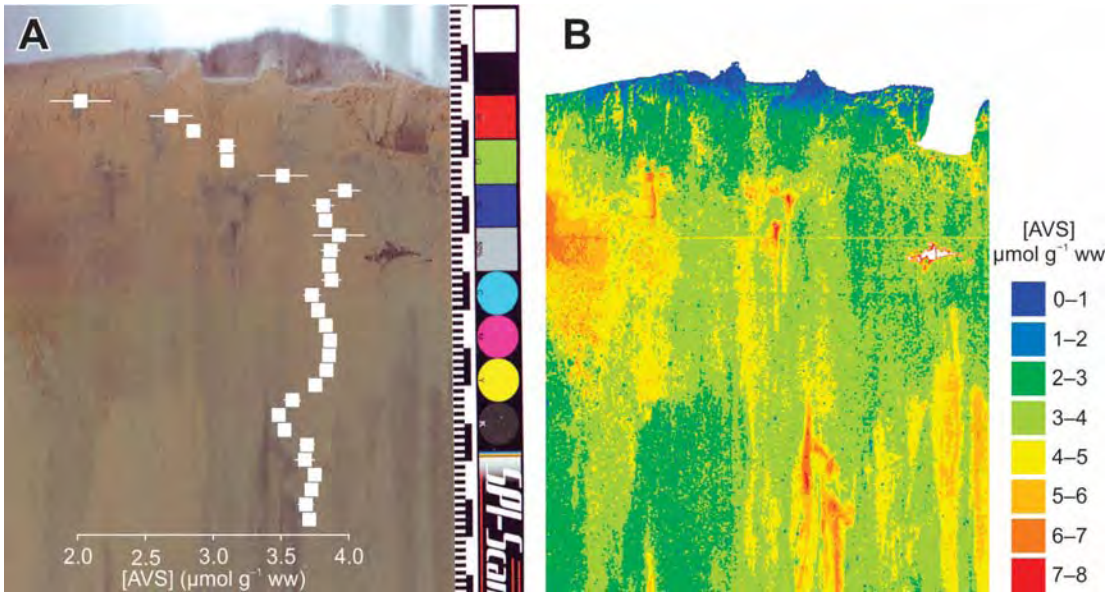

Figure 2: (a) Example of an in situ sediment profile image. Small black and white bars on the scale to the right of the picture are 1 mm each, the larger bars are 10 mm. The image is overlaid with the predicted AVS concentration profile. (b) A two-dimensional AVS distribution plot derived from the image in (a).

Upcoming Conferences

EDS Coastlines Conference

The Environmental Defence Society Conference Coastlines (Auckland, 1 to 2 June 2011) will examine spatial planning of New Zealand's coasts, lakesides and oceans.

Marine spatial planning is becoming a key mechanism for the implementation of oceans policy in many other developed countries. The conference will explore this international thinking and experience along with recent scientific developments and professional practice in New Zealand.

Sessions planned for the first day of the conference include international experience in coastal and oceans management, the case for oceans reform in New Zealand, implementation of the New Zealand Coastal Policy Statement, and a Leaders' dialogue.

Sessions on the second day will focus more closely on the practical application of spatial planning to coasts, lakesides and oceans. There will be a field trip, which will consist of a cruise around the inner Hauraki Gulf viewing coastal management issues, on the afternoon of Tuesday 31 May.

The programme is currently under development and regular updates will be posted on the conference website.

For further details, programme information, and registrations see www.edsconference.com.

Coasts and Ports 2011

Mark your calendars now for Coasts and Ports 2011 which will be held 28 to 30 September 2011 in Perth, Western Australia. The conference is an amalgamation of the 20th Australasian Coastal and Ocean Engineering conference and the 13th Australasian Port and Harbour Conference. Hosted by the National Committee for Coastal and Ocean Engineering (Engineers Australia), PIANC Australia and the Institute of Professional Engineers New Zealand (IPENZ), the conference is also supported by the New Zealand Coastal Society.

The Coasts and Ports Conference series is the pre-eminent forum in the Australasian region for professionals to meet and discuss issues extending across all disciplines related to coasts and ports. Coasts and Ports 2011 will bring together engineers, planners, scientists and researchers to focus on the technological, scientific, policy, planning and design issues related to our diverse and developing coasts.

For further details, programme information, pre-conference short courses and registrations, see www.coastsandports2011.com.au.

Coastal News

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Corporate membership enables organisations and companies to become part of the New Zealand Coastal Society and support the society's mission of taking a leading role in facilitating a vibrant, healthy and sustainable coastal and ocean environment.

Organisations and companies can show their support for the aims and activities of the society and achieve public recognition of that support.

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- Website listing of services provided by corporate organisation, contact details, and links to recent projects or corporate member website.
- One free individual membership for the person nominated as the corporate contact or any subsequent replacement alternate.
- Five complimentary copies of *Coastal News* published three times per year – April, July and November.
- Discounted registration at member rates for the corporate contact to all NZCS conferences.
- Short feature on a corporate member in the *Coastal News* newsletter.

For more information on corporate memberships please contact:

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