

**MINISTRY OF FISHERIES BIODIVERSITY RESEARCH
PROGRAMME**

CALL FOR PROPOSALS: BIOINFO (EEZ BASED RESEARCH)

WORKSTREAM 1. ECOSYSTEM-SCALE BIODIVERSITY

**WORKSTREAM 2. HABITAT DIVERSITY: CLASSIFICATION &
CHARACTERISATION**

WORKSTREAM 3. FUNCTIONAL DIVERSITY

**WORKSTREAM 5. CLIMATE VARIABILITY, CLIMATE
CHANGE EFFECTS ON BIODIVERSITY**

Ministry of Fisheries April 2008

Submissions Sought in this Call for Proposals

In September 2007, the Biodiversity Research Advisory Group (BRAG) met and discussed research proposals for a five year horizon. The Ministry of Fisheries prioritised the research proposals on the basis of discussion at the meeting and further internal discussion. A draft 5 year working plan was circulated to all stakeholders in December 2007.

This document is a call for proposals on BioInfo (EEZ based) research that reflects discussion of proposals ZBD#01, ZBD#05, ZBD#27, ZBD#07, ZBD#11, ZBD#16 at the Biodiversity Research Advisory Group (BRAG) in September 2007.

BMTRP Theme 1 Ecosystem-scale biodiversity

CfP 1. (Based on ZBD#01). Research on biogenic habitat-forming biota and their functional role in maintaining biodiversity in the inshore region (50-250 m depths) (Total available \$750 k)

BMTRP Theme 2 Habitat diversity: classification & characterisation

CfP 2. (Based on ZBD#05). Identification, description and characterisation of macroalgal diversity associated with soft sediments; (Based on ZBD#27) deep sea biodiversity in abyssal, canyon and trench environments. (Total available \$550 k)

BMTRP Theme 3 Functional diversity

CfP 3. (Based on ZBD#07). Research on the role of carbonate sediments in maintaining biodiversity and mitigating the negative effects of land-coast interactions (Total available \$450k)

BMTRP Theme 5 Climate variability, climate change effects on biodiversity

CfP 4. (Based on ZBD#11, #16). Research on ocean acidification and how it will impact on plankton biodiversity and the removal of calcifiers (Total available \$700 k)

All proposals are due by 5 pm Thursday 12 June 2008.

Instructions for Proposal Preparation and Submission

Please follow the instructions detailed below before submitting your proposal(s). Proposals should be sufficiently detailed to permit rigorous assessment of their suitability within the framework of the Biodiversity Medium Term Research Plan 2008-2013. Science Objectives, and full details of data and/or sample requirements, data collection methods, and all analyses proposed, must be given.

Proposals must provide explicit information about field sampling requirements (with dates), methods and proposed methods of analysis.

Budgets for your proposal are required and the format is detailed in the submission template referenced below.

Instructions to guide the preparation of proposals can be found in the document, "Submission Information & Instructions" and "Proposal letter and Schedules".

Submissions must follow the standard submission template. Both of these documents are available online at

<http://www.fish.govt.nz/en-nz/Research+Opportunities/Current+Opportunities/Submission+Information+and+Instructions/default.htm>

and

<http://www.fish.govt.nz/en-nz/Research+Opportunities/Current+Opportunities/Submission+Templates/>

Responses to this Call for Proposals are due to the Ministry by 5 p.m. on **Thursday 12 June 2008** at the following postal address:

**Corporate Monitoring Unit
Ministry of Fisheries
ASB House
101 - 103 The Terrace
PO Box 1020
Wellington
NEW ZEALAND**

IMPORTANT INFORMATION FOR ALL RESPONDENTS:

Please carefully note the following:

1. Submitters must be registered research providers with The Ministry. For more information please see the website.
2. The Ministry will take into account a range of criteria when evaluating proposals including the recent Cabinet Policy on providing full and fair opportunity for domestic suppliers.¹
3. In assessing proposals, the Ministry may require further information from a submitter.
4. All data and research materials collected will be owned by the Crown.

