Supervisor/S: Terry Isson and Louis Schipper

Project Title: How close are we to the temperature tipping point of the marine biosphere?

Field: Carbon Cycle / Earth Science / Biological Science / Climate Change

Division/School: HECS - School of Science

Project Location: Both Hamilton & Tauranga

Project Abstract:
Temperature plays a prominent role in determining the balance of photosynthesis and respiration on Earth. This in turn regulates the extent and efficiency of carbon sequestration and bioavailable O2. While ~30% of anthropogenic carbon emissions have been absorbed by global oceans to date, it remains poorly constrained as to how rates of global marine organic carbon sequestration and dissolved O2 loss is to evolve as global temperatures continue to rise. Recent work highlights a prominent decoupling between maximum rates of photosynthesis and whole community respiration within Earth’s terrestrial biosphere. With C3 and C4 photosynthesis peaking at a lower temperature, a 50% decline in the terrestrial carbon sink is expected within the next 2 decades. Here, we will extend this framework to the marine environment beginning with natural coastal marine sediments (estuaries, mangroves). This study will explore the temperature dependence of whole community (e.g., bacteria, primary producers) respiration rates over a broad range of temperatures via laboratory incubation. We will examine the data against theoretical fits (e.g., Arrhenius, macromolecular rate theory). Overall, the student will (1) assist with lab design, foremost establishment of a temperature heating block for experimentation; and (2) collection of samples in the field followed by dark-incubation experiments to determine whole community respiration rates in a variety of environments, across a large range of temperatures; (3) process the data and perform fits to the dataset; (4) qPCR analysis. The ideal candidate would be comfortable with both quantitative, laboratory and field work.

Student Skills:
- Comfortable in the field
- MATLAB experience
- Organised
- Comfortable in the laboratory

Project Tasks:
- assist with lab design, foremost establishment of a temperature heating block for experimentation
- collection of samples in the field followed by dark-incubation experiments to determine whole community respiration rates in a variety of environments, across a large range of temperatures
- process the data and perform fits to the dataset
- qPCR analysis

Expected Outcomes:
- Student’s Research Poster (as per clause 6 of the Scholarship regulations)
- establish method for data collection
- determine the optimum temperature of whole community respiration