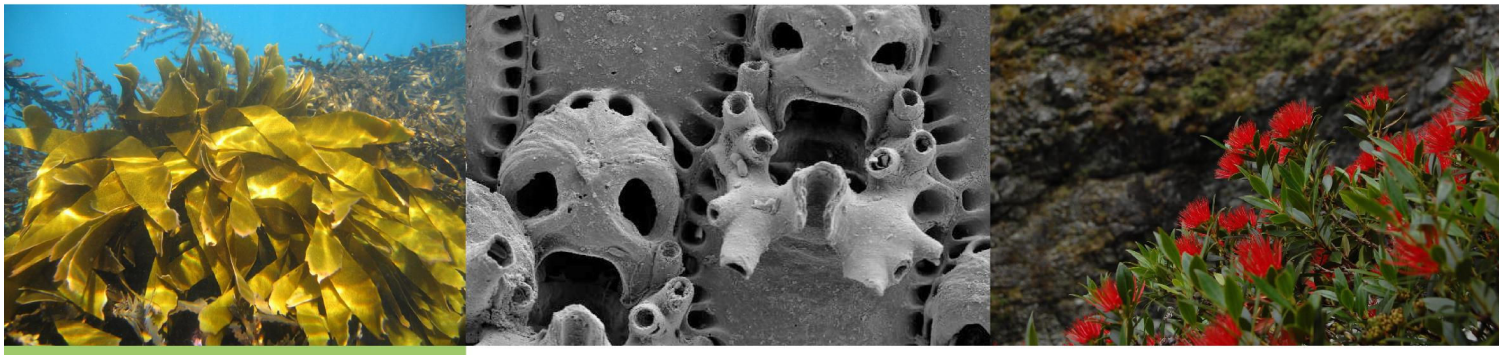
ALPHA 136

In the footsteps of Linnaeus:
biological classification in New Zealand



Dr Anna Meyer

the ROYAL SOCIETY of NEW ZEALAND
TE APĀRANGI

Biosystematics
Biological classification research today (known as biosystematics) follows on from the classification work begun by Carl Linnaeus, and uses a scheme based on the one he devised in the 1700s (see Alpha 135). Biosystematics involves not only classifying and naming living things, but also working to understand how species are related, and what evolutionary processes led to the patterns of life we see today.

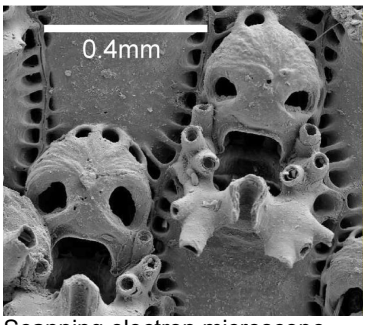
If you love living things and the natural world a career in biosystematics may be a good choice for you. This Alpha introduces you to researchers working in different areas of biosystematics, and gives you ideas about how you could have a career in this area. It also shows you some case studies where biosystematics is being used to solve real-life problems. Biosystematics is carried out in universities, Crown Research Institutes and museums, and by some retired specialists who just can't stop.

Profile: Dr Dennis Gordon
Principal Scientist, Marine Biodiversity and Biosecurity, NIWA.

What does your job involve?
I have the fantastic job of identifying, naming, and classifying New Zealand's non-fish marine life. This frequently means discovery of new species in the course of collecting, not only from deep water but also from the seashore. We also continue to discover new species in the very comprehensive NIWA Invertebrate Collection.

What do you like about your job?
There is the fun aspect of discovery, but there is also the satisfaction of knowing that our work achieves the important job of inventorying New Zealand's biodiversity.

Why is your job important?
There are many significant applications of our work to biosecurity (detection and control of alien species), biotechnology (marine life as sources of natural products), and conservation, quite apart from increased scientific knowledge.



Scanning electron microscope image of new genus and species of bryozoan from Spirits Bay, Northland

What qualifications are needed for what you do?
These days, a PhD.

What were the early influences that led to what you do now?
In fifth form (year 11) biology we studied 'Animals without Backbones'; two wonderfully illustrated paperback books that showed the amazing diversity of creatures that we share our planet with. I wanted to know more!