No legal or other obligation arises between the submitter of a proposal or request for additional data, and the Ministry in relation to this call for proposals and the outcome of the evaluation processes or access to data requested. Specifically, but without limitation, no process contract shall arise out of this call for proposals.

All legal relationships, where they are intended to exist, will be expressed in a written contract between the Ministry and selected providers. The Ministry may accept any or none of the proposals it receives.

Further information

For further information, please contact Charon Mason at the Ministry on (04) 819 4252 or charon.mason@fish.govt.nz.

¹ http://www.med.govt.nz/templates/MultipageDocumentTOC___29917.aspx#tenders

BACKGROUND TO THIS CALL FOR PROPOSALS

The BioInfo programme covers two important aspects of biodiversity. The first is research to describe and characterise the diversity, distribution and abundance of fauna and flora and the patterns observed. The second is research to determine the role of different organisms or groups of organisms in marine ecosystem function. Both are necessary to develop an understanding of what is important to safeguard to ensure the sustainability of a healthy marine ecosystem. These two components, which are not clearly articulated in the Coastal and Marine Biodiversity objectives of the NZBS, are essential if this research programme is to succeed and meet the desired outcomes of the NZBS.

There is a particular emphasis on marine communities that are under threat from human activities. Increasing understanding of patterns in marine communities (the relationship between distribution, abundance and environmental variables) and of the role such communities play in the way the system functions should lead directly to improved management of the marine environment. Ultimately, it will underpin the development of an ecosystem approach to fisheries management (EAFM) as well as broader biodiversity objectives.

In 2007, the Biodiversity Medium Term Research Plan and its strategic goals were updated following the publication of the Biodiversity Strategy Review, MoRST's Environmental Roadmap, SMEEF, Fisheries Plans, Ministry of Fisheries Statement of Intent and other strategic or policy documents².

The current strategic research directions for the BioInfo workstreams are as follows:

- 1. To develop ecosystem-scale understanding of biodiversity in the New Zealand marine environment*
- 2. To classify and characterise the biodiversity, including the description and documentation of biota, associated with nearshore and offshore marine habitats in New Zealand*
- 3. To investigate the role of biodiversity in the functional ecology of nearshore and offshore marine communities.*
- 4. To assess developments in all aspects of diversity, including genetic marine biodiversity and identify key topics for research*

² The New Zealand Biodiversity Strategy <http://www.biodiversity.govt.nz>
IPCC AR4 WG1 Final Report 2007

Green, W.; Clarkson, B. (2006). Review of the New Zealand Biodiversity Strategy Themes

<http://www.mfe.govt.nz/publications/ser/ser1997/>

SMEEF <http://www.fish.govt.nz/en-nz/Publications/>

<http://www.fish.govt.nz/en-nz/Consultations/Under+Review/Fisheries+Standards>

<http://www.fish.govt.nz/en-nz/Fisheries+Plans>

<http://www.morst.govt.nz/current-work/roadmaps/environment/>

5. *To determine the effects of climate change and increased ocean acidification on marine biodiversity, as well as effects of incursions of non-indigenous species, and other threats and impacts.*
6. *To develop appropriate diversity metrics and other indicators of biodiversity that can be used to monitor change*
7. *To identify threats and impacts to biodiversity and ecosystem functioning beyond natural environmental variation*

Proposals should show how the research will advance scientific understanding about the role of biodiversity in the marine ecosystem and should aim to identify important contributions to marine resource management where appropriate. Links to the workstreams above should be clear, and linkages with the Biodiversity Medium term Research Plan 2008–2013, other related research, policies and strategies must be clearly identified.

