Coastal News

Te Hunga Takutai o Aotearoa

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Photo courtesy Bill Southward.

At the Mouth of the Rakaia River

by Shelly Biswell, Editor

There is a tongue-in-cheek quote on NZCS Coastal Champion Bill Southward's business card for his work as a wilderness guide that reads: "Impossibilities done straight away...miracles take a little longer!" And yet, if you talk to planners, scientists, and decision-makers in the Canterbury region they will tell you that Bill's work on the Rakaia River fits this description. His dedication, practical knowledge, observations and meticulous record-keeping, and ability to pull the "right" people together to find answers to some of the complex questions about coastal processes at the mouths of the South Island's braided rivers is not only legendary, it's making a difference.

As one of New Zealand's largest braided rivers, the Rakaia River flows in an east/southeast direction about 150 kilometres from its headwaters in the Southern Alps to the Canterbury Bight. The river flows into a coastal lagoon – a hapua – that is separated from the Pacific Ocean by a mixed sand and gravel barrier.

Dr Bryan Jenkins of the Waterways Centre for Freshwater Management and past chief executive of Environment Canterbury says hapua are different from other coastal lagoons because the barrier impounds the freshwater and causes the river mouth to be offset as it flows into the ocean.

"The mouth's geomorphology is affected by river flow and sediment transport, along with the ocean's wave energy," he says. "Bill's long-term measurements have been instrumental in identifying this unique hapua characteristic."

While coastal processes are dynamic, Bill has observed over the past 15 years as more and more water is taken from the river – either directly or from ground aquifers – and the water flow has decreased, the interface between the river mouth and the sea has changed. "Previously the river flow at the mouth controlled the sea and kept itself open, now the sea controls the mouth of the river," he says.

The effects of this change appear to be that during heavy southerlies – a not uncommon occurrence in Canterbury – the river flow is restricted from going out to sea with an increase in both erosion and flooding of surrounding lands.

"Somewhat against conventional wisdom," Bryan says, "Bill also observed that the Rakaia River's flooding is worse when there are moderate flows – as opposed to high flows – because the water isn't able to escape over the mixed sand and gravel barrier so there's a 'backwater' effect."

With lower and lower river flows, the composition of the barrier is also changing. "I've seen huge changes to the type of shingle that's deposited over the past 10 years," Bill says. "Boulders and large rocks that used to get carried out to sea with the high flows now stay on the riverbed. The bank is also much lower which means that now during storms the ocean's waves more frequently crash over it and into the hapua."

Bill's observations have led a number of researchers to look at hapua more closely in search of answers. It's also highlighted the need for river flows to be gauged in coastal reaches to monitor and manage the effects of water resource use on coastal environments.

Environment Canterbury's Justin Cope says Bill's work has been crucial in getting researchers, planners, and decision-makers to take a whole catchment approach to their work.

"Bill has spent his entire life by the river. The observations he makes are extremely valuable and have contributed greatly to our understanding of not just the Rakaia River, but all of Canterbury's braided river systems. When Bill makes a submission or gives evidence on a river-related issue, people have learned to listen."

Called a "catalyst for change" by the people who nominated him for the Coastal Champion Awards, Bill has been able to bring scientists, planners and policy-makers together to get a fuller picture of what's happening all along the Rakaia River.

"Bill's work has certainly contributed to our thinking around water resources and informed our water policy," Justin says.

At the same time, Bill's questions and observations have made it clear there is still much to learn about these complex coastal processes.

"Ongoing monitoring and physical measuring is required to learn more about hapua in terms of longer-scale processes," says Bryan.

University of Canterbury Senior Lecturer Deirdre Hart says that while there has been research done on these systems for the South Island, the results of the science challenge some catchment practices.

In recent years, during major storms the barrier is almost engulfed by pounding waves. Photo courtesy Bill Southward.

"Bill makes the inconvenient science harder to ignore," she says.

Justin adds, "Bill has become the 'eyes of the operation' for our monitoring on the Rakaia. He doesn't go out to a site weekly, or monthly, or annually to monitor what's happening, he's there day in day out, year after year and he's been able to record information in a way that has assisted us immensely."

Editor's note: Bill was the recipient of this year's national NZCS Coastal Champion Award.

Nice Waves on the Raglan Bar

by Shawn Harrison, PhD student, Earth & Ocean Sciences, University of Waikato

This past summer and early autumn, Raglan surfers found themselves enjoying long, smooth barrelling waves (Figure 1). While this is a normal occurrence on Raglan's famed left-hand point breaks, these waves were being ridden to the right on "The Bar", the ebb-tide delta that sits off the entrance of Whaingaroa Harbour. The Bar is well known as a surfing spot; however, despite abundant swell that consistently breaks over its shallow sandbars, the shape of The Bar only occasionally produces high-quality breakers suitable for surfing. Indeed, before this year, the last time The Bar was working consistently was in early 2005.

Figure 1: Surfers enjoying crisp, overhead, right-handed barrels on the southern end on the ebb-tide delta at Raglan on 2 April 2013. Courtesy: B-rex.

As part of my research into the morphology of ebb-tidal deltas (ETDs), I thought it would be interesting to explore the physical characteristics of The Bar that lead to these optimum surfing conditions. In general, ETDs are morphological structures occurring naturally on the seaward side of tidal constrictions. They form at the interface between a tidal inlet and the open sea where tidal currents and wave action meet in a complex, highly dynamic way – shaping the available sediment into coherent arrangements of bars and channels.

ETDs are a characteristic of the entrances to many of New Zealand's estuaries, and can pose a significant navigational hazard to vessels entering and leaving a harbour. At locations where shipping traffic is important (such as at Tauranga and Otago harbours), maintenance dredging is necessary to stop the natural dynamics of ETDs from impacting on port operations. Moreover, the size and shape of ETDs can greatly impact the nearby coastal zone. The shallow bars of a delta dissipate wave energy offshore, protecting the tidal inlet and redirect waves onto neighbouring beaches. They also provide a bypassing mechanism in the littoral system, allowing sediment to cross tidal inlets on its along-coast journey. There is a strong correlation with ETD size and nearby beach volume due to the repositioning of wave energy by the mobile sandbars of an ETD.

The Raglan Bar (Figure 2) is a complex, multi-component example of an ETD extending approximately 1800 metres offshore of the west coast. Most of the sand is derived from the northerly transport of sediment originating from Taranaki. Tidal and wave action transport the sediment up the west coast along most of the North Island. The sediment is pushed shoreward by waves and seaward by strong ebbing tidal currents exiting the harbour. The heavy, black sand accumulates where these opposing forces meet. The Bar includes an ebb-dominated main channel with spring ebb currents reaching three metres per second. The deepest point of the main channel occurs at the inlet gorge and is approximately 15 metres below low tide. The channel extends seaward to the west, with depths becoming shallower with distance from the inlet. The shallowest part of the main channel is at its terminal lobe, which moves cross-shore and changes depth depending on the combination of wave and tidal conditions. The terminal lobe is the seaward-most extent of the delta where approaching waves break in-line with the jet-axis of the main channel.

