

PhD Project Advertisement

Project title: *Chronobiological changes in behaviour, development and immunity of salmon lice larvae (ChronoLice)*

Project No: FBS25-52-Wilcockson-al

Lead supervisor: Dr David Wilcockson, department of Life Sciences, Aberystwyth University

Email: dqw@aber.ac.uk

Co-supervisors:

Dr Sheena Cotter, School of Natural Sciences, University of Lincoln

Dr Amy Ellison, School of Environmental and Natural Sciences, Bangor University

Drs Kim Last, , Scottish Association of Marine Science

Project description: Background

The exciting PhD research project will help us understand the biology of sea lice (*Lepeophtheirus salmonis*), a pervasive and damaging fish parasite that causes substantial animal welfare, environmental and economic damage by impacting aquaculture of salmon. These copepod “lice” feed on fish mucus, skin and blood, causing lesions that allow secondary infections, reducing fish health and welfare. Control of lice has been focussed on the adult stages when attached to fish, but little is known about the biology of the free-swimming stages, which must locate and attached to a host to complete their life cycle. The project will address this fundamental knowledge gap by examining the parasite’s chronobiology, host seeking behaviour and physiological responses before and during attachment, and whether these can be disrupted or harnessed for reducing infestation. Almost all organisms have endogenous circadian (~24h) clocks that synchronize biology to light-dark (LD) cycles. These biological rhythms enhance the sea lice larvae's success in parasitizing salmon through aligning activity with periods of reduced fish immune defences; optimizing energy use by timing host-seeking to salmon accessibility; regulating development and immunity; and using environmental cues like light and salinity for positioning near to hosts. This novel project will examine the circadian behaviour and physiology of lice larvae under the variable environmental conditions likely to be encountered in nature and answer the following research questions (RQs):

- 1) Larval behaviour:** How does lice larvae behaviour change during the transition from the noninfective to the infective stages and how is this influenced by environmental change (e.g., LD cycles, tidal phases, salinity, and temperature)?
- 2) Molecular mechanisms of transition:** What are the larval immunological and gene expression changes over time and during transition from the free-swimming to the attached infective stage?
- 3) Host location:** What host-derived factors (e.g., fish mucus components, excretions) influence host location and behavioural changes in infective larvae?
- 4) Intervention strategies:** Can the lice chronobiology and physiology be used to disrupt or mitigate lice infectivity?

Training opportunities: The PhD researcher will train in a supportive and inclusive research team with diverse expertise, and spend time at facilities in Scotland (Oban) and England (Lincoln) whilst being based at Aberystwyth (Wales). They will become expert in highly transferable and contemporary research skills such the acquisition and analysis of rhythmic animal behaviour, modern molecular techniques such as RNA sequencing, bioinformatics, invertebrate immunology, and mass spectrometry.

We will provide cross-disciplinary training opportunities throughout the studentship. These include contemporary chronobiology of animal behaviour and molecular biology (RNA sequencing) and bioinformatics (RQ1,2). The student will learn high resolution mass spectrometry at Aberystwyth’s leading-edge facilities specifically geared for analysing water-soluble chemical signatures (RQ3). Research placements will enhance experiential learning on invertebrate immunology (Lincoln), salmon aquaculture and sea lice biology and husbandry (SAMS). For a fully rounded training the student will develop scientific presentation skills, initially at AU and UL departmental and PGR conferences, progressing to national and international conferences (MAST, UK Clock Club etc). AU will also offer the candidate teaching experience through the TPAU teacher training programme and they will have unfettered access to a comprehensive career

development training portfolio (e.g. writing skills, EDI, communications) and leadership workshops. Together these opportunities will provide the candidate with deep, technical research skill-set and invaluable transferable skills.

Project supervision style: The experienced supervisory team is geographically disparate. Therefore we will hold bi-monthly online supervisory group meetings to assess progress, agree targets at each stage of the project and share data, planning and reporting. Locally (AU) the student will have weekly 1:1 meetings with DW (1-2h). Feedback on progress and reporting will be continuous but for bi-monthly meetings written feedback (meeting summaries included) will happen within one week of presentation of reports, in addition to verbal feedback. Student progress will also be monitored by the AU annual PGR reporting mechanism. The candidate will spend time training at SAMS and Lincoln and we will meet on-line at least one during each visit. The candidate will present their work at annual AU Life Sciences Research Festival (annual) and PGR Showcase (AU and Lincoln).

Student profile: A background in biological sciences (biology, zoology, marine biology, physiology, biochemistry) is essential and postgraduate experience (taught or research) would be useful.

Stipend (Salary):

FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2024/25 this is £19,237 (£21,237 at Brunel University) and it will increase slightly each year at rate set by UKRI.

Equity Diversity and Inclusion:

The FoodBioSystems DTP is committed to equity, diversity and inclusion (EDI), to building a doctoral researcher(DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the [FoodBioSystems DTP website](#) and include:

- Offering reasonable adjustments at interview for shortlisted candidates who have disclosed a disability or specific learning difference.
- [Guaranteed interview](#) and [applicant mentoring](#) schemes for applicants, with UK home fees status, from eligible under-represented ethnic groups.

These are opt-in processes.

Our studentships are offered on a part time basis in addition to full time registration. The minimum registration is 50% FT and the studentship end date will be extended to reflect the part-time registration.

For up to date information on funding eligibility, studentship rates and part time registration, please visit the [FoodBioSystems website](#).