The influence of breathing sediment on oxygen dynamics and the marine benthos

Supervisors

Main supervisor: Dr Lee Bryant (University of Bath)
Co-supervisor: Dr Thomas Bell (Plymouth Marine Laboratory)

Project enquiries - Email: L.Bryant@bath.ac.uk **Contact number:** +44 (0) 1225 383359

Supervisory team:
Dr Danielle Wain (University of Bath)
Dr Ana Queirós (Plymouth Marine Laboratory)

Host Institution: University of Bath

Project description

Scientific Background and Significance:

Oxygen (O_2) is a key environmental parameter that governs water quality and biogeochemical processes and defines important habitat thresholds for marine life. Evaluation of O_2 dynamics and other biogeochemical fluxes within the water column and at the sediment-water interface is vital to understanding O_2 and nutrient budgets and overall aquatic ecosystem health.

This project will combine a novel suite of state-of-the-art instruments to measure sediment porewater and water column data and unify established work on eddy correlation fluxes and benthic-water-column interactions (e.g. Berg et al. 2007, Bryant et al. 2010).

Research Methods and Student's Role:

The student will make use of available instrumentation including: 1) a submersible, micro-profiling lander to obtain vertical profiles of O_2, temperature, pH and redox potential across the sediment-water interface, 2) an eddy covariance system to assess turbulent O_2 and temperature fluxes within the benthic region, and 3) O_2, temperature, and velocity measurements within the water column. A comprehensive analysis of the water column O_2 budget will be conducted with these data.

The student will deploy all equipment over at least one seasonal cycle at the Western Channel Observatory (WCO). L4 is a long-term coastal monitoring site that is easily accessed from PML. The L4 study site is an excellent location due to the extensive historical datasets for the water column (> 20 years) and benthos (> 50 years). The novel O_2 data obtained via this project will be combined with the pelagic and benthic datasets to gain important understanding of the O_2 dynamics at L4.

Training:

The student will learn the technique of eddy covariance to determine sediment-water O_2 fluxes. He/she will also learn to assess biogeochemical cycling in the sediment and water column via microprofile measurements. The

student will have the opportunity to form strong links with other PML researchers within the NERC-Defra *Marine Ecosystem Research Program*, which aims to improve understanding of seasonality in benthic-pelagic processes.

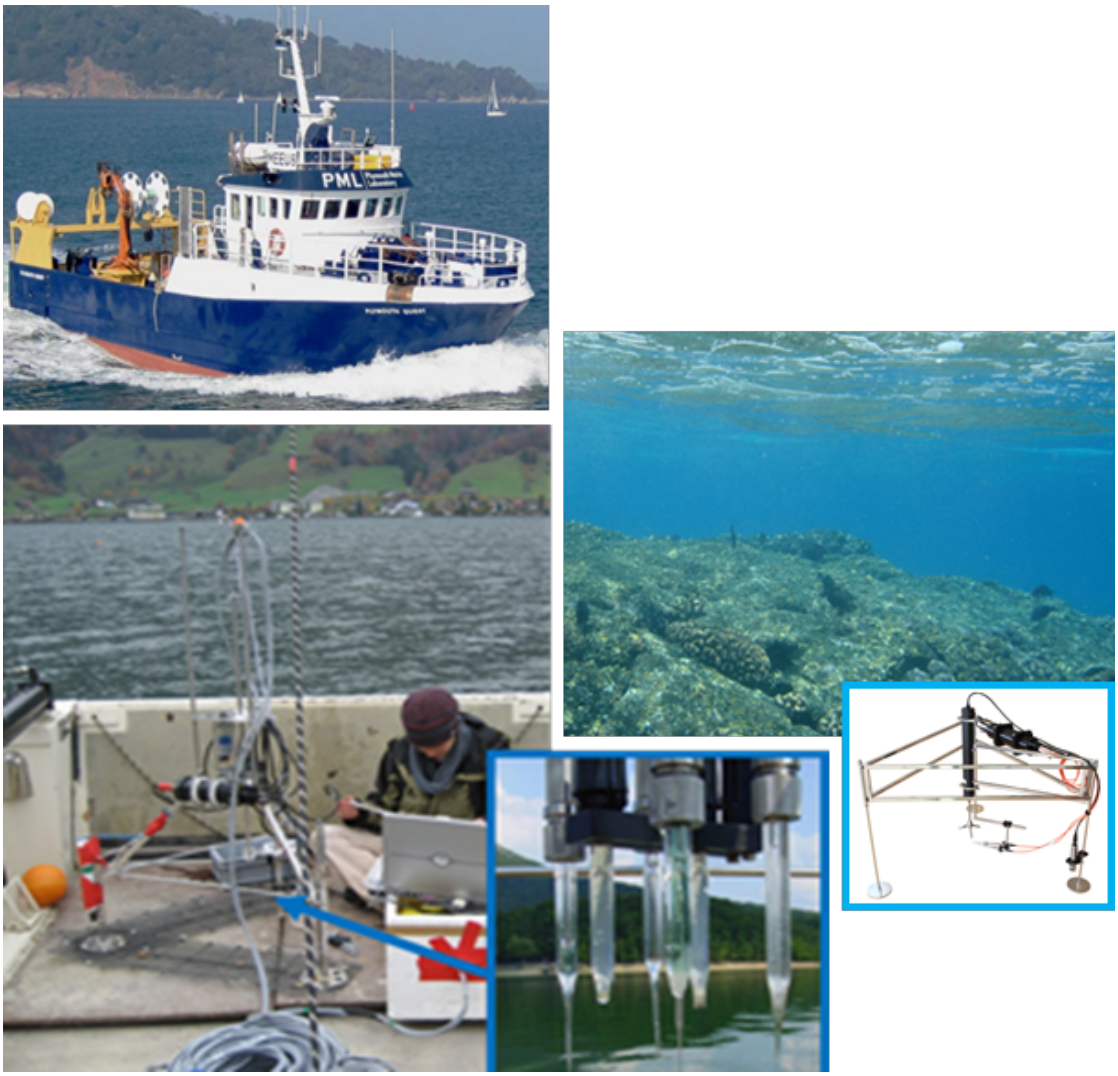
Person Specification:

This project is interdisciplinary and collaborative and will involve a combination of fieldwork, data analysis, and modelling. We seek an enthusiastic student who has achieved at least a 2:1 BSc Honours in a physical or environmental science. Preferred qualifications include experience with fieldwork and laboratory work.

References:

Berg, P., Ry, H., Wiberg, P. L. (2007). Eddy correlation flux measurements: The sediment surface area that contributes to the flux. Limnology and Oceanography 52(4): 1672-1684.

Bryant, L. D., McGinnis, D. F., Lorrai, C., Brand, A., Little, J. C., West, A. (2010). Evaluating oxygen fluxes using microprofiles from both sides of the sediment-water interface. Limnology and Oceanography: Methods 8: 610-627.



Photos: (top left) PML/WCO Sampling Vessel, the Plymouth Quest; (middle right; photos courtesy of unisense.com) benthic terrain that can be assessed by aquatic eddy correlation; (lower left) microprofiling lander system equipped with multi-species microsensors.