

## 10 Marine Biogeochemistry (MB)

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### 10.1 Overview

The Marine Biogeochemistry (MB) program brings together multi-disciplinary research strengths in hydrodynamics and modelling of low-trophic level processes, organic and inorganic chemistry, phytoplankton biochemistry and ecology, aquaculture genetics, and environmental genomics, combined with well equipped laboratory facilities and modern field equipment to study the cycling of key elements and nutrients in marine and estuarine ecosystems. Our particular strength is in bringing data and modelling together to address both fundamental and applied research questions. The MB Program has established strong ties with universities, particularly the University of Tasmania (UTas), and plays a key role in training young scientists.

The focus of the Program is on the fundamental pathways of carbon and nitrogen cycling in the marine environment. A variety of observational platforms are used, including conventional sampling from research vessels and small boats to highly instrumented moorings, sea gliders, and autonomous underwater vehicles (AUVs). The scientists are actively engaged with others across CSIRO and elsewhere in the development of new sensors and genomic tools, including new microarrays for monitoring aquatic environments. A state-of-the-art coastal modelling package has been developed that includes coupled hydrodynamic, sediment, and biogeochemical modelling and near-real-time data assimilation is being included as well as web-accessible outputs. The Program's research identifies the factors that determine the biodiversity and function of lower trophic levels as part of broader studies to facilitate effective management of Australia's coastal and estuarine marine environments and to identify likely impacts of changes, such as eutrophication, caused by natural or human activities.

MB Program researchers apply their nationally unique skills and capabilities to several major projects that aim to increase Australia's food security. MB provides multi-disciplinary capability, unequalled elsewhere in Australia, for the rapidly developing temperate aquaculture industry through selective breeding programs for salmonids and molluscs, development of a vaccine against amoebic gill disease, and comprehensive studies of the environmental impact of the industry on the benthos and water column.

The Program houses the Australian National Algae Culture Collection (ANACC) – the largest repository of marine and freshwater microalgae in the Southern hemisphere – as well as Australian Quarantine Inspection Service (AQIS) certified laboratories and culturing facilities. Strong engagement occurs in interdisciplinary cross-CSIRO projects to develop applications such as aquaculture and livestock feeds of novel terrestrial oilseed crops able to synthesize omega-3 long-chain ( $\geq C_{20}$ ) polyunsaturated fatty acids through incorporation of genes from microalgae into crop plants. MB is also a key player in a major CSIRO program to develop new biofuels based on microalgal production. ANACC and the Program's organic chemistry analytical facilities are essential for this research.

The majority of the research done in the MG program addresses issues vital to delivering the Australian National Research Priority Goal of an Environmentally Sustainable Australia and addresses CSIRO's strategic goals in the Marine and Food Production Outcome Domains.