Coastal News

Te Hunga Takutai o Aotearoa

Issue 54 • October 2013

CONTENTS

www.coastalsociety.org.nz

ISSN 1172-6938

Coastal Quakes

Observations and analyses from backyard Christchurch to 21st century coastal megacities

by Deirdre Hart & Christopher Gomez, Department of Geography, University of Canterbury*

Earthquake and tsunami in the Indian Ocean 2004; Hurricane Katrina, New Orleans 2005; Java, Indonesia tsunami 2006; Bantul, Indonesia earthquake 2006; Cyclone Nargis and Myanmar storm surge 2008; Santa Catarina floods and mudslides 2008; Haiti earthquake 2010; Christchurch earthquakes 2010 to 2012; Touhouku earthquake and tsunami 2011; Rio de Janeiro floods and mudslides 2011; Hurricane Sandy, New York 2012...

Anyone keeping a global tally of recent disasters is likely to be asking: What role will the hazards and disasters of coastal plains play in the lives and economies of 21st century humanity? In this article, we reflect on this question using examples of how different types of coastal land performed during the Christchurch and other earthquake events to examine the complex of coastal-tectonic hazards that are being constructed in the Tokyo megacity (see Figure 1).

Backyard observations and historical records

Since the September 2010 earthquake hit their hometown, a team of University of Canterbury researchers have been gathering evidence from earthquake events in coastal cities, including Christchurch, NZ 2010 to 2012; Napier, NZ 1931; and Wairarapa, NZ 1855; as well as Touhouku, Japan 2011; Haiti 2010; Alaska, US 1964; Charleston, South Carolina, US 1886; and Lisbon, Portugal 1755.

Their findings show how and why coastal settlements are disproportionately susceptible to seismic hazards. Detailed evidence of these settlements' earthquake effects has revealed four key coastal area morphotypes which, when combined with built environments, perform badly during large earthquake events:

- recent coastal plains;
- complex shoreline configurations;
- narrow coastal shelves backed by cliffs; and
- reclaimed land.

Recent coastal plains

Recent coastal plains comprise the continental and high-island fringes of land built through shoreline progradation and fluvial aggradation processes over the mid to late Holocene after sea levels stabilised. For the Christchurch area, for example, 106 km^2 or 60 per cent of the land area on which the city is built formed over the last 6500 years (see Figure 2).

Such recent coastal plains are typically relatively flat and low-lying towards the coast, and extend inland into infilled river valleys. They include many old abandoned and active river channels, and are formed from poorly consolidated mixtures of silts, sands and gravels saturated by shallow groundwater tables.

The combination of poorly consolidated Holocene deposits, sea-level proximal topography and shallow coastal and riverside water tables resulted in extreme liquefaction across large swathes of eastern

*correspondence to deirdre.hart@canterbury.ac.nz

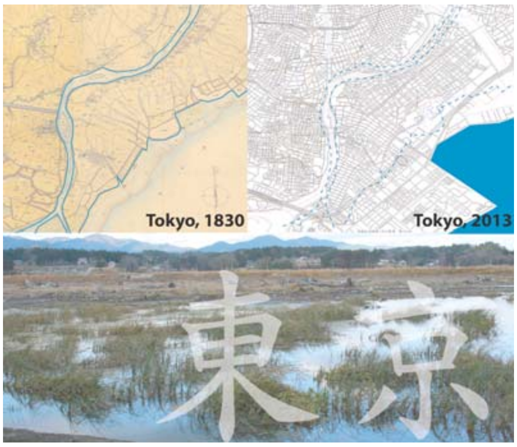


Figure 1: Shoreline comparison of Tokyo 1830 (top left) versus today (top right), showing extensive coastal land reclamation, plus the effects of the 2011 Touhouku tsunami on reclaimed coastal areas (below).

Christchurch between 2010 and 2012. The liquefaction, in turn, caused subsidence of up to 0.7 m per major earthquake event or aftershock, lowering land elevations and causing tidal flooding around shorelines and river mouths. These changes also produced catastrophic failures of the lifelines networks (transport, water, gas, sewerage) throughout the coastal and river suburbs of the city. Similarly, extensive and damaging liquefaction was reported for the Charleston earthquake of 1886 and the Alaska earthquake of 1964.

Complex shoreline configurations

Coastal plains with lifelines networks, which have been developed around the complex shoreline configurations of lagoons, estuaries and/or bays are particularly vulnerable to the effects of liquefaction. This is because these networks lack the inbuilt redundancy of grid systems; are heavily reliant on bridges, which act as vulnerable network linkages; and because liquefaction adjacent to shorelines and river banks results not only in vertical deformation and subsidence but also in horizontal rafting, cracking and lateral spreading of the land's surface, disrupting lifelines infrastructure above and below ground.

FIgure 2: Location of the Christchurch area shoreline around 6500 years ago (dashed blue line in A); old river channels underlying the city's central business district (cyan channels in B); and dune-like deposits underneath the central city (C: for location see white dot in A). Sources: Brown and Webber 1992 (A); D Lucas 2011 (B); RM Kirk (C).

Patterns of damage during the earthquakes of Haiti 2010, Christchurch 2011, Charleston 1886 and Wairarapa 1855 illustrate that the difficulty of maintaining transport network functionality around complex shorelines in earthquake-prone environments is both a recent and a historical phenomenon.

Narrow coastal shelves backed by cliffs

Coastal plains, shelves and adjacent elevated topography have proved to be an attractive environment for human settlement throughout New Zealand and globally. Around 75 per cent of New Zealanders live less than 10 km from the coast, including 96 per cent of Aucklanders, 76 per cent of Wellingtonians, and 36 per cent of pre-quake Cantabrians living less than 5 km from their local shoreline.

Internationally, coastal populations are growing at twice the rate of the total population so that over 50 per cent of humanity is forecast to live in coastal settlements by 2100.

This type of coastal edge is typically prone to deformation, subsidence and horizontal displacement during seismic events. These effects crippled the port facilities of Lyttelton, Christchurch and Port-au-Prince, Haiti, for example. In Christchurch, this failure was compounded by the mass movement of adjacent hillsides and cliffs, which experienced extensive areas of collapse, rockfall and land sliding.

Reclaimed land

The sheer concentration of people, infrastructure and industry described above means that land is at a premium, and space is severely limited, in most coastal cities today. As a result, the majority of port infrastructure and coastal-city airport facilities have been constructed or expanded across reclaimed land and large-scale land reclamation programmes are underway throughout countries like Korea and Japan. This trend towards the artificial terrestrialisation of shorelines and seabed is of concern given that recent and historical earthquake events indicate that reclaimed land is prone to significant failures during earthquakes.