Broad sheets of consolidated accumulations of sand, called "swash platforms" flank both sides of the main channel. The swash platforms are composed of large intertidal sandbars called "swash bars". These sandbars tend to control the course of the tidal flow, forcing flood and ebb currents through different channels. Also, excess water mass from breaking waves is returned through these channels. The terminal lobe connects the swash platforms along the seaward-most limit of the delta. The terminal lobe tends to be the first point for advancing waves to break. Often the terminal lobe can take the shape of a shield.

Part of my work involves the analysis of geo-rectified high-resolution video images, collected by NIWA's Cam-Era system for Waikato Regional Council, used to track wave-breaking patterns which correspond to the evolving position and shape of the Raglan

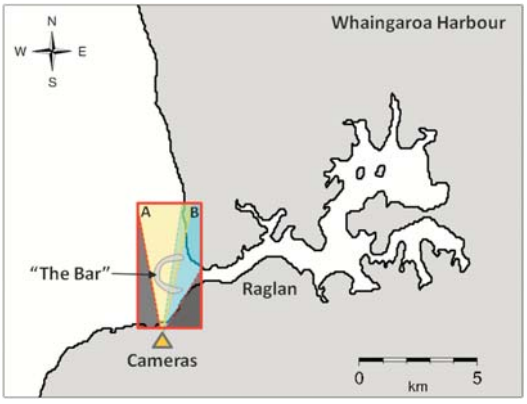

Figure 2: Map showing the location of "The Bar" seaward of the inlet to Whaingaroa Harbour at Raglan. The position and view of Waikato Regional Council's "Raglan A" and "Raglan B" Cam-Era cameras are indicated.

Bar. The movements are linked to the prevailing wave and tidal conditions in order to correlate variation in the hydrodynamic climate with morphological response. Although a local example, these video-based measurements of the morphological responses at Raglan are used to guide development of a model that can be used at ETDs in other parts of the world. Video-based techniques are a useful tool in observing nearshore coastal processes, particularly in areas like ETDs where conditions are often too dangerous to make measurements *in situ*. Also, observations can be made much more frequently than is possible with standard instrumentation. Other studies using similar techniques have been successfully applied to observe rip currents, swash, groundwater seepage, and beach morphology.

The sequence of imagery over recent years shows the evolution of The Bar from unsurfable to surfable (Figure 3). In 2010 and 2011, the terminal lobe was an almost straight, linear shape with the southern end situated relatively far offshore from Ngarunui Beach. This configuration caused waves to break too quickly to provide a surfable wave face. By late 2011, the southern end of the terminal lobe began migrating shoreward while the terminal lobe directly offshore of the main channel moved slightly offshore, increasing the curvature. Also, during this time, a breach in the southern arm caused the formation of a channel through the southern swash platform allowing tidal and wave return flow currents to move between the inlet and the southern lobe. The presence of this channel provided a mechanism for sediment mobilised by waves to be carried away from the beach.

By late 2012, this channel had become compressed and reoriented to almost shore parallel in the very nearshore of the beach. The presence of this nearshore channel corresponded with a substantial loss of sediment from Ngarunui Beach leaving large exposed rocks and a two-metre scarp in the vegetated dunes in some spots. The loss of sand from Ngarunui Beach was paired with an accretion of sand on the beach to the north of the inlet. Previously exposed rocks along that beach are now well covered; the northern terminal lobe has extended and the beach has a full profile with the high-water line well away from the toe of the vegetated dunes.

Meanwhile the southern end of the terminal lobe continued to advance shoreward making an almost shore-perpendicular angle. The long, smooth, curved terminal lobe of early 2013 allowed waves to peel slowly enough for surfing, but quickly enough to make a challenge. Local surfer, Miles Ratima, described the waves as "fast peeling with clean, hollow barrels – shaped similarly to waves in Indonesia". During early April 2013 (Figure 4) a

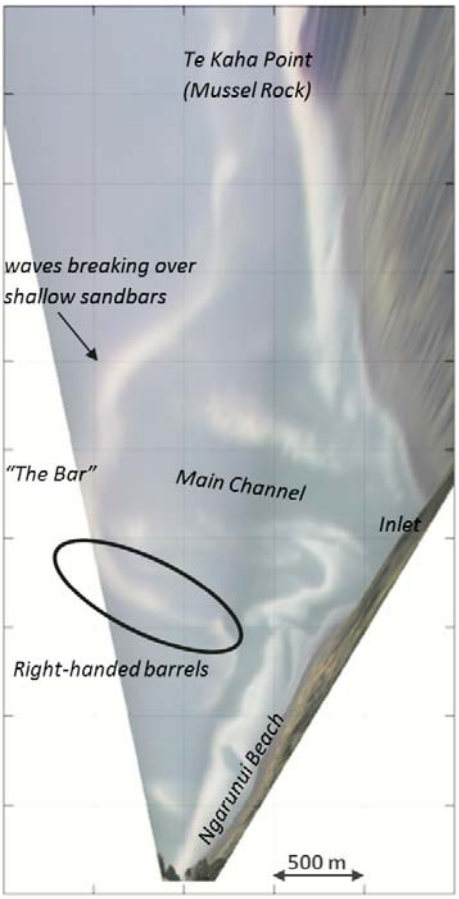

Figure 4: Geo-rectified, 10-minute averaged mosaic of video images during the afternoon of 2 April 2013. The white areas indicate wave breaking and imply shallow sandbar position.