What advice do you have for someone wanting to do what you do?
It helps to have a passionate interest, and then relentlessly pursue your goals. Also, strive to be excellent - it really helps in getting a job!

Is there anything else you would like to add?
I look forward to Mondays.

Case study: The Catalogue of Life
The Catalogue of Life is an online dictionary of all known living organisms. It is the modern version of Carl Linnaeus' work classifying the living world. Until this project there was no complete catalogue of all known species on Earth, despite more than two centuries of research by biologists. The catalogue will be ideal for comparing species around the globe, useful for such things as checking the distribution of introduced species for biosecurity purposes.

Begun in 2001, the project plans to cover all the estimated 1.75 million known species by 2011. Three thousand biologists worldwide are involved, including NIWA scientist Dr Dennis Gordon, who coordinates the cataloguing of New Zealand species.

The Catalogue of Life has an individual page for each species, with the accepted scientific name and other names. It has the species' position in the biological classification system and its geographical distribution. The catalogue's website is www.catalogueoflife.org.

Profile: Dr Bob McDowall
Scientist, NIWA

Banded kokopu (*Galaxias fasciatus*)
The young of this species are one of the components of whitebait.

What does your job involve?
Determining which distinct fish species are present in New Zealand; describing and naming them; writing publications to help identification; running fish identification courses; determining the evolutionary relationships among New Zealand species, and their relationships with fishes in other countries; exploring patterns of distribution, and how these patterns developed across space and time.

What do you like about your job?
The sense of adventure in never knowing what is going to turn up; exploring and explaining patterns; opportunities to do field work.

Why is your job important?
Because we have a responsibility to the future, to ensure that our distinctive species are preserved for all time. This is perhaps best seen in animals like kiwis and kakapo, but all species are just as important, even if not quite so widely understood.

What qualifications are needed to do what you do?
An advanced degree, preferably a PhD, which includes training in the relevant aspects of science and working under noted workers in the field.

What were the early influences that led to what you do now?
I was always interested in natural history and grew up in a home where both my parents were scientists.

Brown trout (*Salmo trutta*).
An introduced species that is an asset for anglers, but a pest for native fish.

Do lots of relevant reading and get to know people involved in the field, through connections with institutions like museums, going to talks, or joining organisations like Forest and Bird and the Ornithological Society. Develop some understanding of your field of interest and a focus on some part of it that you like; keep some animals or plants of interest in captivity or gardens - but make sure you know what is legal; and make collections of plants or animals.

Case study: Protecting Fisheries
Parts of the sea are 'biodiversity hotspots' – areas where a large number and variety of species live. Protecting these from over-fishing is important, but often no one knows exactly where the hotspots are. Which is where biosystematics comes in.

Surveys, sampling and identification of species have been carried out of parts of the sea floor off the coast of New Zealand. This has revealed a very diverse area in the north, many unique species. As a result of this discovery the Ministry of Fisheries closed the area to trawling and commercial scallop dredging, to allow areas of affected habitat to regenerate.

This unique marine biodiversity hotspot was identified and protected only because of detailed biosystematic research. Now more studies of the area can be carried out, and the area will be able to provide a spawning ground for the surrounding fishing industries.

Profile: Dr Ilse Breitwieser
Research Leader in Plant Systematics at Landcare Research, and Director of the Allan Herbarium.

What does your job involve?
I lead a group of 16 staff who work in plant biosystematics, and I am the director of the Allan Herbarium. My work as a scientist involves carrying out research on New Zealand's everlasting daisies. My aim is to research where they came from, how they have colonised New Zealand, how they have formed species, how many and what kind of species we have, and how we can distinguish them. To achieve this we are carrying out DNA studies, and morphological and anatomical investigations. I am collecting plants from all over the country and cultivating them in our glasshouses, and also examining specimens we have in the herbarium.

What do you like about your job?
Biosystematics is a wide research area that requires a big range of skills. I like providing leadership and helping staff to produce excellent research. I like the challenges of doing hands-on research, collaboration with other scientists, and the variation in the wide range of types of research I am involved in.

Examining a specimen in the Allan Herbarium

Why is your job important?
I am passionate about biosystematics, because it underpins all research based on organisms. The names and knowledge of relationships of organisms provided by biosystematics ensure our ability to recognise and protect what is uniquely ours.