Applying our observations to a Tokyo case study

Since the early 2000s, East Asian countries have taken a lead role on the international economic stage. The majority of these new economic leaders have much in common physiographically with New Zealand, being coastal high-island nations, straddling the most active tectonic margin in the world: the Pacific 'Ring of Fire'. They are characterised by geologically young coastal plains, bordered to one side by the sea and to the other by active mountain or volcano systems. These settings are also, like New Zealand, very prone to earthquakes. The elongated shapes of island arcs, such as Indonesia and Japan, concentrate most of their population on recent coastal plains within the 1000-year storm surge zone.

The Japanese capital Tokyo, for instance, is largely constructed upon late Holocene (<6500 years old) coastal and river valley deposits with seaward margins of anthropogenic reclaimed land and polders (see Figure 3).

Tokyo is located in the Kanto Province in the centre of an active horseshoe-shaped chain of mountains and volcanoes that produce immense volumes of sediments, from which the Kanto plain is mostly constructed. Over the last 5000 years, the Kanto plain has grown seaward by over 2200 km², progressively transforming open-coast environments into marshes, wetlands and finally hinterland.

For the period 5000 to 4000 years ago, the land prograded by 350 km², prograding a further 90 km² during the period 4000 to 3000 years ago, while the period from 3000 years ago to present produced 900 km² of new coastal plain (see Figure 3). Almost all of this area is topographically flat or low-lying.

In recent times, the Japanese have perpetuated the seaward land expansion, practicing reclamation of nearshore and marsh environments as early as the Edo period (1603-1868), beginning in the Nihonbashi area, and extending into the 20th century as far as the iconic ward of Odaiba, which is entirely built on sandy fill and compacted waste, and beyond with the international Haneda airport, an artificial island in the bay of Tokyo.

The seaward advance of the city has been accompanied by significant work to transform the marshlands east of Tokyo into agricultural land using dense drainage networks. This eastward expansion, where the Senju 'shitamachi' (literally downtown) and developments further east are located, is very recent. Records from the early 18th century describe some of these areas (for example, Ayase) as marshland needing to be tamed.

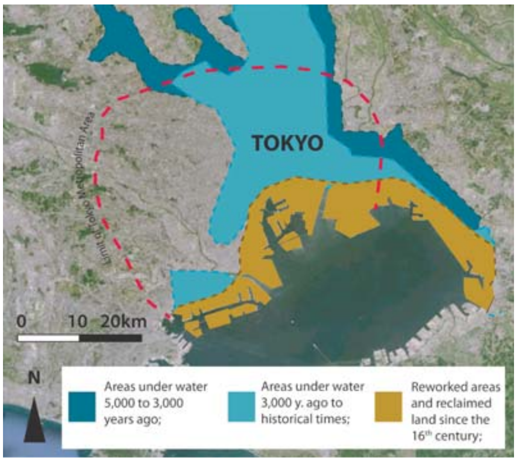


Figure 3: Shoreline change in Tokyo Bay from 5000 years ago to present. Holocene coastal progradation and river valley infilling prior to the 16th century created much of the land area occupied by central Tokyo city today, while subsequent wetland drainage and land reclamation created the land that now constitutes the coastal suburbs, port and airport.

Although space is at a premium in Tokyo – the value of the Imperial Palace land alone is estimated as equivalent to that of the state of California while the total Tokyo city land value is estimated to exceed that of the entire United States – its development may have a much higher cost in the event of an earthquake than anybody anticipates. Like for Christchurch, the subsurface of Tokyo is made of abandoned river channels, drained marshes, and reclaimed land infilled over a number of historical time periods. This patchwork of low-lying unconsolidated fine sediments with near-surface water tables makes the area very vulnerable to earthquake-induced liquefaction and amplified ground acceleration (the same way a jelly desert wobbles more than the plate it sits upon).

Conscious of this problem and pushed by the 11 March 2011 events in the Touhouku area, the metropolitan government of Tokyo has released a series of maps predicting shaking intensities during earthquakes across the city.

Lessons learnt

Because of its location on young estuarine and coastal sediments, Tokyo is prone to liquefaction, bank slides and all the problems Christchurch experienced between 2010 and 2012. Despite a level of preparedness Christchurch could only dream of – sustained by 'world-class engineering' – we predict that a major earthquake below Tokyo would likely damage the country's and the world's economies. More worryingly, with the rise of East Asian economies, there are tens of other coastal megacities perched vulnerably along the Pacific's coastal Ring of Fire margins.

Given the poor performance of the four coastal morphotypes identified in this article, the question arises: What is the cost of continuing to develop coastal areas that are so susceptible to quakes and quake-induced hazards? Evidence from the Christchurch events and our desktop GIS analyses of Tokyo suggest that, in reality, our capacity to incorporate into recovery plans the lessons that could make coastal cities more disaster resilient is limited if the hazard links are not understood before a quake occurs.

These case studies also illustrate that the complex of earthquake-coastal vulnerabilities we have found is really quite predictable – for places like Dunedin, Christchurch, Wellington, Tokyo and Touhouku, it is not difficult to find and quantify the links. This provides us with a great opportunity to avoid or mitigate future development-disaster cycles for quake-prone coastal cities by becoming aware of these links and thus, of how to minimise their effects; how to build resilience into everyday planning; and, before disasters occur, how to construct multi-hazard recovery methodologies.

The vulnerability of coastal cities to quakes is a finding worth acting on given the current and future-predicted concentration of habitation, infrastructure and development around our local and global coasts.

Closure and Mobility of Coastal Outlets: West Coast, South Island

by Don Neale, NZCS Conference Committee Chair

A visit to the South Island's West Coast can certainly teach you a thing or two about water. And the NZCS 2013 Conference is a chance to come and see for yourself!

The title of the conference "The Coast – Rough Around the Edges" (Hokitika, 19 to 22 November) alludes to both the dynamic environment of the New Zealand coastline, as well as the rugged and easy-going reputation of the region hosting the conference.

The West Coast is home to some of the country's best remaining examples of natural wetlands and waterways. An impressive 340 waterways drain out to sea along the region's 600-km coastline. Coasters have always had a close association with these waterways, and the estuaries and river mouths have become a meeting place, of not only fresh water with salt, but also of people with nature. It's no coincidence that the West Coast's three largest towns sit at three of its largest river mouths.

But these outlets to the sea are dynamic features of the landscape. Their changes and movements can have dramatic effects on the region's ecosystems, people and communities … and its whitebait!

The closure and mobility of river mouth outlets are natural processes that contribute to the character and functioning of the West Coast's coastal environment. It's important to understand and accommodate these natural processes while addressing the associated natural hazards and other resource management issues.

