

SPITFIRE Doctoral Training Partnership

What is the effect of high CO₂ and temperature on phytoplankton photo-physiology in the Atlantic Ocean?

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Background: Phytoplankton primary production in the ocean accounts for 50% of all carbon fixed on Earth. Recent evidence suggests that productivity by some phytoplankton species can be affected by changes in pH. Recent increases in atmospheric CO₂ from 280 to 370 μatm which has decreased surface ocean pH by 0.12 units with a simultaneous rise in ocean temperature by 2 to 6°C. In the open ocean, such changes have been proposed to increase surface ocean stratification and light availability by producing a shoaling of the mixed layer, which would in turn reduce the nutrient supply. How different components of the phytoplankton community respond to the interaction of nutrients and light, with global (CO₂, SST) stressors and how this affects primary production, is still unknown but has huge implications for the ecosystem. RubisCO is the key enzyme in regulating carbon sequestration of phytoplankton which is enhanced by carbon capture mechanisms (CCM). These are modified by species-specific genes. An estimation of RubisCO & CCM gene expression from various phytoplankton groups could provide an important new means to broadly assess the response of phytoplankton productivity to different environmental effects.

The primary research questions of this PhD are (1) how the interaction of multiple environmental variables influences phytoplankton photosynthesis at group specific and molecular levels? Consequently, (2) how projected anthropogenically driven changes to marine ecosystems will likely affect future rates of primary productivity?

Training: The PhD student will receive multi-disciplinary training in sea going oceanography, biological and chemical analyses, impact of climate change on biogeochemistry, experimental design, numerical and statistical data analysis. They will work in a world class research institute and have opportunities to present their work at international conferences. They will have the opportunity to take part in research cruises (e.g. Atlantic Meridional Transect www.amt-uk.org/). The project will make use of state-of-the-art field, laboratory, computing and instrumentation facilities available across both institutions.

The student should have obtained at least a 2i BSc in Remote Sensing, Oceanography, Computing, Marine Biology or a related field.

