



## 9 Fully funded Ocean Sciences PhD Projects - New Zealand

The Moana Project ([www.moanaproject.org](http://www.moanaproject.org)) is a large cross-institutional team of researchers and PhD students who are exploring ocean dynamics and connectivity, including marine heat waves. New sensors for measuring will help us better understand and manage ocean warming impacts on our seafood industry. We will also explore how mātauranga Māori connects and inter-relates with this physical data.

As part of the Moana Project 9 fully funded PhD positions are available. The positions include full university fees plus a tax free stipend for 3 years of approximately \$27,000 NZ, and some research expenses. The positions are open to all nationalities (i.e., the successful applicants do not have to be a NZ citizen). However, an international student (i.e., non-NZ and non-Australian) will require a NZ student visa to be allowed to study in NZ, which can take several months to obtain. Project topics, university and supervisor information are outlined below. Candidates should be willing to start by July 2019.

**Please apply with the primary supervisor.** Applications should include:

- i) a statement of research interests and experience,
- ii) your CV,
- iii) a copy of your academic transcripts,
- iv) an indication of your potential start date, and
- v) the names and contact details of two academic referee willing to provide confidential comments on your suitability for the project.

### Theme 1: He Papa Moana: Ocean Knowledge for Aotearoa

In Aotearoa, our kaimoana economy is hugely reliant on the physical dynamics of our marine waters, but the precise nature of these currents and movements remains largely mysterious, making sustainable management of these taonga a continuing challenge. How can each be better understood using a collaborative approach? Addressing these questions invites a hapu-specific approach to mātauranga. To that end, two PhD scholarships are available to work on tangata whenua understandings – past and present – of ocean dynamics, hapu aspirations for marine harvest and aquaculture and connecting these to physical data on te moana.

#### **About the PhD Candidates**

This research would suit highly-motivated students who can work both independently and within a team. The students will have excellent written and oral communication skills, and have cultural competencies in wānanga settings and/or experience facilitating hui. Ideal students will have good connections with their iwi and/or hapū, and be able to form good relationships with people in research



settings and with Māori communities. The successful candidates will have or be near completion of a Masters degree in one or more of the following disciplines: Māori studies, marine or environmental studies, ecology, biology, geography or sociology.

## 1. Informing Iwi Interests: An effective cross-cultural ocean knowledge-exchange platform

**Supervisors:** Dr Ocean Mercier (Victoria University of Wellington), Kimberley Maxwell, Maui Hudson (University of Waikato)

**Institute:** [Victoria University of Wellington](http://www.vuw.ac.nz).

### **Project Description:**

The specific aims of this PhD are to:

- Understand, define and describe a ‘cross-cultural knowledge platform’ and how it relates to ‘he papa moana’;
- Catalogue, describe, understand and evaluate the relative usefulness (to iwi/hapu) of different data and knowledges, and different ‘knowledge platforms’, in ocean observing and forecasting;
- Understand how these elements contribute to Māori interests and how broadly they may apply to other iwi;
- Contribute to knowledge exchange across a network of researchers, iwi, partners and stakeholders sharing interests in te moana, for te moana (eg with wānanga and digital platforms), in order to understand the impacts of marine heat waves, ocean dynamics and connectivity on hapū taonga marine species (eg larval dispersal, genetics);
- Collect and analyse data in relation to relevant theories and frameworks, reflecting critically on how science, technology and data interface with mātauranga; and
- Communicate findings (oral and written) with hapū, on marae and at public seminars; and in academic forums such as departmental seminars, conferences and journals.

**Contact:** Dr Ocean Mercier, (Victoria University of Wellington) - [ocean.mercier@vuw.ac.nz](mailto:ocean.mercier@vuw.ac.nz)

## 2. Māori as Oceanographers

**Supervisors:** Dr Jackie Tuapiki, Maui Hudson, Kimberley Maxwell.

**Institute:** [University of Waikato](http://www.uwa.ac.nz).

### **Project Description:**

The specific aims of this PhD are to:

- Seek the views of Māori non-instrument navigators on ocean dynamics and connectivity, and how this informs their relationship with and knowledge of te moana;



- Contribute to knowledge exchange across a network of researchers, iwi, partners and stakeholders sharing interests in te moana, for te moana (eg with wānanga and digital platforms), in order to understand the impacts of marine heat waves, ocean dynamics and connectivity on hapū taonga marine species (eg larval dispersal, genetics)
- Collect and analyse data in relation to relevant theories and frameworks, reflecting critically on how science, technology and data interface with mātauranga;
- Present Māori non-instrument navigators aspirations to the wider project team and community
- Communicate findings (oral and written) with hapū, on marae and at public seminars; and in academic forums such as departmental seminars and conferences.