I tend to group the West Coast's river mouths into four main types – 'tidal flat estuaries', 'gravel-bed river mouths', 'tidal lagoon streams', and 'hillside streams'. They range from unmodified natural ecosystems, to highly modified 'ditches' with low natural character. High energy seas, and rivers with high sediment loads, make them inherently dynamic.

Figure 1: As every West Coast whitebaiter knows, the region's river mouths are fickle creatures, changing daily with the weather and the tides. Photo: T Lilleby, DOC.

Figure 2: The frequent closure of the Okarito Lagoon outlet near Westland National Park causes elevated water levels to inundate wetland margins that might otherwise be left permanently high and dry. But since the early gold rush days, artificial opening of the outlet has been necessary to avoid flooding of the Okarito village. Closure has become more frequent in recent years. Photo: A Short, NIWA.

All four types have examples where the outlets are known to close and/or migrate alongshore.

Outlet closure is a complex event, but is typically caused by an over-supply of sediment from river floods or high seas that 'choke' the outlet, followed by low river flows and calm seas that are unable to breach the buildup of sediment. On the West Coast, artificial water abstraction is unlikely to be a cause of river outlet closure, but catchment modification might affect the natural dynamics of some river mouth areas.

Outlet mobility results from a similarly complex interplay of sea, river and shore. It is natural for some outlets to migrate several kilometres alongshore, unless restrained by natural barriers (for example, headlands), hydrological factors (for example, insufficient water flow), or human intervention (for example, artificial reopening or rockworks). Historical evidence and site assessments can give a good indication of outlet mobility.

Patterns of outlet closure and mobility vary greatly between locations, but some features (such as the frequency and duration of closure, area of inundation, and outlet position) can often be predicted to some extent based on past experience or comparison with similar sites. They can therefore be readily planned for in advance. The natural dynamics of some coastal areas are very strongly driven by outlet closure and mobility, especially for the tidal flat estuary and tidal lagoon stream types.

The dynamic nature of West Coast river mouths is part of their natural character, but when development encroaches upon this dynamism significant hazards and inconveniences can arise.Demands to reopen, reposition, or otherwise modify a river outlet are not uncommon on the West Coast. Permanently open and static outlets are sometimes preferred for a variety of reasons, aiming to eliminate the natural closure and mobility of these sites and to reduce the flooding of adjoining land.

Human intervention at river mouth outlets is sometimes a necessary part of hazard management, but can have adverse effects on natural lagoon systems. The artificial reopening of outlets can alter the natural dynamics and environmental values of coastal waterways, by degrading riparian vegetation, altering wetland hydrology, reducing natural character, and reducing outlet mobility. To say that outlet reopening and repositioning just serves to hasten a natural process, oversimplifies a much more complex situation.

These effects can often best be managed using case-by-case assessments and monitoring. Lower levels of management attention are needed on the most highly modified outlets with low natural character. The *West Coast Regional Coastal Plan* recognises the need to balance natural character with hazard management needs, by including a schedule of outlets at which artificial opening may be undertaken where it does not interrupt natural dynamics. The plan also identifies significant sites where the protection of natural values is a priority.

Knowledge of the dynamics of relatively natural river mouths on the West Coast can contribute to broader discussions about sustainable coastal management throughout New Zealand. The 2013 NZCS conference in Hokitika will be a great place for us all to have those discussions.

Figure 3: The New River outlet near Greymouth has naturally wandered along more than six km of coastline. Since this photo was taken in 2006, northern movement of the outlet has been restrained by rockworks placed half way along the lagoon's length. In June 2013, the outlet broke directly out to sea near the bottom of this photo, but has since moved back to a more northerly position. Photo: D Neale, DOC.

21st Annual NZCS Conference

19 to 22 November 2013 – Hokitika

The Coast: Rough around the Edges

The themes and flavour of this year's conference will encompass the broad scope of the aims of NZCS, while taking the best advantage of the spectacular location, and its rural and coastal communities. Session and poster themes are:

Communities and our coasts • Coastal science
Coastal hazards • Coastal conservation
Managing resource conflicts, sharing natural spaces and resources

Aside from great speakers and sessions, other conference highlights include:

Fieldtrip to Punakaiki along the world-famous 'Coast Road' highway

Workshops on coastal monitoring, hazard planning, ports and community involvement

Movie night and mentoring breakfast for early-career coastal professionals and students.

Visit www.coastalsociety.org.nz/conference2013 to learn more

If your organisation is interested in sponsoring the conference, contact Graeme Jenner at graeme.jenner@beca.com

Thanks to major conference sponsors:

NIWA Taihoro Nukurangi

Department of Conservation Te Papa Atawhai

Thanks also to our other conference sponsors, including West Coast Regional Council, Ross Dowling Marquet Griffin, Eliot Sinclair and Partners, and MWH.

Coastal News

Onemana Beachcare: Community action begins with one individual

by Shelly Biswell, Editor

While the Nike slogan "Just do it" may not seem to have much in common with dune restoration programmes in New Zealand, it's a fitting description of the approach Barry Turk took when establishing Onemana Beachcare.

Located a few kilometres north of Whangamata on the eastern Coromandel Peninsula, Onemana is a beachside settlement that features a well-stocked dairy, a local restaurant, and a few year-round residents. Like many places in the Coromandel, the population of Onemana swells on long weekends and during the summer. It's one of the few places where the endangered New Zealand Dotterel lives.

Onemana Beach is also home to Barry Turk who has been affectionately described by coastal scientist Jim Dahm as a "force to be reckoned with".

Jim explains that with Barry at the helm, the Onemana Beachcare group broke record after record when it came to the history of Waikato's Beachcare Programme.

"Barry became aware of the need for dune restoration in 2005 after a walk on Onemana Beach with his son who is a landscape architect in Australia. His son pointed out various issues, such as erosion, lack of managed access, and the lack of native vegetation," says Jim.

Never one to wait around for others to fix something, shortly after that life-changing walk Barry contacted Waikato Regional Council and was put in touch with Jim, who is the council's Beachcare contractor, to work on establishing the Onemana Beachcare group.

"Based on my knowledge of Beachcare groups and the degraded state of the dunes, I thought we had 12 to 15 years of work ahead of us," Jim laughs. "But I hadn't taken one very important factor into consideration – I was working with Barry."

Barry Turk (centre) was presented with his Coastal Champions award by Waikato Regional Council staff and Onemana Beachcare volunteers earlier this year. Photo: Coastal News *(Coromandel newspaper).*

While Barry respected Jim's knowledge and experience, he estimated the group could achieve its objectives in three to five years. With 15 to 20 volunteers helping with most plantings it seemed clear that Barry would prove to be right.

