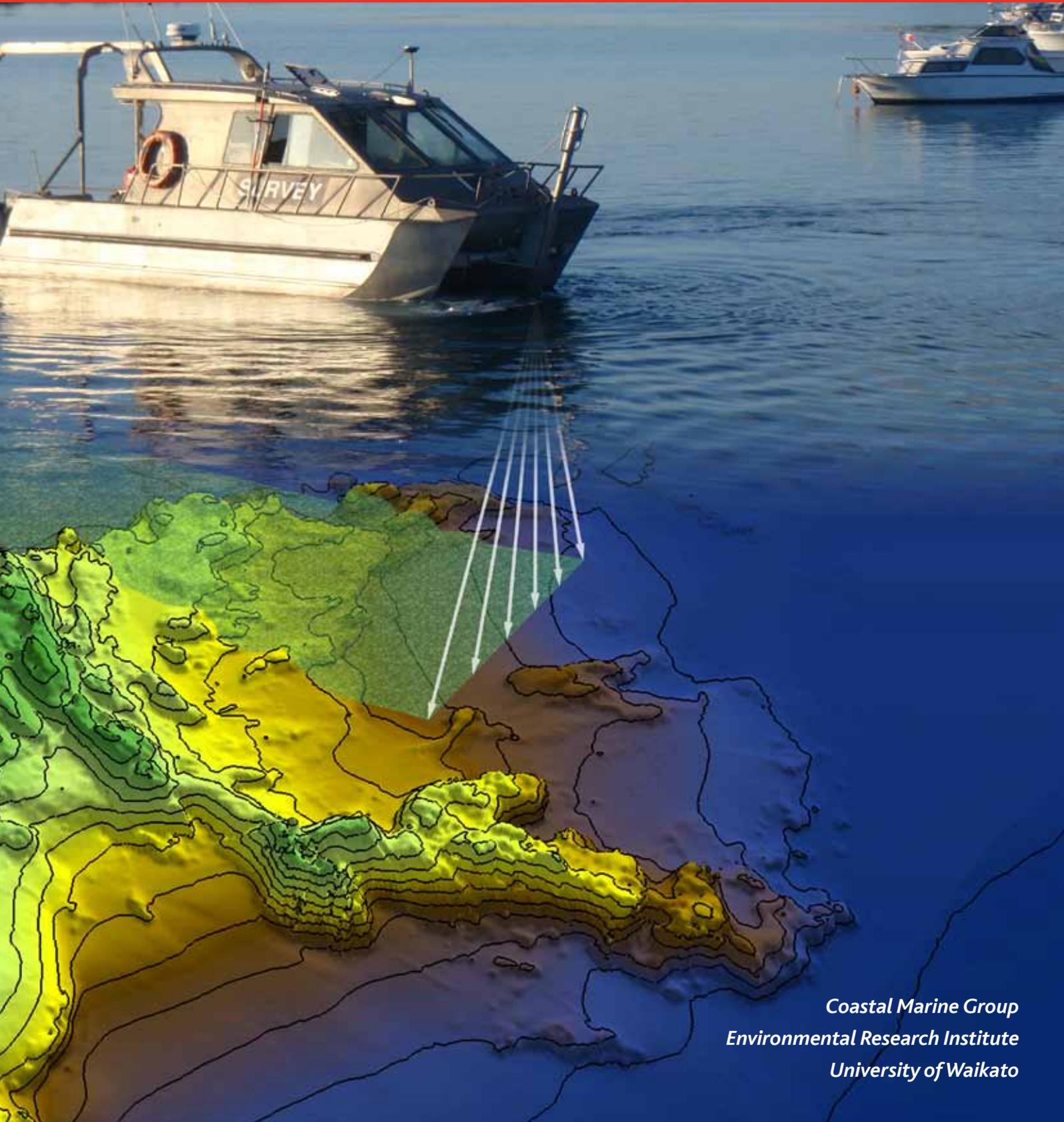




THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

Coastal Marine Research & Services

Researching and monitoring New Zealand's marine and estuarine resources



*Coastal Marine Group
Environmental Research Institute
University of Waikato*

Managing a Valuable Resource

WHY DOES IT MATTER?

