INSTITUTE FOR MARINE & ANTARCTIC STUDIES
ECOLOGY & BIODIVERSITY
RESEARCH CAPABILITY

The Ecology and Biodiversity Centre at the Institute for Marine and Antarctic Studies (IMAS) is broadly concerned with understanding the structure and functioning of marine ecosystems our research has a particular emphasis on temperate systems, though has global outlook and capacity.

Our key capability areas include:

Data systems
IMAS research activities collect large volumes of data on marine systems across a wide spectrum of disciplines, and the IMAS data management policy stipulates open data as the default. Ecology and Biodiversity Centre staff contribute to the development of the Australian Ocean Data Network (AODN) and its collections and data collected by our staff is made available to the AODN through the IMAS portal.

Animal tracking and telemetry
Deployment and retrieval of state-of-art satellite and acoustic tags, and analysis and interpretation of associated data to determine details of marine mammal and seabird movement and behaviour, e.g. discernment of diving behaviour, flight, feeding, and resting modes.

Dietary analysis and trophic connections of top marine predators
Use of fatty acid signatures, stable isotopes, and molecular detection of prey from faecal samples to determine diets and thus trophic links and impacts of top marine predators (i.e. whales, seals and seabirds).

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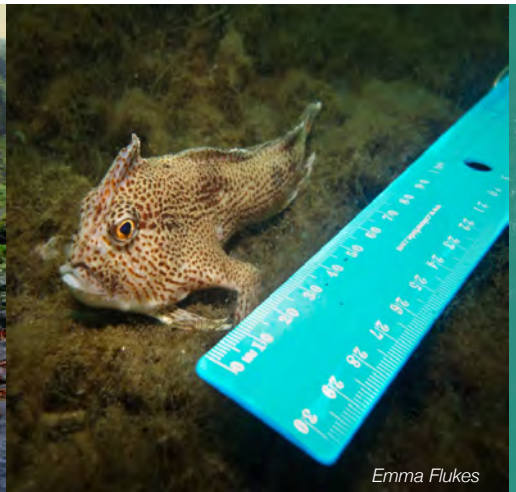
Animal population ecology and dynamics
IMAS researchers are expert in a range of techniques to determine the demographics and population structures of seabirds, seals and whale species. This work typically requires measuring age-specific fecundity, growth and mortality rates, and estimating population size and trends in population size. Integration of this work with data on animal movement and behaviour (from tracking and telemetry studies) and trophic linkages yields powerful insight into the role of top predators in Southern Ocean, Antarctic and temperate Australian marine ecosystems.

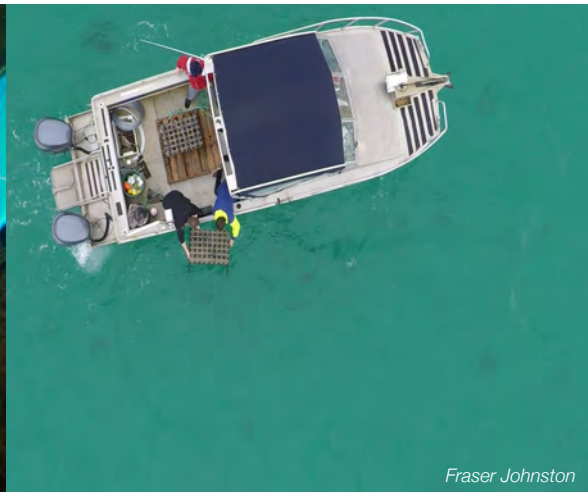
Ecology, culture and diversity of marine microbes, phytoplankton and fungi
There is significant capability to identify limits to and controls of phytoplankton production and bloom dynamics, analyse interactions among phytoplankton species and the impact of grazers on phytoplankton, and quantify the effects of ocean acidification and other aspects of global environmental change on phytoplankton growth, production and community diversity and dynamics.

The Ecology and Biodiversity Centre has capacity and expertise in detection, identification, monitoring, and measuring production of marine microbes, phytoplankton and fungi. This capability includes application of molecular and metabolic marker approaches of metabolite markers. The Centre uses state-of-art environmentally controlled mesocosms to experimentally determine responses of phytoplankton in pure and mixed culture to changes in pH, alkalinity, salinity, temperature, macro- and micro-nutrient concentrations, and dissolved organic compounds. The Centre also operates specialist equipment to study ice-associated microbes and algae.