In the years from 2007 to 2009, Onemana Beachcare held six to 10 working bees a year – another Beachcare record. The group planted more than 8000 plants in their best year and over 30,000 plants in total.

The main species planted were spinifex, pingao, knobby club rush, pohuehue, sand coprosma, sand carex and the native spinach. "We also planted some sand pimelea and sand tussock at the site, but with limited success. Spinifex and pingao were the main species planted on the frontal dune as these are the key species for natural sand trapping and dune repair. The other species were used in the backdune vineland community," Jim says.

Aside from plantings, Barry says it was important to change people's behaviours in how they accessed the beach. "That included creating pedestrian access ways and a kayak boardwalk, roping off newly planted areas, and putting up signage."

It also meant understanding the needs of the community, for example, an area at the southern end of the beach was left because it was a popular area for kids to slide.

The work also required pest control – weeds and rabbits – while the new vegetation became established.

Since 2010, the work of the Onemana Beachcare group has been more targeted with smaller groups of volunteers working on projects. "In fact, we have recently done some work at the southern end (where the kids slide) to reduce erosion and have gone back and 'spot' planted where required," Barry says.

Barry says it helped to have Jim working with the group from the start. "His working knowledge of plants and the Coromandel was a big advantage for the group and meant that we didn't make many planting mistakes along the way. Plus his dedication was incredible. He showed up to most of our plantings and was always willing to lend a hand."

While much of the work has been ticked off for the Onemana Beachcare group, you can still find Barry and other volunteers picking up rubbish and maintaining the dunes on their daily walks. "We live in a beautiful place, so it's really just a matter of doing our bit to look after it." he says.

Jim adds, "When we started, the vineland community was limited to the odd clump of knobby club rush. We have now restored this right along the back of

Onemana Beach before the Beachcare group was established. Photo: Waikato Regional Council.

A restored Onemana Beach in 2011. Photo: Barry Turk.

the frontal dune over the southern half of the beach. At this stage, it is only a relatively narrow zone, but could be widened landward at some future date if desired by the community. The vineland community is still young and dominated by knobby club rush which provides the shelter and architecture desired by many of the vine species, but the various vine species (pohuehue, sand coprosma, spinach) will spread over time."

In 2013, Barry received a regional Coastal Champion award from NZCS for his leadership on dune restoration through Onemana Beachcare.

Oil Rigs and the Biosecurity Standard

by Shelly Biswell, Editor

In August, the *Kan Tan IV* entered New Zealand waters on its way to the Maari field in the Taranaki Basin which is operated by OMV New Zealand. Built in 1983 and capable of operating in water depths of up to 457 metres, the rig has been used all over the world.

Biofouling can be of particular concern for rigs like the *Kan Tan IV* that have been stationary in the coastal waters of other countries, says MPI Senior Advisor Liz Jones. "Once introduced, marine pests such as the Mediterranean fanworm and the sea squirt *Styela clava* are difficult to contain. That's why MPI has worked to develop a new standard under the Biosecurity Act to mitigate and manage biosecurity risks."

While the standard is still in draft form, Frigstad Offshore, which operates the *Kan Tan IV*, and OMV New Zealand were keen to have the rig meet the standard when it entered New Zealand waters. Frigstad Offshore retained the services of the Cawthron Institute to develop a plan that would meet the standard and minimise any biosecurity risks.

"It was a real collaborative effort between the owners and operators of the vessel, MPI, and Cawthron to develop the plan," says Cawthron Biosecurity Team Leader Grant Hopkins.

When finalised, the plan was assessed and approved by MPI under a new section of the Biosecurity Act created to manage the risks posed by craft.

The plan included a thorough cleaning of the *Kan Tan IV* while it was in Singapore undergoing maintenance prior to departing for New Zealand. That meant removing biofouling and sediments from areas of the rig that were submerged during prior drilling operations.

"Part of the work required hiring a specialised dive team working nearly around the clock over a two-week period," says Grant.

When work was completed, the rig was loaded onto a heavy-lift vessel (HLV) for the journey to New Zealand. "The three-week trip on the HLV meant that any remaining marine pests and diseases would be dessicated," says Grant.

The HLV and the rig's support vessels were also defouled in preparation for arrival into New Zealand waters.

Liz says MPI gave pre-arrival clearance to the *Kan Tan IV* for biofouling based on Cawthron's reports, including photographic evidence. "Once arriving in New Zealand in August, the *Kan Tan IV*, the HLV, and support vessels were checked and given the 'all clear' by MPI inspectors."

The *Kan Tan IV* is expected to be active in New Zealand waters for about a year. It's currently being used to drill the Manaia-2 appraisal well, located south-west of the main Maari field.

Kan Tan IV *on its way to the Maari field in the Taranaki Basin. Photo: OMV New Zealand.*

Mangrove Management

by Shelly Biswell, Editor

In early August, Environment Court Judge Smith ruled on a case brought by individual Basil Graeme and Forest and Bird against decisions by the Bay of Plenty Regional Council (BOPRC) on its mangrove management and sections of the proposed Bay of Plenty Regional Policy Statement (RPS).

The decision clarifies the role of mangroves as indigenous plants that play an important role in coastal ecosystems and that councils need to be clear about the reasons for mangrove removal on a case-by-case basis says Boffa Miskell senior ecologist Dr Sharon De Luca who was an expert witness for the appellants in the case.

"The key point in this decision is the recognition that mangroves have ecological value and their removal has no ecological benefit. Judge Smith concluded that there will be cases where the removal of mangroves is justifiable for reasons of amenity, recreational, access, or cultural reasons and that these will need to be considered in the context of the ecological values of the mangroves and the ecological effects of their removal," she says.

Mangroves in context

Basil Graeme has been championing mangroves and their habitat for about 40 years. "I was fortunate enough to know Professor John Morton of the University of Auckland who was a staunch advocate for mangroves at a time when their habitat was being paved over to make way for development. In 1970, we fought for and won the protection of saltmarshes in the Bay of Plenty, but since the 1990s there has been a thrust by many to get rid of mangroves, particularly if they feel the mangroves affect access, views or housing prices.

"Mangroves have been vilified. The social campaign against them has been every bit as successful as the campaign against possums on land. The difference is mangroves are an indigenous species and are a natural part of the ecosystem," Basil says.

Unlike much of the rest of the world where mangrove habitat is in decline, according to NIWA scientists

Aerial view of mangroves in Whitianga. Photo: NIWA.