Marine and freshwater resources and ecosystems are now recognised as ranking among the world's most valuable assets. Managing these resources wisely is a key challenge in the 21st century. New Zealand has jurisdiction over a maritime area that is 24 times the size of its land mass, yet relatively little is understood about this area's resources and capacity.

In New Zealand these assets are largely managed through the Resource Management Act 1991, together with the legislation regulating the fisheries and aquaculture industries, and other ancillary regulations and policies.

The RMA requires a New Zealand Coastal Policy Statement (NZCPS) and this was updated in 2010 (from 1994). The new policy contains several objectives and smaller policies, including recognition for tangata whenua; safeguarding and sustaining the coastal environment; managing natural hazards; and ensuring New Zealand complies with its international obligations.

The policy is clear about the issues facing the nation's coastal environments:

- Continuing decline in habitats and species in coastal areas
- Climate change exacerbating coastal erosion and hazards
- Poor water quality that impacts on aquatic life, food-gathering, recreational use and the opportunity for aquaculture
- Pressure on coastal spots to be used for infrastructure such as energy generation and aquaculture
- A lack of understanding that affects the ability to manage activities in coastal environments.

Local authorities must now apply the principles of the NZCPS in their regional policy statements, regional plans and district plans.

The University of Waikato's Coastal Marine Group plays an important part in this. The group was established 25 years ago and has had a key focus on Tauranga Harbour since. For many years the group operated under the guidance of highly respected researcher, the late Professor Terry Healy.

The Coastal Marine Group is now part of the newly established Environmental Research Institute at the University of Waikato. The University has five research institutes that are multi-disciplinary in their approach and are the University's way of taking a cohesive approach to society's big issues – their consequences and possible solutions.

The Coastal Marine Group works with regional councils and central government agencies with responsibilities in the marine area such as the Department of Conservation, the Ministry for the Environment, the Ministry of Fisheries and Land Information New Zealand.



CHAIR IN COASTAL SCIENCE

Professor Chris Battershill, BSc, MSc(Hons), PhD Auckland, holds the University of Waikato's Bay of Plenty Regional Council Chair in Coastal Science, based in Tauranga.

Among other national and international collaborations, the inaugural Chair oversees the New Zealand operation of the INTERCOAST programme, established by Waikato University and Bremen University in Germany to create a major centre of marine research excellence in the Bay of Plenty and Waikato regions. Professor Battershill, pictured above, also heads the Coastal Marine Group.

INTERCOAST research projects have been developed with input from Bay of Plenty Regional Council, Waikato Regional Council and the Port of Tauranga, and will contribute to building a comprehensive picture of Tauranga Harbour and its coastline to help local planners with their decision-making.

Professor Battershill and other scientists from the University of Waikato have been working on the oil spill from the container ship Rena which ran aground in Tauranga Harbour in October 2011. They ascertained what contaminants were in the oil leaking from the ship, advised on the use (or otherwise) of oil dispersants, and provided evidence as to which habitats in the Bay were most likely to be sensitive to oil pollution.

An expert in marine biodiversity, Professor Battershill will collaborate with international research institutions and work with students to conduct studies into marine organisms which could generate innovative biomedical and agrichemical leads. New Zealand is the first southern hemisphere nation to have generated a successful anti-tumour active chemical lead from a marine organism, which is now a breast cancer drug.

While the Bay of Plenty hasn't yet been sampled for biodiscovery, its diverse marine environments offer considerable research opportunities.

Professor Battershill is formerly Principal Scientist and Research Team Leader (Supporting Sustainable Use of Marine Biodiversity) at the Australian Institute of Marine Science (AIMS). His research focuses on marine ecology and environmental science, and he was responsible for the establishment of the first dedicated marine biodiscovery teams in Australia and New Zealand, focusing on the medicinal and agricultural sectors.

Coastal Marine Group – About Us

The integrated management of marine and other water resources, and the growing complexity of the regulatory environment, requires a sophisticated and systematic approach to data collection and monitoring of these resources.