For further information on the Biodiversity Medium Term research Plan and history of this call for proposals, copies of the BMTRP and of research outlines submitted to BRAG in September 2007 can be viewed in the draft 5 year research plan posted on the BRAG Science Group website <http://cs.fish.govt.nz/> . If you require access to this website please contact beatrice.stewart@fish.govt.nz DDI (04) 819 4265

BMTRP Theme 1 Ecosystem-scale biodiversity (Total available approx \$750 k)

CfP 1. (Based on ZBD#01). Research on biogenic habitat-forming biota and their functional role in maintaining biodiversity in the inshore region (50-250 m depths)

Project Code: ZBD2008-01

BioRoss/BioInfo: BioInfo

Biodiversity Workstreams: 2

Start Date: July 1 2008

Length of project: Three years

Vessel Use: Small coastal vessels as required

Overall Objectives:

To characterise and map the occurrence of significant areas of biogenic habitat forming hotspots and associated biodiversity in New Zealand's near-shore coastal zone (50–250 m)

Rationale:

Management and protection of biodiversity in the marine environment often requires the use of spatial tools to protect habitats. The general consensus emerging from a wide range of studies on different marine system components is that as habitat complexity increases (at multiple scales), so does a given unit of area value for biodiversity (species richness, abundances, age/length structures, provision of settlement surfaces, juvenile survivorship/growth, benthic-pelagic coupling, and base trophic production, 'goods and services'). In Europe, less than 15% of the coastline is considered to remain in good condition, with near elimination of many productive and diverse coastal habitats. Similarly, a comparison of 12 estuarine and coastal ecosystems in North America, Europe, and Australia found human impacts to have depleted 90% of formerly important species (including many habitat-builders), destroyed 65% of seagrass and wetland habitat, degraded water quality, and accelerated species invasions.

In New Zealand, biogenic habitats (especially those created by large habitat-forming species) also play very important roles in maintaining biodiversity and healthy marine ecosystem functioning. Except for the Otago shelf, very little is known of biogenic habitat spatial distribution around New Zealand's coastline in depths of 50–250 m and their role/value in fisheries productivity, and threats to them, are being reviewed (HAB2007-01).

The close proximity of biogenic habitats to land makes them vulnerable to fishing (both direct and indirect), land-derived sedimentation, sediment dumping and spoil dispersal, pollution and to other human impacts. Although under threat, there is evidence that biogenic reefs are still intact in some areas of New Zealand. Recent work such as that at Spirits Bay in the 1990s shows that areas of dominant biogenic structure still persist in some areas, significantly elevating biodiversity and ecosystem functioning where they occur, and representing potential source populations for future ecosystem recovery.

Locating such remaining habitat areas in the coastal environment might at first glance appear to be an extremely daunting task.

Through this CfP we are seeking proposals with a broad and innovative approach to locating and identifying the extent of such biogenic habitats. We envisage a structured approach that will potentially draw on non-conventional knowledge sources such as fishers, as well as existing science literature in the published (journals, government reports) and non-published (project and thesis reports) domain.

Once the distribution and extent of such structures and hotspots have been determined, we are seeking prioritisation of hotspots for targeted sampling to determine the biodiversity characteristics and drivers that could lead to predictive modelling of other likely locations in the inshore zone. This CfP is also seeking proposals which investigate the functional role of habitat-forming fauna in maintaining or restoring biodiversity in the inshore zone.

The information collected should be able to be used in a risk analysis which identifies threats to biodiversity and the maintenance of aquatic health in the New Zealand inshore environment. Important questions to consider are:

What is the current extent of biogenic habitat-forming hotspots in New Zealand's inshore zone?

What is the estimated loss from anthropogenic effects?

Can we predict their optimal location?

What is the functional and structural role of these habitats to biodiversity?

Are they at ongoing risk?

Is restoration planning required?

Project proposals should provide details of how the research will build on other work underway (e.g. FRST projects, Biosecurity NZ projects).