Matua Estuary in the Bay of Plenty in January 2012 where mangroves were hand removed three years previously. Area in the foreground is where bivalves returned two years after removal. To the right near the mangroves is where mangroves were removed by mulching. Photo: BOPRC.

mangroves have been spreading in New Zealand at the rate of about four per cent each year. Sediments entering estuaries from catchments are the main culprit behind mangrove expansion says NIWA scientist Dr Carolyn Lundquist.

"Farming and other land-use changes, particularly over the past 50 or 60 years, means we have higher sediment loads in many of our estuaries which changes the sediment properties to make them more suitable for mangroves," she says.

For some, the expansion of mangrove habitat is an unwelcome change. They cite loss of access, amenities, and historical uses. Numerous estuary care groups have been established across Northland, Auckland, the Coromandel, and the Bay of Plenty with mangrove removal and containment as primary tenets. It's important to note that many of these care groups have done much to enhance estuaries and the coastal environment, including riparian plantings to reduce erosion, pest control, bird and sediment monitoring, rubbish removal, and the reestablishment of high-tide bird roosts.

Not surprisingly, affected councils have been under increasing pressure to remove and contain mangroves. Councils have needed to develop policies and statements in their coastal plans on mangrove management. Of concern to some was that the BOPRC's proposed RPS had several provisions that apparently suggested that removing mangroves had ecological benefits. As noted in the decision, "Use of words such as *manage mangroves to avoid the adverse effects of mangrove proliferation* appears to involve an assumption that proliferation has adverse effects".

BOPRC senior environmental scientist Stephen Park notes that arguments as to whether the BOPRC's mangrove management policy was appropriately balanced were also raised through the submissions

Omokoroa Estuary in Tauranga Harbour two years after mulching. Photo: Basil Graeme.

process of the proposed RPS and much of that language had been revised before the case went to the Environment Court.

Catchment-wide approach

There may be differences of opinion on mangroves, but there is general agreement that a catchment-wide approach is required in improving the health of the coastal environment. In making his decision, Judge Smith noted that "the reference with the Policy [RPS] to a Catchment Management Plan gives us a great deal of faith that the question of mangrove management will not be addressed as an isolated issue. It is simply part of a much larger and complicated jigsaw."

BOPRC land management manager Robyn Skelton says that the focus of BOPRC's efforts has been on reducing sedimentation in the harbour by implementing catchment action plans. "These include landowner incentives and assistance with planting and fencing of waterways and habitat protection. We also work with the 10 Estuary Care groups around the Tauranga Harbour, to help them understand and take action on the wider catchment issues that have promoted mangrove growth," she says.

Monitoring change

Over the last four years NIWA has monitored a number of consented mangrove removals and the results are mixed says Carolyn. "It can't be assumed that just because you remove mangroves means you are going to 'restore' a previous habitat. Our monitoring suggests that there are a number of factors involved, for example, location, depth, exposure, energy, and how much sediment is entering the harbour. There's also questions on the best way to remove mangroves if that's the management decision that's been made."

NIWA is currently working with Auckland Council on management guidelines for mangroves that are expected to be completed before the end of the year. It will be publicly available and should be helpful for other councils as well.

Sharon says, "While there's still much we need to learn about managing our coastal environments, the important thing is that policies support good decision-making. When the judge gave his final decision that '[M]angroves are indigenous plants and play an important role in coastal ecosystems', it was confirmation of their important ecological role."

The judge's decision includes the strongly worded statement that "the removal of mangroves is prima facie a breach of the preservation requirement of Section 6(a) of the [Resource Management] Act. Accordingly, there must be some justification to remove mangroves beyond a mere public dislike."

State of play

In the Bay of Plenty region, 110 ha of mangrove habitat have been removed using a mechanical mulching method. This year, the BOPRC is proposing to remove approximately 15 ha of mature mangrove plants from the Uretara, Matahui, Waikaraka, Welcome Bay and Matua estuaries as well as areas near the Mokoroa golf course and Matahui Road. An Assessment of Environmental Effects is currently being undertaken for the resource consent application which is due to be lodged before the end of the year.

BOPRC also applied for a resource consent to undertake mechanical removal of mangrove seedlings in approximately 600 ha of the Tauranga Harbour in an area where volunteers have removed seedlings by hand for the past nine years. An Independent Commissioner decided that this application would not require public notification and this consent application has now been approved.

Carbon sequestration

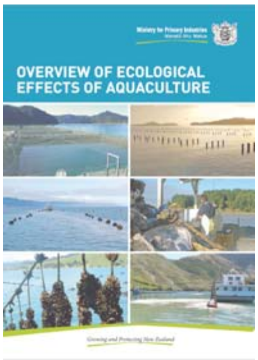
Basil says overall he's pleased with the outcome, but is disappointed that suggested provisions for the RPS on carbon sequestration by mangroves weren't included in the final decision. "Mangroves have an important role to play in carbon sequestration. It's strange to me that we discuss offsets when it comes to native forests on land and our forestry, but pay little attention to mangroves. Even now, it seems like we're still short-changing the important role mangroves play."

The Environment Court decision is available in the knowledge centre on the BOPRC website: www.boprc.govt.nz.

Mangrove propagules in Waikareao Estuary on January 2012. Photo: BOPRC.

News in Brief

Ecological guidance for aquaculture



In late August, the Ministry for Primary Industries published a comprehensive *Literature Review of Ecological Effects of Aquaculture, along with an Overview of the Ecological Effects of Aquaculture.*

Senior Aquaculture Advisor Steph Hopkins says the publications focus on the potential ecological effects of existing commercial aquaculture species in New Zealand, and those species that are likely to be developed over the next five years.

"Beyond assisting with current marine aquaculture planning and management decisions, the literature review also identifies knowledge gaps and will aid in prioritising future research," she says.

The web-based literature review was compiled by two of New Zealand's main science providers in aquaculture – the Cawthron Institute and the National Institute of Water and Atmospheric Research. NIWA and Cawthron also contributed to the overview, with additional input from the Department of Conservation, regional councils, the aquaculture industry, and others.

The literature review will serve as the basis for additional aquaculture planning and decision-making tools that MPI is set to publish later this year. One is a *Decision-makers' Dashboard* that will help decision-makers, planners, marine farmers, and others apply the knowledge in the literature review to specific aquaculture development proposals. The other is an Aquaculture Risk Screening Tool.

Aquaculture analyst Michael Nielsen says the risk screening tool will provide a method of vetting aquaculture proposals to identify, prioritise and potentially manage ecological risks and uncertainty associated with the proposal.