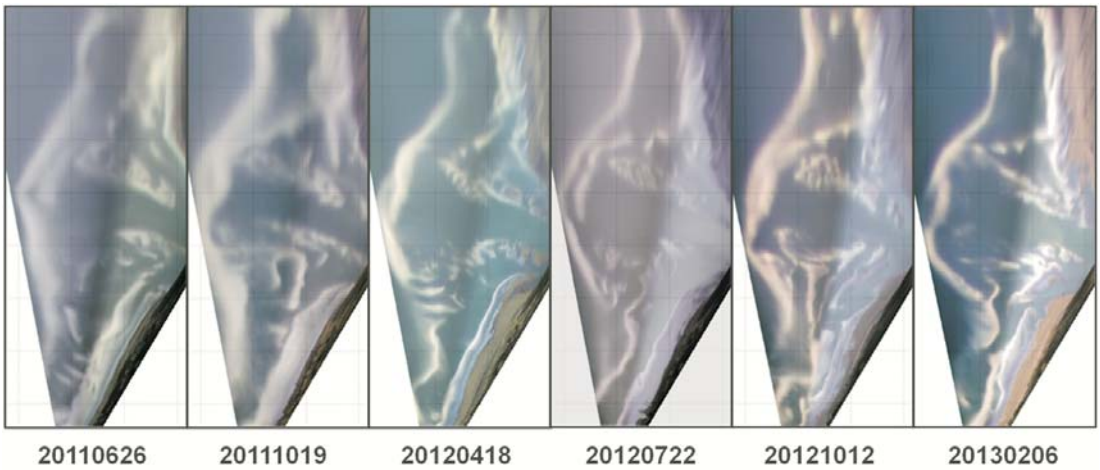

Figure 3: Sequence of geo-rectified, time-averaged video image mosaics showing the evolving configuration of the ebb-tidal delta at Raglan, New Zealand (The Bar) from 26 June 2011 (left) to 6 February 2013 (right).

combination of calm, fine weather and a series of well-organised long-period swells brought The Bar to life with excited surfers claiming minute-long barrels and turn after turn of right-handed pleasure.

The size and shape of the ebb-tidal delta at Raglan are near equilibrium on decadal timescales; however, the positions of the shoals and bars can move dramatically over a period of days to weeks in response to changing energetic conditions such as storms or large swell events. Indeed, as this article is being written, The Bar has changed shape again and is no longer consistently surfable.

The Raglan Bar is an example of a morphological system, which just like beaches, undergoes state changes. My doctoral work explores the hypothesis that upstate geometries are more along-coast uniform, whereas the more complex bar patterns develop during downstate changes which accompany

Figure 5: Perfect waves breaking on the southern end of The Bar at Raglan on 2 April 2013. Courtesy: Brad George.

lower energy conditions. My challenge is to find the trigger that forces these state changes. These sandbar patterns drive wave focusing and currents on The Bar, which apart from being good for surfing, also control the navigation hazard. My thesis will ultimately contribute to better hazard management in this highly dynamic environment.

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Effects of Sediment Accumulation on the Productivity of Habitat-forming Seaweeds

by Edwin Ainley, MSc student, University of Auckland

Increasing human population, coastal development, infrastructure and land-use changes are causing large amounts of sediment to be transported into adjacent marine ecosystems. Although sediment occurs naturally in the environment, human activities have greatly accelerated the supply of sediment through indirect activities such as accelerating natural soil erosion or modifying the coastline.

The scarcity of long-term data makes it difficult to explicitly relate the increase in sedimentation to human activities. Over the last couple of decades, however, there has been increasing evidence that changes in land use, both inland and along the coast, has accelerated natural soil erosion. These changes are responsible for greater sediment inputs into our coastal marine ecosystems. Macroalgae are often at the heart of these ecosystems, and despite the increasing interest in sedimentation around the world, there is little information on the effect that sediment has on subtidal macroalgal stands in New Zealand.

My study investigated the effects of deposited sediment on two important habitat-forming species of macroalgae in the Hauraki Gulf, *Ecklonia radiata* and *Carpophyllum flexuosum*. The first objective was to examine the temporal and spatial variability in the accumulation of sediment on these species and determine the primary environmental drivers responsible for this. This was examined by monitoring the amount of sediment on both species at a range of sites in the Hauraki Gulf throughout 2012.

The second objective of this study was to experimentally examine the effects of sediment accumulation on the growth and productivity of *E. radiata* and *C. flexuosum*. This was done by simulating the effects of sediment deposition on macroalgae for up to 11 days in the laboratory, removing the sediment and comparing the growth and photosynthetic rates of the sediment affected plants to controls.

The amount of sediment accumulating on seaweeds was highly variable over time and among sites. At open coast sites dominated by *E. radiata*, sediment accumulation was negatively correlated with wave action, with sediment accumulating on seaweeds during periods of calm sea conditions. In contrast, at sheltered sites dominated by *C. flexuosum*, sediment accumulation was highly correlated with rainfall events. After high rainfall events, sediment was washed into the coastline and allowed to settle onto the macroalgae. The maximum amount of sediment recorded on *E. radiata* was 4.5 mg cm^{-2} which was estimated to reduce light levels by more than 75 per cent.

Not surprisingly, accumulated sediment has the effect of greatly reducing light available for photosynthesis. Laboratory measurements clearly demonstrated that photosynthetic rates were greatly reduced by a layer of fine sediment. With prolonged exposure to accumulated sediment (~11 days) plants began to decay, with perforations and bleaching occurring on areas of the thalli that had been covered in sediment (Figures 1 and 2). Under the combination of sediment and low light *E. radiata* plants struggled to acclimate. Subsequently this had detrimental effects on photosynthesis, considerably reducing oxygen production of the plant. These effects were greatest under low light conditions (Figure 3) suggesting they will be magnified with increases in turbidity in the coastal environment and at depth, as light and wave exposure is reduced. Conversely, *C. flexuosum* was slightly more tolerant of sediment deposition with no evidence of bleaching, and had greater ability to acclimate to the effects of sediment accumulation. This may be one of the reasons that *C. flexuosum* is commonly found on sheltered reefs that are subjected to greater sediment inputs.

This study produced the first evidence of bleaching, inhibiting growth rates and reduced oxygen production of laminarians in the Southern Hemisphere, and in particular *E. radiata*, which is one of the most common species found throughout

Figure 1: Sediment accumulation on A) Ecklonia radiata *B)* Carpophyllum flexuosum.

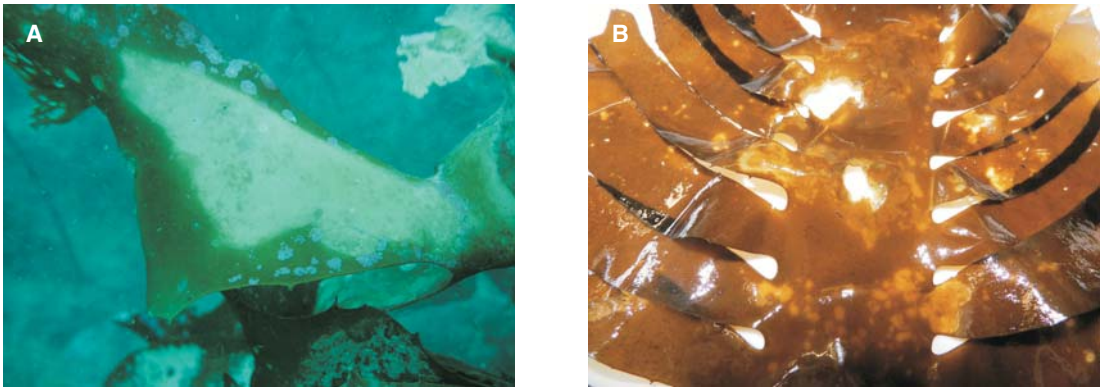


Figure 2: A) Bleaching occurring on E. radiata *under sediment B) Evidence of bleaching and rotting occurring on* E. radiata *in the laboratory experiments.*

New Zealand. *E. radiata* is a building block of many rocky reef ecosystems in Australasia and its life supporting capacity may be vital for coastal foodwebs. These results clearly demonstrate that sediment accumulating on seaweeds has significant negative effects on their productivity reducing its ability to act as a fundamental provider at the base of the food chain and therefore negatively affecting their life-supporting role in coastal ecosystems.