The Ecology and Biodiversity Centre maintains a culture collection of >250 strains of marine phytoplankton comprising ~70% temperate species, 20% Southern Ocean and polar species, and 10% sub-tropical and tropical species.


Jaimie Cleeland


Emma Flukes


Fraser Johnston

Harmful algal blooms

Harmful algal blooms are increasingly problematic in eroding ecosystem services to humans, and the Ecology and Biodiversity Centre engages in this work at a national and global scales. Capacity and expertise includes bloom detection, species identification and mapping, studies of bloom dynamics, biotoxindetection and profiling.

Temperate and southern ocean zooplankton

Zooplankton, from microzooplankton to large krill, play key roles in marine systems in controlling phytoplankton population growth and as a conduit for flow of energy and other resources from phytoplankton (the base of primary production) to higher trophic levels, including species harvested by man and those regarded as 'charismatic megafauna'.

IMAS researchers design and conduct zooplankton surveys, collect and identify zooplankton, and conduct dietary and lipid analyses. We use state-of-art mesocosm chambers to determine trophic interactions among zooplankton, phytoplankton and other microbial species, and to examine how these interactions are affected by global environmental change.

Ecology and ecophysiology of macroalgae (seaweeds)

Seaweeds in general, and kelps in particular, support vital ecosystems on shallow coastal temperate reefs that collectively contribute enormous value to the Australian economy, and support high levels of production and biodiversity, which provide a range of other ecosystem services to humans.

IMAS provides state-of-the-art diving equipment, including closed circuit re-breathers and technology for routine use of nitrox gas, and provides training in scientific diving to professional accreditation standards. Diving based work is supported by a large and well maintained fleet of small boats for coastal work. For these reasons, IMAS is superbly equipped for diver-based in situ work in shallow (to 40 m) sub-tidal marine habitats. There is considerable expertise in monitoring reef communities and their functioning (e.g. rates of primary production), and in conducting in situ experiments to determine, for example, key drivers of the dynamics of reef-based systems, and responses to anthropogenically driven environmental change. We are able to routinely survey macroalgal community structure, determine the population biology of selected seaweeds species, and monitor seaweed abundance, growth, production, reproduction, and their physiological 'health' in situ.

Sophisticated environmental control facilities at IMAS enable analysis of the response of seaweeds to changes in water temperature, salinity, alkalinity, pH, nutrients, and light, singly and in combination. Other IMAS laboratory facilities enable growing seaweeds through all stages of their lifecycle, and determining their detailed physiology and biochemistry.

Introduced species

Ecology and Biodiversity staff have extensive experience with introduced marine species, including pest species. Their experience and knowledge base includes detection of introduced species, quantifying their population biology and ecological impacts, and determining options for management.

Mapping marine habitat and analysis of marine single and multibeam acoustic signals

Rapid and accurate mapping of marine habitat – ranging from under sea ice and ice shelfs, to kelp beds and deep reef sponge gardens – is an important required of understanding and monitoring ecological dynamics and biodiversity patterns. Use of acoustic technologies are revolutionising this field, and through collaboration with the Australian Maritime College, Ecology and Biodiversity staff are at the leading edge of developing and deploying this technology in marine environments from sub-tropical to polar habitats across a large depth range.

Monitoring of deepwater reefs

In addition to the application of acoustics, Ecology and Biodiversity staff collaborate closely with staff of the Integrated Marine Observing System (IMOS) Automated Underwater Vehicle Facility to monitor deepwater reefs well beyond diving depths and at scales beyond the capacity of divers to swim. This ongoing collaboration has pioneered application of 3D high definition photography in deepwater for monitoring, and in extraction and analysis of data from the massive amount of imagery collected.

Modelling and quantitative analysis

Marine systems are complex systems with complex dynamics, and determining and predicting trends is essential for informed and robust decision support and management. This requires a high level of quantitative skill, and highly quantitative science is a feature of IMAS research activity. Modelling is particularly effective means to integrate knowledge and data in an interdisciplinary framework. Ecology and Biodiversity staff develop statistical, mathematical and simulation models for biodiversity prediction; to simulate population, community and ecosystem dynamics; and for scenario analysis and decision support.

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