"The methodology has been tested using case studies and refined following a workshop with key technical and management experts. The tool will be primarily intended for use during the site selection phase of aquaculture development as a way to flag potential ecological risks so they can then be addressed appropriately," Michael says.

A prototype of the tool is expected to be available on the MPI website later this year.

Taken together, the resources are part of an Aquaculture Ecological Guidance Package that is being developed to assist in maintaining and strengthening New Zealand's reputation for high environmental performance in aquaculture products and development.

The guidance also meets the aims of both MPI's medium-term aquaculture research strategy and the Government's *Aquaculture Strategy and Five-year Action Plan*.

Conservation Management Strategies

On 13 September, submissions closed on the draft Canterbury, Otago, and Southland Murihiku conservation management strategies (CMS). CMS are 10-year strategic documents that describe how the Department of Conservation (DOC) will manage places that are special to communities and tangata whenua. The strategies reflect ways to achieve both national and local conservation goals.

In Otago, one of the issues identified in the CMS is protection of representative examples of Otago's marine ecosystems and habitats in a network of marine protected areas.

"This would keep our marine environments healthy and ensure our special biodiversity, including the habitats of threatened wildlife, like New Zealand sea lions and yellow-eyed penguins, survives into the future," DOC's Coastal Otago Ranger Jim Fyfe says.

He says the national marine protected areas gap analysis by DOC and the Ministry for Primary Industries in 2011 shows the Otago coast is lagging behind the rest of New Zealand.

"This report shows how low the levels of marine protection in Otago are. There are major gaps in representation with only five out of the 37 habitats described for this region represented in marine protected areas in New Zealand. Very few of our habitats and special wildlife foraging habitats are protected from pressures on the marine environment," Jim says.

For the draft Canterbury CMS, one of the key issues identified is "[V]aluing the coastal environment, both land and marine, and establishing adequate protective measures". In the draft Southland Murihiku CMS, priorities for marine conservation include, "managing marine reserves to ensure the full benefit of protection is realised, managing biosecurity threats, and ensuring that marine wildlife such as the New Zealand sea lion, southern right whale, and Hector's dolphin are flourishing within intact ecosystems".

Over 1000 submissions were received across the three CMS. Hearings will be held in October and November for submitters who asked to speak to their submission. DOC will then prepare a summary of submissions and revise each draft CMS in preparation for sending them to their respective conservation boards by March 2014.

Earlier this year, submissions and hearings closed on CMS for Northland, Auckland and Waikato. Revised draft CMS were prepared and sent to respective conservation boards in late August and early September.

Word from the Chair

by Deirdre Hart

In my previous Word from the Chair, I promised an update from the International Geomorphology Conference in Paris. The conference was well attended, with the main room occupied by the coastal sessions. While there were a number of excellent talks and discussions, I would like to mention three that may be of particular interest to NZCS members.

1) Gerd Masselink, formerly from Australia and now at the University of Plymouth, gave an interesting talk about gravel-barrier nourishment and recontouring. The ‘take home’ message was that width is the key to creating an effective storm defense, whereas increasing barrier height increased swash run-up elevations and therefore over-topping, hinterland flooding and breaching potential.

2) Edward Anthony, from Marseilles, gave a talk co-authored by Charles Lemckert, from Griffith University, about the future of coastal resort cities, such as Gold Coast City, with climate change and sea-level rise. Their conclusion was that managed retreat was the only viable strategy for such places, which could mitigate the hazard while safeguarding the environmental values that their economies were based around, a strategy which was not being applied to the necessary scale at present, particularly in Australia.

3) Lastly, Dennis Brunsden, Kings College London, gave a plenary titled “Tales from the Deep”. Using an impressive array of chemical and sounding analyses and illustrations, he called for coastal scientists to pay more attention to researching the world's seabeds. He commented,

> “The sea floor occupies 71 per cent of the Earth’s surface, some 361,419,000 km². It is truly the last geomorphological frontier.”

At the conference overall, it was great to see coastal issues centre stage among other geomorphic topics.

This is my last Word from the Chair before I step down from the management committee at the end of seven years of service. During this time, I have been amazed by the professionalism, skills, depth of experience, and commitment to all things coastal of NZCS members, as demonstrated by the members of our management committee, contributions to *Coastal News*, volunteers involved with the conference organising each year, as well as throughout our wider society. I hope that the Professional Development Award launched this year proves to be effective encouragement for individuals and an opportunity for NZCS to capitalise on the extension of our knowledge and experience.

I have been fortunate to learn much from NZCS members and associates, and firmly believe that the breadth of our professional background and qualifications is a key NZCS strength, unmatched by other professional bodies with whom I interact.

At the same time, I have been humbled and encouraged by the dogged dedication of non-professional individuals and groups in coastal communities. It is thanks to these people that many of our more stunning coastal environments have been protected, cared for and/or rehabilitated. I encourage you to acknowledge the work of these people by nominating them for the Coastal Champion Awards.

This is not goodbye as I will continue to be involved with NZCS in the future and encourage those of you who have not yet had a go on the management or conference committees to volunteer your time and skills.

A bientôt – see you in Hokitika.

Tsunami Hazards

A new report from GNS Science shows some parts of the New Zealand coast are exposed to greater tsunami hazard than previously thought, while the hazard in other coastal regions is the same or even less.

The report was compiled by GNS Scientist Dr William Powers and was commissioned by the Ministry for Civil Defence and Emergency Management.

The main areas where tsunami pose a greater hazard than previously understood are:

- the coasts of Northland, the northwest part of Auckland, Great Barrier Island, the Coromandel Peninsula, and the Bay of Plenty;
- the North Island’s East Cape and parts of the Wairarapa coast; and
- Southland, Stewart Island, Fiordland and Westland.

The estimated maximum tsunami wave heights in some of these areas have increased by about 50 per cent.

The report is available on the Ministry of Civil Defence and Emergency Management website at www.civildefence.govt.nz/.

Coastal News

Coasts and Ports 2013 Overview

Article and photos by Tom Shand, Tonkin & Taylor Ltd and New Zealand representative on the local organising committee.

The first Australasian Conference on Coastal Engineering was held at Manly Beach, Sydney in 1973 attended by a handful of the then-fledgling coastal engineering and science fraternity. Since this inaugural gathering, the conference has grown in size and scope and, 40 years later, returned to Manly for arguably the most successful conference yet.

Held 19 to 21 September, the 21st Australasian Coastal and Ocean Engineering Conference included keynote addresses on:

- the "Sustainable Development of Nourished Shorelines" featuring the massive 20 million m^3 'sand engine' project in the Netherlands;
- the World Association for Waterborne Transport and Infrastructure's (PIANC) "Working with Nature" philosophy; and
- the "Interpretation of Good Faith in Statutory Immunities for Coastal Land-Use Planning Decisions".