This will not only affect the kelp, but will proliferate up through the food chain affecting the many bigger fish species which are not only important to the ecosystem, but that we as humans are dependent on. Further, macroalgae is a major sink of atmospheric carbon dioxide and may play a vital role in removing manmade CO_2.

It is important we understand the consequences that human development resulting in increased sedimentation is having on natural marine systems. With impending climate change and increasing development set to increase sedimentation and reduce light levels in the coastal environment, this may further exacerbate the negative effects of sediment accumulation on kelp productivity. Therefore, there needs to be an emphasis on the importance of improved policies and land-management practices to reduce terrestrially derived sediment inputs into the coastal environment to ensure the maintenance of this important life-supporting habitat.

Editor's note: Edwin was the recipient of a 2012 NZCS scholarship.

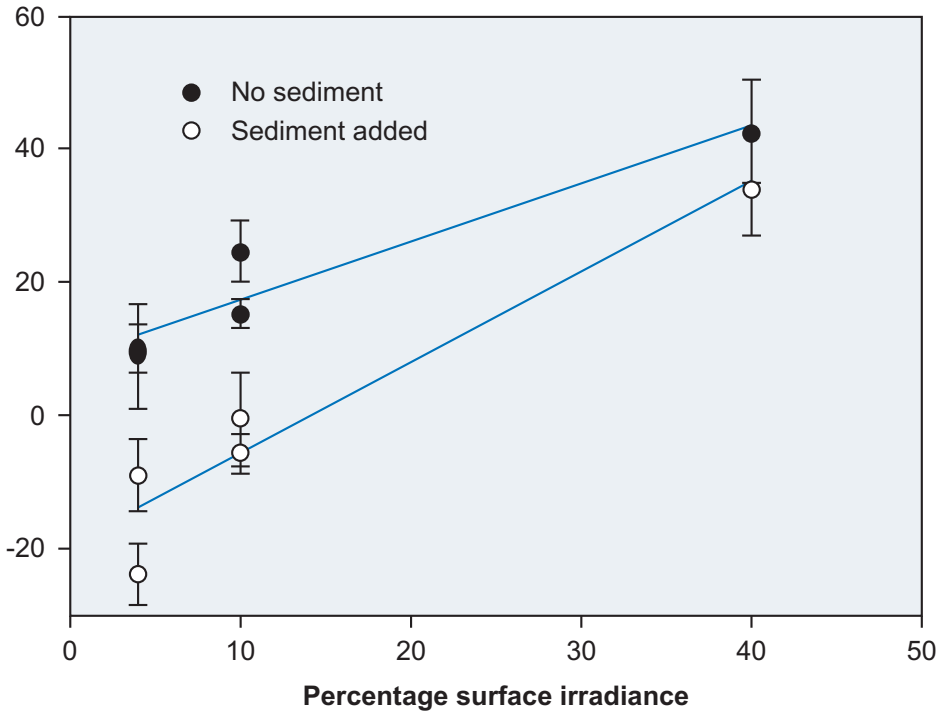


Figure 3: Change in wet weight of E. radiata *as a function of surface irradiance (±1 SE).*

Contributing to *Coastal News*

We always welcome contributions for forthcoming issues of *Coastal News*. Please contact the Editor, Shelly Biswell, at shelly@biswell.net if you'd like to submit a newsbrief, article, or have content suggestions. The submission deadline for the next issue is 10 September 2013.

Hokitika – Rough around the Edges

by Don Neale, Conference organiser

The title of our 2013 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.

Nowhere could be a better example of these two themes than the seaside West Coast town of Hokitika.

In the beginning

Nestled tightly inside the elbow of the Hokitika River and the Tasman Sea, Hokitika became the heart of the West Coast goldrushes in 1864 when payable gold was discovered in the rivers and glacial terraces nearby. Rapidly expanding from almost nothing to having 37,000 people pass through the port during 1865 to 1867 (and with 102 hotels!), there was little time for town planning. The town's beachfront roadway along Revell St is still known as "The Crooked Mile" in reference to the lines drawn by the first surveyors frantically marking out sections for the incoming hordes of fortune seekers looking for a place to erect their shanties, shops and pubs.

Today, the town of Hokitika extends along two kilometres of coastline, facing the fickle seas of the roaring forties. Courtesy: A Short, NIWA.

A history of hazards

The youthful town quickly felt the force of nature when in 1866 the Hokitika River changed course to cut a channel right along the beachfront. Houses were falling into the sea, and some of the first efforts at beach protection were put in place. Wooden groynes proved ultimately futile and all that could be done was to wait for the forces of nature to shift the river back to the south. But the town survived to see out one of the world's great gold rushes, with the region's population quickly reaching about 29,000 in 1867.

Harbour works built in 1913 served to control the migration of the river outlet, but also arrested the northward littoral drift, starving the beach of gravel and causing another phase of erosion in front of the town. Groynes were again placed to hold back the sea, but it was largely thanks to natural changes that the beach accreted again.

"Déjà vu all over again" – Coastal erosion has been a hazard for Hokitika's residents since the day the town began. Courtesy: #226/1914, Hokitika Museum.

Further phases of erosion occurred in the 1940s, and again in the mid 1980s when the Hokitika Borough Council engaged Dr Jeremy Gibb from the Ministry of Works' Water & Soil Division. Gibb explained that the river plays a major part in the dynamics of the town's beach, and recommended planning and engineering measures that included coastal hazard zoning, asset management, sediment retention, river training and a groyne field. Gibb also raised the prospect that global sea-level rise could rule the town's destiny. Since 2012, the sea has again cut dramatically into the beachfront land. Minor assets have been drawn back to safety and some sections of rock wall have been put in place.

Is it a cycle?

A common view is that the erosion happens on a 30 to 40 year cycle, but the evidence is less clear. Major events in 1866 and 1914 were clearly caused by exceptional conditions explained by river channel alignment and harbour works, respectively. More recent events have occurred within a pattern of "dynamic stability", in which the beach has moved in and out in response to a wide range of factors relating to sediment supply, river alignment, and the climatic patterns of floods and sea storms.