BMTRP Theme 2 Habitat diversity: classification & characterisation

(Total available combined approx \$250 k)

CfP 2. (Based on ZBD#05, #27). Identification, description and characterisation of macroalgal diversity associated with soft sediments; (Based on ZBD#27) deep sea biodiversity in abyssal, canyon and trench environments;

Project Code:	ZBD2008-05
Topic:	Macroalgal diversity associated with soft sediment habitats
BioRoss/BioInfo:	BioInfo
Biodiversity Workstreams:	2
Start Date:	July 1 2008
Length of project:	3 years
Vessel Use:	n/a

Overall Objectives:

1. Map occurrence and distribution of macroalgae in soft sediment marine environments

Rationale:

The review of soft sediment habitats around New Zealand (Draft Final Research Report ZBD2001-06) indicates that the underlying knowledge of the macroalgal diversity distribution and abundance in soft sediment habitats around New Zealand is poor, and there are few examples of targeted collecting programmes for macroalgal assemblages. In the international literature macroalgae are recognised to contribute to biodiversity in soft sediment environments, for example, through the provision of structural complexity, modification of flow and sediment regimes, and through their contributions to productivity.

No papers that specifically address the nature of the relationships between macroalgae associated with soft sediments and high biodiversity have been published in New Zealand. Higher macrofaunal diversity has, however, been reported in association with high macroalgal cover in the southern South Island, Stewart Island and parts of north eastern North Island.

Shallow areas of soft sediment areas such as harbours and estuaries are highly vulnerable to human-induced changes through land and catchment use/management as well as to sea temperature changes, changes in freshwater inflows (e.g. increased rainfall or altered rainfall patterns), and sedimentation.

This CfP seeks research proposals that will use a stratified sampling approach to collecting macroalgae from representative estuaries and harbours (estuarine classification system) from regions around New Zealand. Research that will document diversity and distribution of macroalgae in relation to environmental variables, including anthropogenic effects, is sought.

The research should aim to test hypotheses about the distribution of macroalgal biodiversity in soft sediment environments with respect to rarity and abundance, seasonality, and distribution in relation to known faunal distribution patterns (e.g. fishes) There is a critical need to build up collections from these habitats to underpin future taxonomic and ecological studies. The lack of these data has consequences for our ability to measure or determine

change in vulnerable nearshore habitats. Links to the port surveys carried out by Biosecurity New Zealand should be provided.

Topic: Biodiversity of deep sea abyssal, canyon and trench environments

BioRoss/BioInfo: BioInfo

Biodiversity Workstream: 2

Start Date: July 1 2008

Length of project: 1 year

Vessel Use: nil

Overall Objective:

1. To assess biodiversity and ecosystem functioning in New Zealand deep sea abyssal, canyon and trench habitats.

Rationale:

About half of New Zealand's EEZ consists of abyssal plains, deep sea canyons and trenches at depths below 2000 m, yet little is known of the fauna, ecosystem functioning at depth, or how these habitats are linked to more productive surface waters. The relationship between biodiversity in New Zealand abyssal, canyon and trench habitats with similar depths elsewhere in the Pacific and around the world are also unknown.

Three expeditions in the last 135 years have obtained a small number of samples from these depths in NZ waters: The *Challenger* voyage, 1872-76; the *Galathea* expedition, 1950-52, sampled in abyssal depths with a Peterson grab and few open wide meshed nets. A survey in 2007 by the vessel *Sonne* sampled a small area of the deep sea in New Zealand waters with a focus on cold seeps. Technology has advanced significantly in recent years with the development of sophisticated towed deepwater camera systems, ROVs, submersibles, multibeam and sonar scanning mapping tools, and a range of sampling equipment. In addition, methods for preserving material for different analyses (e.g. genetic study, isotope work) have also advanced.

With the advances in technology, international studies have shown that abyssal depths can yield large numbers of new species and that phylogenetics can be used to advance understanding of basin evolution and speciation processes. In 2008, abyssal plains in the Southern Ocean were sampled during the IPY-CAML voyage and it is envisaged that comparisons between New Zealand and the Southern Ocean will be made.

Little is known of trophic interactions and benthic-pelagic coupling processes in the deep ocean. Recent studies have revealed a dampening of seasonal effects of primary production in surface waters near the bottom in deep water. Lateral transport to the abyssal plains appears to have a much stronger influence than primary production, at least down to 1000 m. How this relationship continues down to abyssal depths will be an interesting question to address.