The University of Waikato Coastal Marine Group is strategically placed to deal with the most pressing science issues affecting coastal areas (i.e. increasing sediment and nutrient inputs, loss of benthic habitat/biodiversity and the modification of waterways for shipping).

OUR RESEARCH CONNECTIONS

The Coastal Marine Group has strong links with NIWA, port companies, the Department of Conservation and the Waikato and Bay of Plenty regional councils.

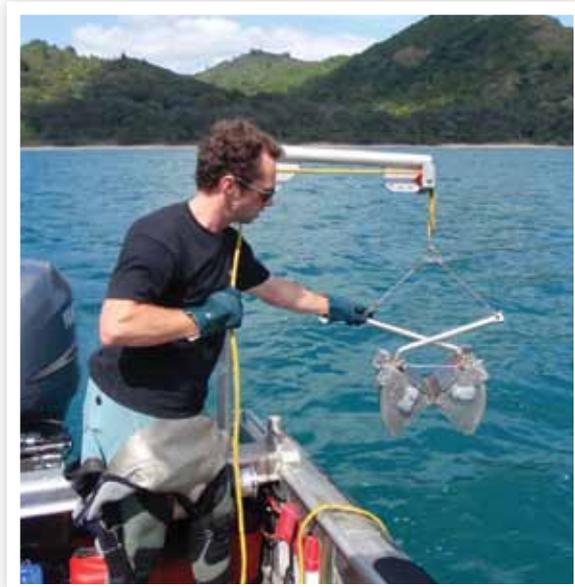
In particular, the group has received substantial funding from the Port of Tauranga to investigate dredging issues/marina establishment, and regional councils and NIWA have funded researchers for coastal-related research including erosion issues and flooding hazard work. Between 2000 and 2010, the Coastal Marine Group attracted more than \$2.5 million in research funding.

HOW WE CAN WORK WITH YOU

The Coastal Marine Group is a specialist niche operator in shallow water mapping and surveying, meeting the needs of researchers, managers, and developers of New Zealand's marine and water resources. The group contains a mix of established and emerging researchers supported by outstanding technical personnel, and offers contract research, collaborative research, consultancy, survey work, monitoring programmes, data analysis and interpretation and shallow water mapping (see page 6).

Regional councils use mapping information to help develop regional coastal plans, identify aquaculture management areas, manage environmental hazards (from coastal erosion to tsunami) and help administer the use of coastal and water resources through consent and monitoring processes.

District councils, ports authorities, power companies and developers use shallow water mapping for resource consent issues around building bridges and marinas, aquaculture, river flow control and discharge activities.



The group has extensive field capability that includes coastal research vessels, hydrographic/habitat survey equipment (multi-beam, sidescan sonar, RTK GPS, underwater cameras), currents meters and CTDs and has the ability to operate in environments ranging from shallow estuaries to the 12-mile territorial limit, covering all the marine habitats most impacted by anthropogenic activities.

To complement this field capability, the Coastal Marine Group has software licenses for state-of-the-art numerical modelling packages to predict coastal hydrodynamics and sediment transport. The laboratory has a suite of methods for studies of fluid-sediment interactions and boundary layer processes as well as access to analytical equipment to undertake nutrient, stable isotope and trace metal measurements.

The focus is on system-level science that integrates across disciplines. The expertise in coastal processes (e.g. hydrodynamics, mixing, sediment transport, nutrient dynamics, beach erosion) combined with soft sediment ecosystem dynamics is unique in New Zealand; other marine research groups are based predominately around hard shore reef ecology or coastal geomorphology.

International Connections

The University of Waikato is an internationally connected university that has partnerships with top universities around the world which benefit staff and students. All Coastal Marine Group researchers are well-connected internationally with active collaborations with leading marine scientists/institutes in North America, Western Europe and Australia.

INTERCOAST

Of particular international significance is the INTERCOAST programme, a joint initiative involving the University of Waikato and the University of Bremen in Germany that sees PhD students working on coastal research problems of global significance in the two countries.



INTERNATIONAL CONNECTIONS: Professor Chris Battershill with some of the INTERCOAST students.