What's the problem?

Erosion of land and assets at the top of the beach is just a symptom. The heart of the problem lies elsewhere, in the fact that there is not enough gravel out on the offshore bar and the beach foreshore on which storm waves can disperse their incessant energy.

In 2012, NIWA Principal Scientist Dr Murray Hicks noted that there have been few recent floods in the Hokitika River, and this has probably reduced the amount of bedload from this undoubtedly important source of beach sediment. With a roughly estimated annual river bedload of 340,000 cubic metres, the removal of gravel from the Hokitika River by contractors also has a plausible but indeterminate effect on the beach.

What's being done?

Coastal planning

Since the 1980s, the district plan has installed a coastal hazard zone over the beachfront's unformed legal road, to limit the development of assets close to the beach. The council avoided the inevitable public outcry by not including any private land in the hazard zone. While Gibb mapped zones covering the entire town centre, restrictions over private land and developments are always going to be a contentious step to take.

Hicks has more recently provided independent advice on the hazards at Hokitika. He also considered the wider issues of sea-level rise and tectonics that could also have very significant impacts on the town's coastal landscape.

Rock groynes

Following Gibb's advice, the council installed rock groynes to trap the northward drift of beach sediment. Initial groynes were placed at the northern end of town and the sewage ponds in the 1980s and 90s. Three more were placed along the town's frontage in subsequent years. The groynes offer some comfort but their effectiveness is debatable, being relatively short and not extending far into the surf zone where most of the sediment movement occurs. At best, they trap only a small wedge of beach sediment, so that the effect of the groyne can be eliminated or even reversed over the duration of a northerly storm.

Seawalls

Rock walls and stopbanks have lined the riverbank for many years to keep the Hokitika River from flooding the town. Sections of seawall parallel to the shoreline were installed near the river mouth in 2012 where beach erosion was threatening the Tambo shipwreck replica and eating into the coastal walkway. Although the replica still stands, the seawall there will not prevent any widespread shoreline retreat.

Public land and buffer zones

The Hokitika beachfront zone is unformed (and mostly undeveloped) legal road reserve. In places, adjoining landowners have "claimed" parts of this land over the years for their lawns, sheds and buildings.

In 2012, the Westland District Council decided to stop a portion of the unformed road near Beach Street, close to the river mouth end of town. The Environment Court sensibly reversed that decision, convinced by opposing evidence concerning the coastal dynamics, amenity values and public access of the legal road, as well as procedural issues relating to the application.

What's the answer?

The solutions to Hokitika's coastal hazard problems are not easy to address. Any efforts to withstand the full force of the Tasman Sea will inevitably be a costly exercise, and any call to retreat from the coast is made more difficult by the fact that the town's central business district is right next to the most vulnerable areas of coastline.

The beach and river are part of everybody's life in Hokitika, no better demonstrated by the Driftwood and Sand event when hundreds of residents and tourists create works of art on the beach every January. Courtesy: L Neale.

The council is taking a sensible "wait and watch" approach, pulling back minor assets on the beachfront while considering longer-term options. Committing to an expensive and, ultimately, probably futile attempt to fight back with engineering works could simply serve to worsen the problem if it is not maintained in perpetuity. Planning approaches are likely to become more necessary, not least because of the impending threat of climate change.

The 2013 NZCS conference in Hokitika (see page 15 for conference details) will be a prime opportunity for us all to examine coastal hazard management issues first hand. Planning solutions to manage the hazard must go hand in hand with engineering. Good science and technical expertise will be needed to inform the decisions. The multidisciplinary membership of the NZCS reflects the multi-layered approach that the town will need to find for a successful response. While coastal hazards are just one of the many topics to be discussed at the conference, Hokitika will set the scene for some great and wide-ranging discussions.

Beach erosion in May 2013. The Beachfront Hotel – one of the 2013 NZCS conference venues – is in the distance. Courtesy: Greymouth Star.

The 2013 NZCS conference in Hokitika will be a prime opportunity for us all to examine coastal hazard management issues first hand.

Marine Footprints

by Peter Wilson and Kay Vopel, Institute for Applied Ecology New Zealand, School of Applied Sciences, Auckland University of Technology

Do you remember being stuck in coastal mud? Do you remember the smell of rotten eggs once you had gotten yourself out? It is the odour of hydrogen sulphide – a colourless, toxic gas that some bacteria in the mud produce when they decompose organic matter in the absence of oxygen. In the mud, hydrogen sulfide readily reacts with iron to form iron sulfide, a black mineral that is responsible for the dark colour of your footprint.

The dark colour of your footprint confirms what we already know: humans increasingly enrich coastal sediments with organic matter, a trend with ecological consequences we are far from fully comprehending. This trend does not stop at our doorstep, that is, the intertidal, estuarine mudflat that tells the story of people living in its catchment, but extends beyond the intertidal: marine farms too, be it mussel or fish farms, enrich the seafloor with organic matter. They create footprints of their own – areas of organically enriched sediment.

Like your footprint, these areas have their size and depth. For example, the area of organically enriched sediment underneath a fish farm may grow larger over time as the farm continues to produce. In addition, this footprint may gain depth, that is, the sediment underneath this farm may accumulate iron sulfides turning it darker. Such changes attract the interest of farmers and environmental managers worldwide because their understanding is of utmost importance for the management of our marine resources. Effective tools to create such understanding, however, are just about to become available.

During the past four years, the Marine Research Group of AUT University has developed such a tool – a novel technique that allows scientists to rapidly assess the size and depth of marine farm footprints. This technique includes colour analysis of sediment profile images.

Briefly: we use a clear acrylic tube that holds the hardware of a flatbed scanner (Figure 1). First, we push the tube into the sediment and then the scanner moves around the inner surface of the tube scanning outwards to produce an image of the sediment surrounding the tube (Figure 2). A series of automated image analysing steps then estimates the sediment iron sulfide content from sediment colour. Finally, analyses of many images, taken along transects across the farm, reveal the size and depth of the farm iron sulfide footprint. If repeated (for example, annually), this assessment will show if and how size and depth of the farm footprints increases over time (Figure 3).

Developing this technique has been like a slow walk through mud; sometimes we failed to take the next step, we got stuck and fell backwards, but finally succeeded with a tool that may change the way we assess environmental effects of marine farms. The tides will wipe away the prints that we have left on our way but this new tool may have a lasting effect: it takes us another step closer to a smart and sustainable use of our marine resources.

Figure 1: AUT University student Peter Wilson out in the field sizing the footprint of a mussel farm in the Auckland region using a recently published method by Wilson and Vopel (2012) doi: 10.4319/lom.2012.10.1070.