Over 170 papers were presented to nearly 400 delegates on topics ranging from advances in coastal science and management practices, to port and harbour engineering. Field trips along Sydney's Northern Beaches and to Sydney Port were supplemented with a sand-nourishment forum to share ideas and experiences.

Local Aboriginal custodians welcomed the 400 conference delegates.

Special thanks to the New Zealanders who supported the conference by making the trip across the Tasman and to Discovery Marine Limited, MetOcean Solutions and Tonkin & Taylor for their generous sponsorship.

The conference was wrapped up with an announcement that the next Coasts and Ports will be held in New Zealand in 2015. With some extremely large boots to fill we look forward to seeing you all there.

Returning to where it all began, the 21st Australasian Coastal and Ocean Engineering Conference was held at Manly Beach, Sydney in September.

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.

North Island

Northland	Michael Day André Labonté	michaeld@nrc.govt.nz labonte@xtra.co.nz
Auckland	Hugh Leersnyder	hugh.leersnyder@beca.com
Waikato	Christin Atchinson	christin.atchinson@waikatoregion.govt.nz
Bay of Plenty	Mark Ivamy Sharon De Luca	MIvamy@tonkin.co.nz sharon.deluca@boffamiskell.co.nz
Hawke's Bay	Neil Daykin	Daykin@hbrc.govt.nz
Taranaki	Emily Roberts	emily.roberts@trc.govt.nz
Wellington	Iain Dawe	iain.dawe@gw.govt.nz

South Island

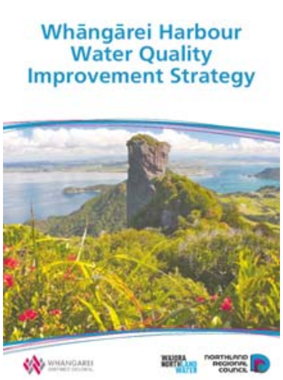
Upper South Island	Eric Verstappen	eric.verstappen@tasman.govt.nz
Canterbury	Justin Cope	justin.cope@ecan.govt.nz
Otago	Suzanne Watt Jamie Torrance	suzanne.watt@orc.govt.nz jamie.torrance@orc.govt.nz
Southland	TBC	hugh.leersnyder@beca.com

News from the Regions

Northland Region

by Michael Day, Regional Coordinator

Whangarei Harbour Water Quality Improvement Strategy



The *Whangarei Harbour Water Quality Improvement Strategy* (the strategy) is the result of a joint Northland Regional Council – Whangarei District Council project to better align and enhance the management of water quality in the Whangarei Harbour.

The strategy sets out what we know about the quality of water in the harbour, the known and likely impacts of water quality on its important uses and values, the sources of contamination, and the respective actions of both councils to maintain and improve its water quality.

The focus of the strategy is on the upper harbour because that is where water quality is often degraded. Water in the middle and lower areas of the harbour is generally of a high quality.

A key action of the strategy is to collaboratively develop an integrated catchment management plan for the harbour and its contributing catchment. This will involve working closely with the community, key stakeholders, and iwi and hapu to establish catchment-specific management objectives and associated water quality limits (enforceable standards). Other important actions include improving the performance of wastewater and stormwater reticulation and treatment infrastructure and working closely with rural landowners in the harbour catchment to prevent and reduce loads of sediments, nutrients, and faecal matter entering the harbour.

The strategy can be viewed at: www.nrc.govt.nz/whangareiharbourstrategy.

Whangarei Harbour Sedimentation Report

The Northland Regional Council and Northport commissioned NIWA to determine historical rates of sediment accumulation and contemporary sources of catchment sediments depositing in the Whangarei Harbour system.

The results of this study will provide resource planners, politicians and the public with valuable information regarding sediment accumulation rates and the present-day sources of sediment accumulating in the Whangarei Harbour system. This, together with previous studies of sedimentation in the Kaipara Harbour and the Bay of Islands system, will help the regional council to make informed management decisions on activities that contribute to sediment erosion and prioritise land-management initiatives to reduce sediment erosion and runoff to estuaries.

The information from this report will be valuable for the development of water management objectives, limits, and targets for the harbour catchment. The report can be viewed by going to the resource library on www.nrc.govt.nz and search for *Whangarei Harbour Sedimentation Report*.

Bay of Plenty

by Sharon De Luca and Mark Ivamy
Regional Co-Coordinators

Bay of Plenty Coast Care

Bay of Plenty Coast Care has been in action for 19 years, and now has over 20 local Coast Care groups restoring the region's dune vegetation. Bay of Plenty Coast Care recently celebrated the one-millionth plant to find a new home on the Bay of Plenty coastline.

Pilot Bay Boardwalk

Tauranga City Council (TCC) has recently completed construction of a boardwalk along Pilot Bay at Mount Maunganui. The boardwalk was installed in response to the severe wear marks in the turf (informal tracks) due to high use from walkers. The wear was becoming worse with the general population increase and the rising number of cruise ships visiting Tauranga.

TCC received strong public opinion both for and against the boardwalk, with the majority supporting the boardwalk. The elected members wanted to try and maximise the green space at the Salisbury Wharf end and this is why the boardwalk weaves in and out of the trees. Public feedback upon completion of the project has been extremely positive.

TCC has also replenished the beach with sand to eliminate the drop off from the grass to the beach. Two other projects were also incorporated into the boardwalk project, namely pedestrian crossings and stormwater upgrades.

Pilot Bay Boardwalk. Photo: TCC.

Coastal News

Papamoa Surf Lifesaving Club

Boffa Miskell has been working for the Papamoa Surf Lifesaving Club assisting them in planning for their new building and ensuring it is appropriately provided for in Tauranga City Council's *Coastal Reserve Management Plan*, which is currently being finalised. The building is designed to meet the needs of the club's 655 members (and growing) who last year saved 59 lives along Papamoa Beach.

The building will be a huge improvement upon the existing building, which is now in a state of disrepair and too small to meet the activity and storage requirements of the club. Green building principles will be used in the design. Its low slung architectural design will fit better within the coastal landscape.

The next phase of the project is to obtain resource consent followed by detailed architectural design.

Waikato

by Christin Atchinson, Regional Coordinator

Erosion at two Whitianga beaches

A severe storm in late September led to a reasonably significant amount of beach erosion at Whitianga's Buffalo and Brophy's beaches, raising concerns about future damage to Buffalo Beach Rd and adjoining reserve areas. A recently planted dune designed to help stabilise central Buffalo Beach bore up well to the storm. The rock revetments also generally stood up well, although the walls contributed to wave overtopping on to the adjacent road.

