Title of Project:

Modelling the role of marine cyanobacteria in Great Barrier Reef nutrient cycles

Names of supervisors:

Name	Affiliation (AIMS or JCU)
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Drs. Jennifer Skerratt and David Blondeau-Patissier (both CSIRO) will provide additional external advice/supervision

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Brief description of the project

The purpose of this project is to quantify the contribution of the marine cyanobacterium, *Trichodesmium,* to the nitrogen budget of the Great Barrier Reef (GBR) and to develop better models to predict how *Trichodesmium* might influence the responses of GBR water quality to catchment management interventions. Recent modelling and satellite observation research has shown that *Trichodesmium* may contribute a large quantity of nitrogen to the GBR, however *Trichodesmium* are poorly understood and current estimates are very uncertain.

In this project, the student will incorporate the findings of laboratory experiments quantifying how *Trichodesmium* respond to varying environmental conditions into an improved version of the eReefs marine models for the GBR. They will then use the model to simulate how Trichodesmium and nitrogen fixation might respond to possible future conditions, including climate change and improved catchment management.

The student will also have the opportunity to develop machine learning models (likely using deep learning methods) to improve and operationalise satellite ocean colour detection of *Trichodesmium* in GBR waters.

This project would suit someone who:

Has a Bachelors or Masters degree in a quantitative STEM subject such as oceanography, applied mathematics or computer science, or a marine science degree including strong results in relevant mathematics and programming courses. Experience in mathematical modelling of physical processes (e.g., hydrodynamic modelling) and/or development of neural network models would be an advantage, as would an understanding of marine biogeochemistry and nutrient cycles.

Key words: modelling, oceanography, Great Barrier Reef, water quality, mathematics, machine learning