Abyssal organisms have to cope with long periods of starvation and pulses of high food input. First results of a Southern Ocean deep sea project concerning feeding biology of detritivorous

amphipods and echinoderms in the Weddell Sea indicate a potentially important role of bacteria in this ecosystem.

Reproduction of benthic organisms in the abyssal Pacific Ocean has a profound influence on distributional patterns. For example, the wide distribution of polychaetes strongly suggests dispersal by larvae. It is believed that most larvae of abyssal organisms live in the nepheloid layer which has to be targeted specifically.

In this CFP, the Ministry is seeking a review what is already known of abyssal, canyon and trench faunas in NZ and around the world and to prioritise science questions and locations for exploration. We also seek to assess NZ capacity to sample at the required depths, and identify sampling equipment needs. The project should also design a suitable vessel based sampling programme to sample key locations and investigate priority questions identified in the review.

BMTRP Theme 3 Functional diversity (Total available approx. \$450)

CfP 3. (Based on ZBD#07). Research on the role of carbonate sediments in maintaining biodiversity and mitigating the negative effects of land-coast interactions

Project Code: ZBD2008-07

Topic: Land-coast interactions: role of coastal carbonate sediments in functional diversity

BioRoss/BioInfo: BioInfo

Biodiversity Workstream: 3

Start Date: July 1 2008

Length of project: 3 years

Vessel Use: small < 8m, MSA approved for coastal operations,

Overall Objective:

1. To characterise the functional diversity of mollusc dominated (carbonate) coastal sediments and determine how these are influenced by both estuarine trophic subsidies and stresses associated with elevated sediment loading.

Rationale:

Some of the most diverse marine habitats are coastal sediments rich in carbonates derived from mollusc shells. Carbonate-sediment habitats are widespread in New Zealand coastal ecosystems, for example, the surf clam dominated coastal shelf of North Cape-East Cape, West Coast North Island, Hawke Bay, Golden and Tasman Bays, and potentially, regions of the Otago-Southland coast.

Recent research shows that shell-dominated sediments can enhance biodiversity at local and regional scales, and appear to contain a high proportion of habitat-dependent species. The generation and maintenance of these habitats is dependent to a large extent on the abundance of molluscs, especially suspension-feeding bivalves, that can be both positively and negatively influenced by land-coast interactions. For example, nutrients and food resources generated in estuaries can fuel increased production on the adjacent coast, while contaminants, especially sediments, can have adverse effects. What remains unknown is how functional biodiversity changes around estuary entrances in association with changes in carbonate habitats; nor is there any quantitative data on the connections between coast and estuary (and its catchment).

This CfP is seeking integrative research working at both a 'systems' and a community scale. It will need to be conducted at a number of representative locations encompassing variations in estuarine/catchment conditions and oceanographic conditions. This project should lead to an example of the role of connectivity between estuaries and coasts in influencing functional diversity.

The ecological values of these habitats is also under threat from climate change (increased storm frequency and ocean acidification) which further emphasises the need for baseline information and an assessment of ecological function and connectivity.

It is envisioned that the project will include quantitative soft-sediment biodiversity assessments, field manipulative experiments, quantification of environment forcing, identification of the relative contribution of food sources using appropriate biomarkers and assessment of bivalve growth rates. The information generated from the project should provide managers with a quantitative assessment of the species richness and functional diversity of this important habitat, an analysis of how shifts in diversity are related to rapid assessment visual surveys. Information linking coastal biodiversity to estuary function and land use will be provided to managers in the context of systemic changes to coastal ecosystems and the potential threat to biodiversity and ecosystem services.

BMTRP Theme 5 Climate variability, climate change effects on biodiversity
(Total available \$700 k)

CfP 4. (Based on ZBD#11, #16 combined). Research on ocean acidification and how it will impact plankton biodiversity and the removal of calcifiers

Project Code: ZBD2008-11 & ZBD2008-16 combined

Project Title/Topic: Predicting changes in biodiversity and productivity of the Sub-Tropical EEZ in response to climate change

BioInfo/BioRoss: Bioinfo

Biodiversity Workstream: 5.