The Waikato Regional Council (WRC) has recently committed $170,000 to the Whitianga Coastal Action Steering Group project (a collaboration between WRC, Thames Coromandel District Council, iwi and community members) for investigative modelling work to identify long-term solutions to deal with the coastal erosion hazard at Buffalo Beach.

Hawke's Bay

by Neil Daykin, Regional Coordinator

Clifton Motor Camp

Erosion at Clifton Motor Camp has continued and in recent months has resulted in loss of vehicle access and underground mains water (now reinstated with a surface pipe). Permission has been sought from Hawke's Bay Regional Council (HBRC) for temporary concrete blocks to be placed on the beach to protect the power transformer providing power to the camp and fishing club.

Hastings District Council (HDC) worked with the camp owners on a resource consent application to construct a limestone rock revetment at the Clifton Reserve. Resource consent was given and the 80-m long revetment has restored access to the reserve and its campground, marine club and boat ramp. As part of the application, HDC proposed that the structure should be removed after five years or earlier if it is found to cause significant downdrift erosion.

Clifton Motor Camp. Photo: HBRC.

Napier (Westshore) Breakwater

Napier City Council has applied for a resource consent to construct a breakwater at Whakarire Avenue, Westshore, Napier. The proposed rock breakwater will be 'H' shaped. Part of it will be constructed over an existing breakwater structure.

The purpose of the new structure is to prevent further erosion occurring along Whakarire Avenue and at the southern end of Westshore Beach. The application has been publicly notified.

Haumoana Coastal Protection Project

Representatives from HDC, HBRC, and the Haumoana community group Walking on Water (WOW) recently met to discuss potential mitigation measures to manage the effects of the proposed Haumoana groyne scheme on coastal processes and shoreline erosion.

During the meeting, the representatives agreed that the provision of a groyne field in the vicinity of Haumoana will have the benefit of stabilising the shoreline at that location through accretion and in a reduction in the rate of erosion within the groyne field.

There was also agreement that there would be negative downstream effects from a groyne field (such as increased erosion to the north around East Clive foreshore).

The following possible approaches to mitigate the impacts were reported on during the meeting:

1. Replace the gravel that the scheme withholds from the longshore drift supply, both in terms of filling the beaches between the groynes (one-off 100,000 m^3) and an annual compensation volume (18,000 m^3).
2. Allow the increased rate of erosion north of the Tukituki groyne to take place and address the impacts on infrastructure through new and extended (landward) coastal protection structures.
3. Consider a combination of components from options 1 and 2.

Figure 1 (page 15) is the projected coastline to the north (downstream) of the proposed groyne field after 50 years with no groynes. Figure 2 (page 15) is with a groyne field, but no mitigation.

Figure 1 (left): Predicted coastline after 50 years with no Haumoana groyne scheme; Figure 2 (right): Predicted coastline after 50 years with the Haumoana groyne scheme (no mitigation or prefill). Figures: HBRC.

Regional Coordinator Close-up – Sharon De Luca

Sharon is the regional co-coordinator for the Bay of Plenty. She has more than 12 years' experience in marine ecology, along with six years' experience in freshwater and terrestrial ecology. She is currently a Senior Ecologist and Principal with Boffa Miskell and leads the company's marine ecology team. Prior to working for Boffa Miskell, she was a Post-Doctoral Research Fellow at City University in Hong Kong.

Sharon has significant experience in assessment of effects on coastal/marine and freshwater ecological values, preparation of aquatic monitoring programmes, habitat surveys, contaminant analyses and restoration plans, and preparation and presentation of expert witness evidence.

In her role with Boffa Miskell, she advises a large range of clients, including private landowners, district and regional councils, infrastructure companies, and government agencies. Over the past several years, she has also worked closely with NZTA on a number of Projects of National Significance.

Sharon is a Certified Environmental Practitioner with the Environment Institute of Australia and New Zealand.

NZCS Management Committee

Chairperson:	Deirdre Hart	deirdre.hart@canterbury.ac.nz
Deputy Chairperson/IPENZ Coordinator:	Rick Liefting	rick.liefting@waikatoregion.govt.nz
Treasurer:	Eric Verstappen	eric.verstappen@tasman.govt.nz
Deputy Treasurer:	Andrew Swales	a.swales@niwa.co.nz
Membership & Partners Liaison:	Paul Creswell	paul.creswell@mpi.govt.nz
Regional Coordinator:	Hugh Leersnyder	hugh.leersnyder@beca.com
Education & University Coordinator:	Christopher Gomez	christopher.gomez@canterbury.ac.nz
Central Government Coordinator:	Sarah McRae	smcrae@doc.govt.nz
***Coastal News* Coordinator:**	Amy Robinson	amy.robinson@waikatoregion.govt.nz
Website & Digest Coordinator:	Jose Borrero	jose@ecoast.co.nz
Other NZCS Contacts		
Administrator & Communications Coordinator:	Renee Foster	nzcoastalsociety@gmail.com
***Coastal News* Editor:**	Shelly Biswell	shelly@biswell.net

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 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 Renee Foster (email: nzcoastalsociety@gmail.com).

Coastal News

Professional Development Award

NZCS is currently accepting applications for its inaugural Professional Development Award.

The purpose of the award is to enhance the ability of NZCS members to contribute to the vision of NZCS.

Applications are open to NZCS professional members who have been a full NZCS member for at least three consecutive years prior to the date of application, and be in full or part-time employment in New Zealand with relevant responsibilities in coastal management, research, consulting, or similar work. The successful applicant will be awarded up to NZ$10,000 toward the expenses of pursuing a professional development opportunity that is relevant to the achievement of the NZCS vision.

Applications close 8 November 2013. For an application form, visit www.coastalsociety.org.nz or contact the NZCS Administrator at nzcoastalsociety@gmail.com.

The successful applicant will be announced at the NZCS Conference (19 to 22 November in Hokitika).

The New Zealand Coastal Society would like to acknowledge our corporate members for their support:

Beca

Andrew.Stewart — Environmental & Infrastructure Resource Management

OCEL Consultants NZ Limited

Environment Canterbury — Your regional council

Maccaferri — Engineered Environmental Solutions

Tonkin & Taylor

NIWA — Taihoro Nukurangi

Taranaki Regional Council

spiire

Disclaimer

Opinions expressed in *Coastal News* are those of various authors and do not necessarily represent those of the editor, the NZCS management committee, or NZCS. Every effort is made to provide accurate and factual content. The publishers and editorial staff, however, cannot accept responsibility for any inadvertent errors or omissions that may occur.