This provides us with a basis for sustainable environmental management, economic development, and cultural progress. Our ability to answer a wide range of questions relating to ecology and conservation, sustainability of habitats and ecosystems, and bioscience in general, depends on biosystematics.

What qualifications are needed to do what you do?
PhD in plant systematics.

What were the early influences that led to what you do now?
I studied biology at the University of Munich and specialised in plant systematics because I thought the lectures and labs were fascinating. During my studies I had the chance to take part in student field trips to Greece, Spain and North Africa, as well as to the Bavarian Alps and the local woods around Munich. The variation of plants I saw and the excellent teaching of my professors certainly inspired me.

What advice do you have for someone wanting to do what you do?
Contact the Allan Herbarium at Landcare Research and watch systematists at work or contact New Zealand's plant systematics university lecturers.

Case study: controlling introduced species
Wild passionfruit was first recorded in New Zealand in 1947, and the Department of Conservation and regional councils spent much time and money controlling it. It was a difficult task, partly because the species which caused the most trouble were difficult to identify. Recently, biosystematic research has shown exactly which passionfruit species are present in New Zealand, and interestingly the results were different than previously thought. As a result of this, it is now much easier for DoC and councils to identify which passionfruit species need controlling and which ones are less likely to cause a problem. Based on this new knowledge, the best ways to control wild passionfruit can now be selected, resources for control can be reduced, and millions of dollars can be saved.

Profile: Dr Wendy Nelson
Principal Scientist, Marine Biodiversity & Biosecurity, NIWA.

What does your job involve?
I am a botanist and have specialised in the study of marine macroalgae (large algae such as kelp). I do this through field work, lab and herbarium studies. I write up the results as scientific papers and popular articles, and give talks. I also seek funding for research.

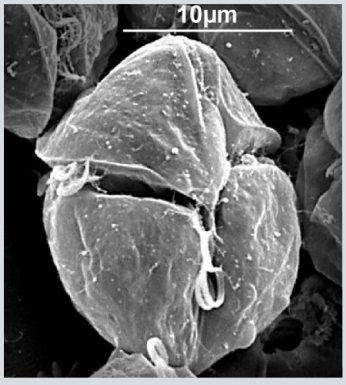
A key part of my work is describing and naming the new species that we are discovering all the time – and also making the links to what we already know. This involves investigating how the new discoveries can illuminate our biological history and the evolution of the flora.

Why is your job important?
It is critical that we understand our flora and fauna and that the biological heritage of New Zealand is documented so that we can better manage our resources and also protect and conserve fragile habitats and vulnerable species.

What qualifications are needed to do what you do?
I have a PhD degree in Botany, built up of a BSc in Botany and Zoology (3 years) and an Honours degree in Botany (1 year) at New Zealand universities and then just over 4 years in Canada.

What were your early influences that led to what you do now?
Holidays at the beach – I was given a mask and snorkel when I was young. I had an early love of bush and a strong affinity for wild places; an excellent high school biology teacher; and inspiring university teaching.

What advice do you have for someone wanting to do what you do?
There is a world shortage of specialists who know a particular group of organisms very thoroughly, and understand their particular characteristics and relationships. Biosystematics allows you to look at the finest details of organisms and also the big picture of evolution and relationships. If you are excited by these things you will be in for an interesting ride! Biosystematics requires a thorough grounding in a wide range of subjects, so it is helpful to have strong background knowledge of biology, ecology and natural history, as well as drawing on a wide skill set e.g., anatomy, microscopy, biochemistry, molecular biology.



Case study: monitoring toxic algae
Almost a hundred types of marine microalgae (microscopic algae) are known or suspected to produce toxins. Coastal areas around the world experience harmful algal blooms, including New Zealand. Microalgae can cause illness in people who eat shellfish which have accumulated algal toxins, and it may kill fish and impact tourism. Identification of harmful algal species is difficult because there is a lot of variation among and within populations. In most countries that face problems with harmful microalgae, biosystematics is important for identifying algae. Establishing monitoring programmes can greatly minimise the negative health and economic impacts.

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