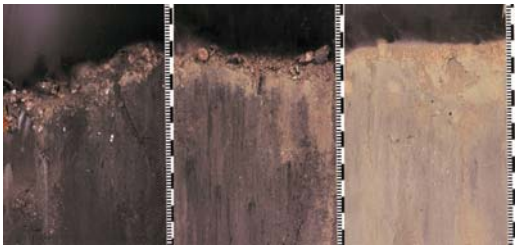


Figure 2: Shades of grey in the sediment underneath (left) and outside (middle and right) of a marine farm reveal the size and depth of the farm's footprints. Scale bars, millimetre and centimetre.

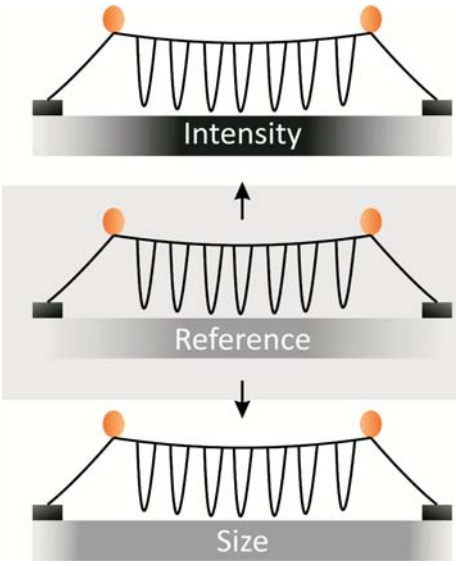


Figure 3: Over time, the sulfide footprint of a mussel farm (centre) can intensify (increase in sulfide concentration, upper panel) and/or increase in size (horizontal expansion, lower panel).

Word from the Chair

by Deirdre Hart

Welcome to winter and ...it would seem, the season of coastal conference planning. If you would like to muse about an escape to warmer waters or an exciting learning opportunity, there is certainly a lot to choose from at present. Over the "great fire break", we have the Sydney Coasts and Ports conference fast approaching in September. This year's offering will be based in the relaxed seaside suburb of Manly and is an amalgamation of the 21st Australasian Coastal and Ocean Engineering Conference and the 14th Australasian Port and Harbour Conference. Thanks to Tom Shand for liaising with the conference's organising committee on behalf of the NZCS.

Later this year we have our own national conference, to be held beachfront in Hokitika and themed *The Coast: Rough around the Edges*. The Department of Conservation's Don Neale and his experienced team are blazing an organisational trail on the way to what is shaping up to be an event with a difference.

If you have always been dying to see expansive wetlands and Punakaiki's pancake rocks, to network your way across the grand Southern Alps in a bus full of coastal colleagues, to visit a seaside town with a beach envelope wider than the length of a footy field, or to 'taste the wild West Coast', then this is the event for you. Details, abstract submission and registration forms for early birds are now live on our new website.

Et moi? Before heading to Hokitika, I'll be sauntering off to Paris for the 8th International Conference on Geomorphology, including special sessions on coastal geomorphology, management and how we can use "big data" to examine hazardous questions. I promise an update in my final word from the chair later this year.

Last but not least on the conference news front, we have now confirmed Tauranga's ASB Arena as the venue for Coasts and Ports September 2015, to be co-chaired by the University of Waikato's Professor Chris Battershill and Tonkin & Taylor's Richard Reinen-Hamill, with help from Tourism Bay of Plenty, IPENZ, and Engineers Australia National Committee for Coasts and Ocean Engineering.

I would like to extend a huge thank you to Rick Liefting, formerly of Tonkin & Taylor and now of Waikato Regional Council, for successfully bringing this conference to Tauranga. Anybody wanting to be involved with the conference, please contact Rick via Rick.Liefting@waikatoregion.govt.nz.

Now on to the web: if you have not already, I encourage you to browse our new and improved NZCS website – old address, new look, greater functionality. Renee Foster and Jose Borrero have worked closely with IPENZ, our new hosts, to make sure that we can now do/process/modify more on www.coastalsociety.org.nz AND all of that faster. With our new system, it will be efficient and inexpensive to keep the site updated and changing.

As always, we are open to suggestions as to what you need and want from our site – and we are now in a better position to act on those suggestions. Please forward any comments on the site to Renee (nzcoastalsociety@gmail.com) or Jose (jose@ecoast.co.nz).

Finally, you may recall my February word on the National Science Challenges project run earlier in the year to set the directions of tens of millions of dollars of science research funding. The results of this public and professional consultation are out in the form of 11 new science challenges, including one focusing on the Southern Ocean. Details and updates can be found via: www.msi.govt.nz/update-me/major-projects/national-science-challenges/key-documents.

Best wishes for a warm and progradational winter (we can dream)!

New Zealand Coastal Policy Statement – Guidance Notes

The Department of Conservation has developed a series of guidance notes to support the implementation of the New Zealand Coastal Policy Statement 2010. In May, three guidance notes on the following topics were published to add to this series:

- Policy 1: Extent and characteristics of the coastal environment;
- Policy 10: Reclamation and de-reclamation; and
- Policy 18: Public open space.

The guidance notes have been prepared with input from local government and are available at www.doc.govt.nz/conservation/marine-and-coastal/coastal-management/nz-coastal-policy-statement/policy-statement-and-guidance/.

News from the Regions

Bay of Plenty Region

Sharon De Luca and Mark Ivamy, Regional Coordinators

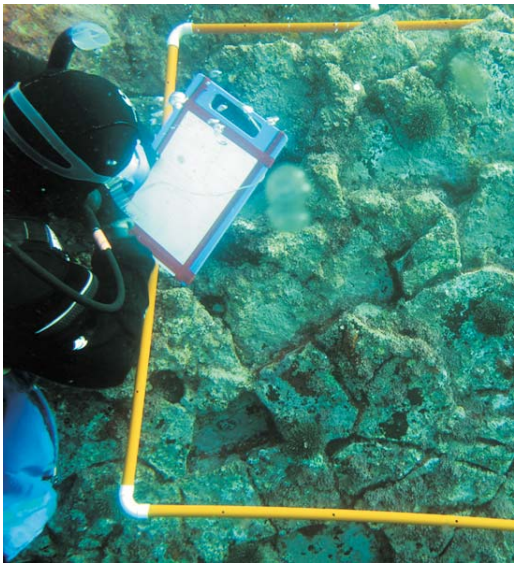
Rena recovery update

Information provided by Bay of Plenty Regional Council (BOPRC), University of Waikato and SweeneyVesty

BOPRC's deep-water sampling on rocky reefs

A team of researchers have been monitoring sites near where the *Rena* grounded. Bay of Plenty Polytechnic Marine Research Leader and Programme Coordinator Keith Gregor says that samples taken at 21 sites before the *Rena* grounded have provided important baseline data.