INTERCOAST (integrated coastal zone and shelf-sea research), is the first project to come out of the New Zealand-Germany Science and Technological Agreement and the first Australasian science collaboration for the University of Bremen, one of the world's leading marine research institutions.

Research themes for this multi-disciplinary programme focus on aspects of global and climate change which have strong impacts in coastal and shelf-sea zones and are of ecological, geo-scientific, socio-economic, and legal interest.

The University of Waikato's Chair in Coastal Science, Professor Chris Battershill, leads the programme in New Zealand. The PhD students will spend time in each country, focusing on marine research in the Bay of Plenty, the Waikato region and the North Sea.

Both marine systems face similar pressures from rapid population increase, commercial development and recreational usage. The projects aim to provide long-term data modelling and impact analysis to aid decision making by regional and environmental planners.

Case study – New Zealand's natural resource decisions under spotlight

Lisa Marquardt, from Warburg, Germany, is researching the proposal to dredge Tauranga Harbour and the processes involved in making a decision.

Regional and environmental authorities here are in negotiation over proposals to dredge shipping channels in Tauranga Harbour. Similar negotiations are in progress in Hamburg, where, like Tauranga, the port authority wants to deepen its access shipping channel in readiness for the likelihood of larger ships, carrying up to 10,000 containers and more, in the future. Currently ships freight about 6000 containers on average.

To allow for a draught of up to 13.5 metres (Hamburg) and 14.5 metres (Tauranga), both harbours would need to be dredged by up to 3 metres.

The proposed dredging activities are the subject of hot debate in both countries, as the long-term impacts upon the environment are difficult to predict. What is the environmental impact if all ports were able to dredge shipping channels? How does New Zealand measure the

necessity of this kind of action? And should it become a national decision rather than a decision to be made by individual regional authorities? Lisa is looking at the processes involved in making these decisions.

Germany has far stricter conservation legislation and different legal processes, and the proposal has been dragging on for five years. It involves similar issues of local authorities making decisions which are of national consequence.

Lisa's research will compare the German and New Zealand processes, looking in particular at public consultation and the input sought from potentially affected parties, and the criteria upon which decisions are made.



ON TOP OF THE WORLD: Intercoast student Lisa Marquardt on top of Mt Maunganui.

Coastal Marine Group

CASE STUDIES

TAURANGA – MT MAUNGANUI

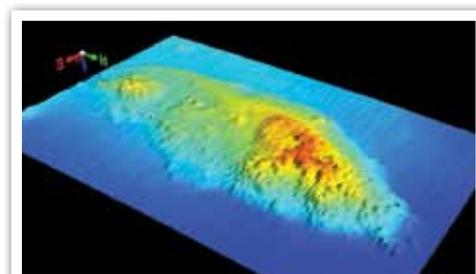
Tauranga is home to one of New Zealand's busiest ports and most popular beach resorts. An innovative dredging operation re-uses sand removed from the shipping channels to replenish Mt Maunganui Beach by dumping it where tide and current can carry it on to the beach. The Coastal Marine Group monitors the dredging operation through hydrographic surveys, bathymetry and computer modelling of tides, currents and sediment transport patterns in the shipping channels, the tidal inlet and off the beach. An artificial surfing reef built at nearby Omanu Beach is also the subject of ongoing research to determine its impact on coastal protection, habitat enhancement and ocean recreation.



Photo courtesy of Port of Tauranga

BAY OF PLENTY

The Astrolabe Reef in Tauranga Harbour was the scene of the Rena grounding in October 2011. The Coastal Marine Group and other University of Waikato scientists helped ascertain what degree of impact may occur. Work involved a dive team – made up from the Bay of Plenty Polytechnic, Tauranga City Council and University staff – taking samples of sediment, bivalves and fish from the full range of habitats to establish background levels of hydrocarbons and other potential pollutants. Divers also undertook video profiling and of the reefs around Astrolabe, including Motiti. Photoquadrats were analysed to establish what reef biodiversity existed in the region before any oil engagement. This work established a baseline from which the impact of any oil pollution event could be quantified and also provided information that allowed the time for recovery to be reliably estimated.



