

PhD studentship: Harmful Algal Blooms (HABs) in complex flows

We are looking for an exceptional candidate for an EPSRC-funded strategic PhD studentship on the mathematics of harmful algal blooms in complex flows. Candidates should have a first degree in Mathematics, Physics or a related subject, with a keen interest in applying mathematics to an ecological problem of global significance.

Background: Annual bursts in oceanic planktonic productivity fix as much atmospheric carbon dioxide as terrestrial systems: they underpin our climate and are fundamental to the marine ecosystems. However, less predictable local coastal blooms can be harmful; toxins concentrated by fluid flow can contaminate the food chain, impacting health and food supply. HABs are a global problem. HABs cost the EU £1Bn per year (Davidson et al. 2014), and are increasingly prevalent in India (D'Silva et al. 2012) where fisheries employ >10 million people and provide essential nutrition for the growing population. HAB impact, even at small spatio-temporal scales, is therefore of great importance to societal health and well-being.

Research: Blooms are caused by several different physico-ecological mechanisms (see, for example, Pitchford & Bridley 1999; Findlay et al. 2006; Reigada et al. 2003; Guirey et al. 2007). These models work well at large scales, but lack a rigorous inclusion of the small-scale biological and physical processes (e.g. Croze et al. 2013) governing the key interactions between species and environment. A new collaboration with Dr Prasad Perlekar, Tata Institute of Fundamental Research (TIFR), Hyderabad, will help to address these gaps.

The PhD will investigate systematically HAB triggering, prediction and mitigation via mathematics and bio-physical simulation. Concentration and/or dissipation by fluid flow, surface run-off, and salinity gradients are key targets. The conceptual pathway includes (1) horizontal flows (Fig. 1), (2) vertical structure, (3) 3D turbulence, and (4) active transport. These complex interdisciplinary questions require advanced mathematical and biophysical modelling and data analysis.

The studentship is fully funded via a University of York EPSRC DTA strategic studentship, with generous annual travel funds.

Potential applicants can seek further information from Prof Martin Bees or Dr Jon Pitchford, Mathematics, University of York and can apply for the position at

<https://www.york.ac.uk/math/postgraduate/pg-research/courses/phd-mphil/>

There is a closing date of **Mon 13th March 2017**, with an interview date of **Tue 21st March 2017** (on invitation only).

Martin Bees, Department of Mathematics, University of York, UK: large scale spatio-temporal eco-dynamics in advected fluids, active and passive transport. **Jon Pitchford**, Departments of Biology and Mathematics, University of York, UK: ecological complexity and networks, dynamical systems, bloom triggering. **Prasad Perlekar** (external advisor), Tata Institute of Fundamental Research, Hyderabad, India): statistical physics and turbulent flows, ecological dynamics.

Croze, Sardina, Ahmed, **Bees**, Brandt. J Roy Soc Interface 10: 20121041, 2013.

Findlay, Yool, Nodale, **Pitchford**. J Plank Res 28: 209-220, 2006.

Guirey, Bees, Martin, Srokosz, Fasham. Bull Math Biol 69: 1401-1422, 2007.

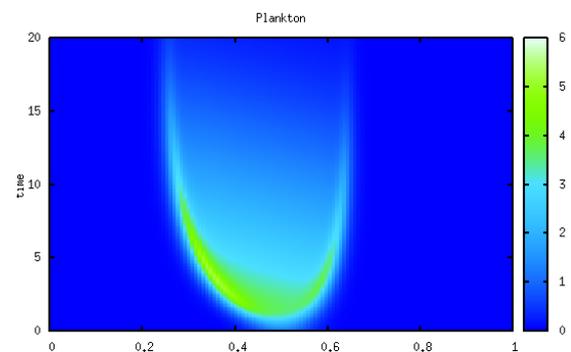


Figure 1: Asymmetric propagation of a HAB front. A spatial generalisation of Findlay et al. (2006) with heterogeneous limnological forcing.

Pitchford & Brindley. J Plank Res 21: 525-547, 1999.

Reigada, Hillary, **Bees**, Sancho, Sagués. Proc Roy Soc B 270: 875-880, 2003.