"We've sampled the same 21 sites twice since the grounding. As part of our work, tissue samples of key species were collected by divers from the Bay of Plenty Polytechnic with assistance from University of Waikato staff. These samples were sent off for analysis. Initial results suggest no obvious impacts on most of the subtidal rocky reef communities surrounding the grounding site, but some impacts on Astrolabe reef itself which is the focus of further sampling," he says.



Researchers from Bay of Plenty Polytechnic have been looking at the impacts of the Rena *grounding on surrounding deep water rocky reefs near the Astrolabe Reef. Photo courtesy Bay of Plenty Polytechnic.*

Monitoring of the environment

BOPRC continues to monitor wildlife, biosecurity, shoreline and matauranga programmes. Initial findings are expected to be reported early in the second half of the year. In April 2013, the University of Waikato held a "within programme" science workshop with over 30 participants to review the full body of work completed to date on the *Rena*. The workshop was held to confirm the final tasks required to complete the monitoring project that was due for submission to BOPRC and the Ministry for the Environment on 30 June.

Salvage operations

Approximately 1009 tonnes of steel from the wreck's bow has been removed, a further 200 to 300 more tonnes will be cut away until it rests at one metre below lowest astronomical tide and no longer represents a navigational hazard. A further assessment of the bow section will be conducted once this work has been completed.

A clean-up operation to recover debris between the bow and stern section is also well underway. So far 625 tonnes has been recovered. Work has now also started to clear remaining cargo debris from hold four, including the two remaining containers of plastic beads.

Heavy storms over the weekend of 20-21 April interrupted this operation, which saw beads escape and wash ashore between Mount Maunganui and Maketu. The owner and insurer's onshore debris management team continues to recover the beads, and has worked with local teams on Motiti and Matakana islands and at Maketu.

Future of the Rena

Community consultation on a proposal to leave the remaining sections of the wreck and any debris in a way that is safe for the public and ensures the consequences of doing so supports the future regeneration of the reef continues. A final decision to apply for resource consent to leave the wreck in place is expected to be made later this year.

BOPRC's Tier Two oil spill response

by Reuben Fraser

BOPRC is currently reviewing its Tier Two Oil Spill Plan and has invited the public to provide feedback on the proposed changes. Tier One responses are carried out at the industry level and Maritime New Zealand is responsible for Tier Three responses. The objectives of BOPRC's Tier Two Oil Spill Response Plan is to prevent further pollution and to contain and clean up spills without damaging the marine environment, in a manner that does not cause further damage to the marine environment, or any unreasonable danger to human life, or cause an unreasonable risk of injury to any person.

When and where does the Tier Two Oil Spill Plan apply?

- The spill is within 12 nautical miles.
- BOPRC is able to respond adequately to the spill.
- The response costs are likely to be less than $250,000.

The actual response options will depend on the incident, the nature of the oil, the location of the

spill, the sensitivity of the area, and the weather and sea conditions.

The response should aim to:

- prevent spillage or stop further spillage;
- prevent spreading (for example, booms);
- enhance evaporation (via agitation);
- enhance dispersion (via agitation, dispersant);
- prevent emulsification (via removal prior to emulsification, dispersant); and
- remove oil from the environment where practicable.

Community meetings were held in May and feedback on the plan closed on 31 May. A summary of feedback from the community meetings will be available at www.boprc.govt.nz/oilspillplan.

Natural character assessment

by Rebecca Ryder

Natural character of our coastal environment has been identified through an assessment undertaken by Boffa Miskell Ltd, Tauranga, for BOPRC. The study gives effect to Policy 13 of the New Zealand Coastal Policy Statement 2010 and has been adopted as part of Variation 1 of the Bay of Plenty Regional Policy Statement. The coastline of the region is some 260 km in length, not including the many islands within the coastal waters. From sand dunes to rocky embayments, the Bay of Plenty coastline is diverse and also supports two large harbours and a number of river mouths and estuaries.

The assessment categorised the coast into 28 sectors within which 39 areas of high natural character, 13 areas of very high natural character, and seven areas of outstanding natural character were identified. Of those areas identified as outstanding, the only mainland area identified is Ohiwa Harbour. The remaining outstanding natural character areas are located on a number of coastal islands.

The identification of natural character was assessed under a multidisciplinary method by Boffa Miskell's landscape architects, ecologists and planners. Regional and district-wide data were used, along with field assessment to confirm the areas of high, very high, and outstanding natural character.

Visit www.boprc.govt.nz/knowledge-centre/policies/next-rps-variation-1-(coastal-policy)/.

INTERCOAST workshop

The Coastal Marine Field Station located at Marine Park, Tauranga is growing in strength and now supports over 100 local and international researchers. The INTERCOAST programme is based there which is a centre of research excellence involving the University of Waikato and Germany's University of Bremen. An INTERCOAST workshop was held recently, involving approximately 30 scientists from the University of Bremen and a similar number from the University of Waikato. The workshop involved a comprehensive multidisciplinary review of coastal science, engineering and policy.

Tauranga Harbour Symposium

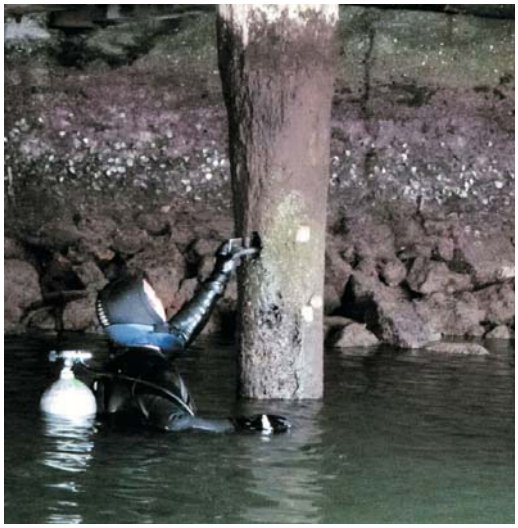
The inaugural Tauranga Harbour Symposium was held in March 2013 as a joint initiative between BOPRC and the University of Waikato. Over 200 attendees gathered to learn and share ideas on protecting and managing the Tauranga Harbour and its catchment. The symposium included 14 presentations that covered the latest research on the harbour, community work to improve our harbour, and agency projects to improve and restore the harbour.

Kaituna River re-diversion

The Bay of Plenty Regional Council intends to re-divert almost a quarter of the Kaituna River's flow back into Ongatoro/Maketu Estuary. The extra water is predicted to improve the estuary's health and will restore some of the mauri of the area by allowing salt marsh and other wetlands to return. The potential project also aims to create more suitable conditions for a range of shellfish and fish species and may reduce the rate at which sand fills in the estuary. Visit: www.boprc.govt.nz/kaitunamaketu.