The initial work carried out in the days after the Rena grounding, and before any oil arrived on beaches or rocky reefs, built off a data set going back 20 years. The fast response survey also filled in the knowledge gaps that were discovered, as very little work had been done on the rocky offshore reefs in the Bay. This is a rare circumstance globally – in most other cases of oil pollution it has been difficult to quantify the extent of impact and even harder to determine when the ecology will get back to normal. Elsewhere there is little or no 'before impact' information hence it is difficult to know what normal is. The work provides an excellent platform to monitor recovery.

WHITIANGA

Whitianga is a popular, coastal marine area with multiple users and a fast-changing environment requiring considerable management. A marina and a canal-based subdivision are changing the tidal and sedimentation patterns, surrounding forestry developments are also affecting sedimentation of the harbour, and dredging operations require monitoring. As is common in many coastal areas, beach erosion is also an issue.



Photo courtesy of Focus Photography, Whitianga

Using a combination of survey methods, the Coastal Marine Group charted the area for Waikato Regional Council, measured sedimentation patterns in the harbour and ebb-tidal delta, modelled the currents and water levels, revealing the effects of wind and tide, undertook tsunami modelling, and measured the impacts of the marina and waterway developments.

DUBAI

The Coastal Marine Group is monitoring shoreline, rip current and sand bar variations using state of the art video techniques for HydroQual and Dubai Municipality, using three video installations on the famous Burj Al Arab in Dubai. Shamal storms can cause serious swimming hazards and intense changes to this vastly dynamic desert-sand dominated environment. Video is an ideal tool for this task, as it monitors continuously regardless of weather, and images can be precisely georectified using high-resolution ground control information.



Image copyright of Dubai Municipality.

Shallow Water Mapping

A UNIQUE SERVICE THAT MEETS YOUR BUDGET

The Coastal Marine Group has more than 30 years' experience in state-of-the-art sampling, measurement and monitoring of shallow water environments. Our strength lies in applying coastal research to real-world issues – providing a scientific basis for resource management from environmental policy to engineering works.

Our equipment is customised for use in small survey vessels ranging in length from 19m down to a 3m inflatable. This supports a range of mapping requirements in offshore and inland locations, particularly in coastal and shallow waters.

Our multi-disciplinary team can tailor its services to meet research and commercial needs. Small survey vessels, and the flexibility to reschedule work when weather and tide permit, allows us to offer a relatively low-cost mapping service.

SERVICE SPECIFICATIONS

The Coastal Marine Group specialises in bathymetry (underwater topography), wave and current flows, sediment movement, and marine geology for environmental and engineering research and management purposes. We do not undertake hydrographic surveys for navigational safety.

Data is validated and formatted for integration with Geographic Information System (GIS) databases that, for example, councils commonly use for planning purposes. Bathymetric maps (undersea topography) and 3D animations can be produced to visualise the data collected.

The Coastal Marine Group's customised mapping equipment includes:

- Side scan sonar – to provide a two-dimensional image of the sea/lake floor with different reflectivities showing different types of bed surfaces
- Single beam echo sounder (SBES) – to provide accurate single depth measurements with a hydrographic quality dual frequency system that can penetrate superficial sediment layers.
- Multi-beam echo sounder (MBES) to provide a wide swath of multiple depth measurements for three-dimensional bathymetric shape imaging of the waterbed
- Real-time kinematic global positioning system (RTK GPS) – to provide horizontal and vertical positioning of soundings including water level measurements and heave compensation for the SBES system.

A wide range of other equipment can also be utilised including Acoustic Doppler Current Profilers (to measure currents at all depths of the water column), other wave and current meters, grab samplers (for sampling sea, river or lake bed), and drop camera (for remote video monitoring).



Our Team – How to Contact Us

The Coastal Marine Group is part of the Environmental Research Institute at the University of Waikato. The group is particularly keen to work with and strengthen relationships with end users. For more information contact one of the staff listed here.



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BOLD IDEAS. SMART PEOPLE. UNLIMITED AMBITION.
WHAKAARO PŪKENGA. HINENGARO KOI. PITO MATA MUTUNGA KORE.

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