**Contact:** Dr Jackie Tuaupiki (U. Waikato) - [Jackie.tuaupiki@waikato.ac.nz](mailto:Jackie.tuaupiki@waikato.ac.nz)

### Theme 3: Ngā Ripō o te Moana: Ocean observing and modelling to understand ocean dynamics, connectivity & marine heat waves

Ocean observation and ocean modelling are crucial and complementary components for understanding and predicting ocean dynamics. The Moana Project will implement data assimilating numerical methods to more accurately represent ocean dynamics around NZ at a range of scales. A nation-wide multi-decadal ocean reanalysis (hindcast) and forecast will be developed and downscaled to increasingly higher resolution in regional zoom-ins. Observation impact experiments will be conducted to inform future observing strategies and use the models to understand marine heat waves and connectivity.

#### **About the PhD Candidates**

The students will have excellent programming, data analysis, and written and oral communication skills. The successful candidates will have completed a Masters degree in one or more of the following disciplines: Oceanography, computer science, physics, mathematics.

### 3. Marine heat waves around New Zealand: Identification and Causes

**Supervisors:** Dr Melissa Bowen (U. Auckland), Dr Rob Smith (U. Otago), Prof. Moninya Roughan (MetService)

**Institute:** [University of Auckland](http://www.auckland.ac.nz)

**Project Description:** Understanding marine heat waves around New Zealand. The project will identify historic marine heat waves from a large archive of high-resolution satellite sea surface temperature data and investigate the environmental factors causing them. The student will be based at the University of Auckland and working with a team from MetOcean, NIWA, University of Otago. The ideal candidate will have a solid background in physical oceanography, good programming skills (e.g matlab or python) and an interest in coastal physical processes and their biological consequences.

**Contact:** Dr Melissa Bowen (U. Auckland) - [m.bowen@auckland.ac.nz](mailto:m.bowen@auckland.ac.nz)



#### 4. High resolution regional modelling and connectivity around Kaikoura, NZ

**Supervisors:** Dr Ata Suanda (U. Otago), Dr Joao Souza (MetService), other external experts as required.

**Institute:** [University of Otago](http://www.otago.ac.nz)

**Project Description:** The goal of this project is to understand nearshore coastal hydrodynamics around a highly-productive New Zealand canyon (Kaikoura). The focus is on flow-topography and surface wave-current interactions that impact the coastal submesoscale. Population connectivity and dispersion experiments are a critical aspect of this work to support the interests of coastal management and the puaa (abalone) industry. It is expected that the PhD candidate communicates with Moana collaborators to integrate physical oceanographic connectivity results with estimates from DNA and shell chemistry testing. The ideal candidate will have a solid background in physical oceanographic modelling with both structured and unstructured grid models, good knowledge of coastal processes, and an interest in the connection between coastal physical processes and their social/biological impacts.

**Contact:** Dr Ata Suanda (U. Otago) - [ata.suanda@otago.ac.nz](mailto:ata.suanda@otago.ac.nz)

#### 5. Nested Regional Modelling of Bay of Plenty - Diagnosing dynamics and circulation to understand Greenshell mussels connectivity

**Supervisors:** Dr Ata Suanda (U. Otago), Dr Joao Souza (MetService), Prof. Moninya Roughan (MetService/UNSW)

**Institute:** [University of Otago](http://www.otago.ac.nz)

**Project Description:** The goal of this project is to understand the circulation within the Bay of Plenty, a key region for mussel aquaculture in New Zealand and the home of Whakatōhea iwi. The focus is on the variability of coastal-scale transport and mixing processes in a high-resolution numerical ocean model (ROMS) and the impacts of two-way nesting on regional-mesoscale surface mixed layer and eddying structures in a coarse-resolution model. Of primary interest is the modification of predictability metrics for coastal connectivity, therefore Lagrangian dispersion experiments are a critical aspect of this work. It is expected that the PhD candidate communicates with Moana collaborators to integrate physical oceanographic connectivity results with DNA analysis and local Māori-based ocean knowledge. The ideal candidate will have a solid background in physical oceanographic modelling, an understanding of Lagrangian methods, and an interest in the connection between coastal physical processes and their social/biological impacts.

**Contact:** Dr Ata Suanda (U. Otago) - [ata.suanda@otago.ac.nz](mailto:ata.suanda@otago.ac.nz)



## Theme 4: Te Hono Moana: Predicting the source, transport and settlement of marine taonga species from national to regional scales to support sustainable management

Understanding the population connectivity of marine organisms is central to conservation and fisheries management objectives. There are 3 modern methods for diagnosing connectivity: Lagrangian particle tracking through ocean modelling, molecular techniques to understand gene flow, and microchemistry approaches to understand where organisms formed. Together they provides a powerful approach to understand connectivity and gene flow amongst populations. We will test hypotheses regarding gene flow, larval dispersal, and source and sink populations at national and regional scales for three kaimoana - pāua, kōura and green-lipped mussels.