Tauranga marine structures assessment

Tauranga City Council recently completed a condition and loading assessment of 19 marine structure assets in the Tauranga Harbour. The assets range from large commercial wharf facilities through to small public jetties and pontoons. The assessment involved inspecting each structure and assigning a condition grade of each structural component, assessing safe surface working loads, and assessing allowable vessel sizes that could be berthed and moored at selected sites. The council now has a long-term maintenance plan for all its marine structures and has programmed high-priority upgrades for later this year.



A diver checks one of Tauranga City Council's marine structures in Tauranga Harbour. Results from the assessment fed into a long-term maintenance plan. Photo courtesy Tauranga City Council.

Coastal News

Waikato Region

Christin Atchinson, Regional Coordinator

Aquaculture guidance

With financial assistance from the Ministry for Primary Industries' (MPI) Aquaculture Planning Fund, Waikato Regional Council (WRC) is currently developing a guidance document for the aquaculture industry and other stakeholders in the region which aims to provide clear information on environmental monitoring requirements for aquaculture consents, as well as a methodology for integrating consent and state of the environment monitoring.

The document will include a review of monitoring approaches in other New Zealand regions and overseas. While developed specifically for the Waikato region, the guidance document, which is due to be released in 2014, will contain useful information and principles of relevance to other regions.

Marine management model

A marine management model is currently being developed for WRC by the Cawthron Institute and MetOcean Solutions Ltd. The model will simulate water currents and environmental effects of marine farms and is scheduled to be completed in August 2013.

Later stages of the marine management model will broaden its scope into a wide range of applications, such as nutrient dynamics, water quality, coastal hazards and community needs. The model and data will be made freely available to the public. WRC invites research organisations and students to contact them if they are interested in using this model. Some financial assistance may be provided for student research projects. Please contact Hilke.Giles@waikatoregion.govt.nz for further information.

WRC has received funding from the MPI-administered Aquaculture Planning Fund for further model development.

Navigation Safety Bylaw

WRC's Navigation Safety Bylaw covers all navigable waters in the Waikato region, excluding Lake Taupo which is managed by the Department of Internal Affairs. The bylaw covers navigation safety for all waterway users. The bylaw has general clauses which apply to all areas and site-specific schedules to manage potential conflicts of use.

The bylaw is currently at the end stages of a review, having followed the Special Consultative Procedures, Section 83 of the Local Government Act. The 2013 bylaw became operative on 1 July 2013.

Hazard management

Work continues on the Tairua and Pauanui tsunami risk inundation model report which is nearing completion. Initial results indicate that the southern beaches of both townships are most at risk from a tsunami event generated from the Tongan-Kermadec Trench. Another key finding is that where there are well-protected, formed dune systems the level of inundation is significantly reduced.

A working party involving local community board members, Thames Coromandel District Council, and WRC staff has also been established. The key focus of the working party (once the report has been adopted) will be to develop a communications and risk mitigation plan for the two communities. Evacuation planning and warning systems are already in place thanks to the proactive work of the Thames Valley Emergency Operating Area.

Marine pest – Mediterranean fanworm

Mediterranean fanworm (*Sabella spallanzanii*) is a marine pest which can damage mussel and oyster farms by crowding out and displacing shellfish. There are known infestation sites in Auckland but *Sabella* is not yet known to have become established in Waikato coastal waters.

Earlier this year, two barges which were heavily infested with *Sabella* travelled from Auckland to Coromandel Harbour. At Coromandel, the infestation was discovered by divers engaged by the Coromandel Marine Farmers Association. In a subsequent operation co-funded by WRC and MPI, divers hand plucked all visible fanworms from the barges, using vacuums to suck up and filter debris. The clean-up has finished and the barge owner has taken the vessels back to Auckland. While the operation has significantly reduced the risk to the Coromandel marine environment, some debris from the fanworms is likely to have dropped to the seafloor during the hand plucking. For this reason, ongoing monitoring will be undertaken to ensure any offspring from the fanworms is found early and removed.

A delimiting survey of the harbour indicates that fanworm is not already established. Cooperation between WRC, MPI, and the local mussel farmers is one of the keys to dealing successfully with marine pests. The next step will be for WRC to work closely with MPI and council partners in Auckland and Northland on ways of better ensuring that *Sabella* is not spread from known infestation areas.

The marine pest Mediterranean fanworm was discovered on two barges that travelled from Auckland to Coromandel Harbour earlier this year. Courtesy: WRC.

Hawke's Bay Region

Neil Daykin, Regional Coordinator

Notice on seawall at Haumoana

Owners of a 40-metre long seawall at Haumoana were served with a notice that gives them until 31 March 2014 to apply for a building consent and bring the seawall up to Building Code standard, or to remove the wall and dispose of all material in an approved landfill.

The notice follows a lengthy process that began with Hastings District Council issuing the owners an abatement notice in July 2009 with orders to stop building the unconsented concrete block seawall. The owners did not comply with the orders and were convicted and fined for breaching the Building Act 2004. Since that time, the owners have applied for a certificate of acceptance for the seawall, but the council refused, stating the seawall was not structurally safe. The Department of Building and Housing upheld the council's decision, and in late 2012 the council sent the owners a notice with the 31 March 2014 deadline.

Oil spill exercise

An oil spill response exercise was held on 27 March at the mouth of the Tukituki River. The exercise focused on the organisation of shoreline clean-up operations, including site assessments with shoreline clean-up assessment techniques (SCAT), and the set-up of a forward operating base, following a recent shore segmentation project and lessons from the *Rena*.

During the exercise, Hawke's Bay Regional Council staff tested the best methods to transfer photographs and information from aerial observations. The response team also worked well together with a rapid boom deployment and efficient use of Maritime New Zealand equipment.

The exercise was another great opportunity to work with the New Zealand Fire Service which supported the team with the command vehicle at the response site. The response team visited the Napier Fire Station later in the day to put up a 25,000-litre frame tank which could be used to support a hazardous substances response.

Coastal News

Regional Coordinator Close-up – Christin Atchinson

Christin is a Senior Resource Officer in the regulatory group at Waikato Regional Council. Her work involves consenting and monitoring all types of coastal activities with an emphasis on aquaculture and marina-related activities.

Christin holds a bachelor's degree in geography and biology from the University of Canterbury. She completed her master's degree in marine science at the University of Auckland in 2008. Her thesis investigated the sediment dynamics of the upper Wharekawa Estuary on the Coromandel Peninsula.

Christin is passionate about the coastal environment, particularly around the Coromandel Peninsula where she spends most of her work and spare time. Christin has been a member of the New Zealand Coastal Society since 2006.

NZCS Mission Statement

The NZCS was inaugurated in 1992 "to promote and advance sustainable management of the coastal environment." It 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).

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

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