Start Date: July 1 2008

Length of project: 5 years

Vessel Use: In conjunction with research surveys

Overall Objectives:

1. To quantify how the abundance and diversity of calcifying plankton will respond to increasing pCO₂.
2. To quantify how phytoplankton diversity and ecosystem productivity will change in the EEZ in response to increasing atmospheric CO₂ and the predicted trends of warming and stratification.

Rationale:

Overall Objective 1.

Ocean organisms that have a carbonate exoskeleton are potentially susceptible to increased acidification of the ocean and a decrease in the availability of calcium carbonate. The plankton community contains three main groups of these calcifying organisms; the coccolithophores (phytoplankton), the foraminifera (protozoa) and the pteropods (zooplankton) which play important roles in ocean biogeochemistry, accounting for a significant proportion of organic carbon and all of the carbonate exported to the deep ocean, and the pelagic foodweb. In addition coccolithophores have other environmental influences, including alteration of surface ocean albedo and production of DMS, a precursor of aerosol and cloud formation.

Current evidence demonstrates the susceptibility of these organisms to elevated CO₂ with all three groups showing increased shell dissolution and reduced calcification rates when incubated at 2100 CO₂ levels. There is however emerging evidence of species difference in susceptibility to CO₂, with some coccolithophore species demonstrating the capacity to adapt to different pH levels over time. However, it is currently unknown whether acidification of the oceans will result in shift in the zoogeographic range of the calcifying groups or whether these organisms will be replaced by less susceptible species within these groups or by non-calcifying plankton. Regardless the evidence suggests that that the planktonic biodiversity of the EEZ will decrease as the ocean acidifies. Time-series monitoring and sensitivity testing of these groups in productive regions such as the Chatham Rise where coccolithophores are most abundant, and where some sampling has already taken place.

This CfP seeks proposals for a time-series study of coccolithophorids, foraminifera and pteropod abundance in pelagic samples collected for a 5-year period at key sites in the EEZ. This should be supplemented with remote-sensing of coccolithophore distribution in this region and sensitivity studies of the major calcifying plankton species in this region to elevated CO₂.

Overall Objective 2

The sub-tropical waters of New Zealand's EEZ are oligotrophic with macronutrients at near-undetectable levels in surface waters. The first studies of this region in 2006-2007 identified different phytoplankton groups that have the capacity to fix atmospheric dinitrogen (N₂), and subsequently increase nitrogen availability and productivity. The 2007 survey identified a bloom of the large colonial sp *Trichodesmium* sp. that supported associated primary and secondary consumers with a significant increase in total biomass. Recent studies have shown that the impacts of climate change may benefit *Trichodesmium* sp.

Although this species has a lower temperature limit of ~20°C, the poleward migration of the 20°C isotherm and the subtropical gyre 'spin-up' suggest that its presence may increase in EEZ waters. *Trichodesmium* also prefers highly stratified waters which are likely to increase in a warmer ocean, and may benefit from increased deposition of dust containing the micronutrient iron and phosphate. Recent publications have also identified an increase in cell division and nitrogen fixation by *Trichodesmium* sp. at elevated CO₂.

Consequently this species may proliferate as atmospheric CO increases and the sub-tropical EEZ becomes warmer and more stratified. The potential knock-on effects include an increase in nitrogen fixation and availability that may stimulate increases in non-nitrogen fixing phytoplankton biodiversity and overall ecosystem productivity.

This CfP seeks research proposals that will quantify changes in the abundance and diversity of nitrogen-fixing cyanobacteria in sub-tropical EEZ waters. The research should also aim to determine the extent of any increases in nitrogen fixation and productivity, as well as assessment of any changes to associated biodiversity and biomass of non-nitrogen fixing phytoplankton and zooplankton.