### 6. Connectivity of 3 Kaimoana species at the national scale

**Supervisors:** Prof. Jonathan Gardner (Victoria U. of Wellington), Prof. Andrew Jeffs (U. Auckland), Prof. Moninya Roughan (MetService)

**Institute:** [Victoria University of Wellington](http://www.vuw.ac.nz).

**Project Description:** The project will use existing multi-site microsatellite DNA data sets to investigate patterns of genetic connectivity across New Zealand for three key seafood species (abalone, greenshell mussels, rock lobsters) with very different pelagic larval durations (short, medium, long). Analyses of network connectivity, effective population size, levels of self-recruitment, and identification of source/sink populations will be carried out. These biological results will be contrasted with physical oceanographic models of circulation and connectivity at the national scale to better understand species-specific gene flow and how this might influence fisheries and aquaculture species. The ideal candidate will have a solid background in population genetic theory, data analysis and interpretation and interests in physical connectivity.

**Contact:** Prof. Jonathan Gardner (VUW) – [jonathan.gardner@vuw.ac.nz](mailto:jonathan.gardner@vuw.ac.nz)

### 7. Kaikoura region abalone (paua) population genetics based on GBS-derived SNPs

**Supervisors:** Prof. Jonathan Gardner (Victoria U. of Wellington), working in conjunction with Dr. Tom McCowan (Paua Industry Council) and Rob Elshire (The Elshire Group).

**Institute:** [Victoria University of Wellington](http://www.vuw.ac.nz).

**Project Description:** Single nucleotide polymorphisms (SNPs) will be used (derived from genotyping by sequencing) to develop a new and detailed understanding of gene flow at the regional level within Kaikoura. Gene flow data will be tested against models of physical oceanographic flow (PO modelling to



be carried out by another PhD student) to better understand genetic connectivity, and how/why it varies over time and space. We are looking for a student with a background in population genetics and/or bioinformatics and an interest in applying SNPs to a marine invertebrate coastal fishery.

**Contact:** Prof. Jonathan Gardner (VUW) – [jonathan.gardner@vuw.ac.nz](mailto:jonathan.gardner@vuw.ac.nz)

## 8. Connectivity of Greenshell mussels from national to regional scales - Population Genetics

**Supervisors:** Prof. Jonathan Gardner (Victoria U. of Wellington) and Prof. Andrew Jeffs (U. Auckland)

**Institute:** [Victoria University of Wellington](http://www.vuw.ac.nz).

**Project Description:** Single nucleotide polymorphisms (SNPs) will be used (derived from genotyping-by-sequencing) to develop a new and detailed understanding of gene flow at the regional level within the Bay of Plenty (a key region for mussel aquaculture) and on the west coast of the North Island (a key region for supply of wild-caught spat to the aquaculture industry). Gene flow data will be tested against models of physical oceanographic flow (ocean modelling to be carried out by another team member) to better understand genetic connectivity, and how/why it varies over time and space.

We are looking for a student with a background in population genetics and/or bioinformatics and an interest in applying SNPs to a marine invertebrate coastal fishery.

**Contact:** Prof. Jonathan Gardner (VUW) – [jonathan.gardner@vuw.ac.nz](mailto:jonathan.gardner@vuw.ac.nz)

## 9. Connectivity of Greenshell mussels from national to regional scales - Microchemistry

**Supervisors:** Prof. Andrew Jeffs (U. Auckland) and A. Prof. Carolyn Lundquist (NIWA)

**Institute:** [University of Auckland](http://www.auckland.ac.nz)

**Project Description:** Project Description: Shell microchemistry using laser ablation mass spectrometry will be used to develop a new and detailed understanding of larval movements at the regional level within the Bay of Plenty, a key region for mussel aquaculture and an emerging area for commercial scale capture of mussel seed. Microchemistry data of settling and pelagic larvae will be tested against models of physical oceanographic flow (ocean modelling to be carried out by another team member) to better understand larval trajectories. The results will also be compared with results from genetic studies undertaken by a fellow PhD at Victoria University (PhD 8).

We are looking for a student with a background or developing interest in larval biology of marine invertebrates.

**Contact:** Prof. Andrew Jeffs – [a.jeffs@auckland.ac.nz](mailto:a.jeffs@auckland.ac.nz)