MASTS Annual Science Meeting 2025

Call for Speakers and E-Posters

Template for Abstract Submission

SPEAKER
General Science Session

How is climate change driving phenological shifts and trophic asynchrony in a coastal North Sea food web?

Full name: Jasmine Freeman
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Organisation: University of Strathclyde
Student: Y

Abstract

Phenological cues are environmental signals that trigger species biological responses such as migration, spawning, and reproduction. The timing of these life history events relative to seasonal food availability is vital for meeting energetic requirements. However, this synchronisation can be disrupted by changing phenology across trophic levels.

Using a coastal North Sea plankton dataset from Stonehaven, we examined how phenology is shifting under climate change. We evaluated the role of asynchrony in explaining changes in species abundance. Cross-correlation analyses were conducted to identify potential cues and lagged relationships between populations in a multi-trophic food web. This was followed by mediation analyses to assess the level of synchrony as a mediating variable in the relationship between phenological cues and responses.

Results showed annual changes in phenology, varying in direction and magnitude, within and among species. The analyses also highlighted the system's sensitivity to potential phenological match-mismatch effects (first described by Cushing, 1974; 1975), as well as the cascading impacts on trophic interactions within the food web.

References

Cushing, D.H. (1974) The natural regulation of fish populations. In: Harden Jones, F.R. (Ed.) Sea fisheries research. London, UK: Elek Science, pp. 399–412.

Cushing, D.H. (1975) Marine ecology and fisheries. Cambridge, UK: Cambridge University Press.

Acknowledgements

This studentship has been funded under the NERC Scottish Universities Partnership for Environmental Research (SUPER) Doctoral Training Partnership (DTP). (Grant reference number NE/S007342/1 and website https://superdtp.st-andrews.ac.uk/).

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SPEAKER

General Science Session

Applying a Biotic Ligand Model to the environmental monitoring of deep sea mine tailings placement.

Full name: Hannah Towns
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Organisation: Scottish Association for Marine Science (SAMS)

Abstract

In some scenarios, the deep sea can become impacted by anthropogenic activities including Deep Sea Tailings Placement (DSTP). DSTP is the disposal of mine tailings (as rock slurry) into the ocean at depths >100m. DSTP is a solution for mine waste disposal when onshore storage/disposal isn't feasible (e.g. seismic risk). The process involves ocean discharge of tailings and the residual liquid from ore processing via submarine pipeline typically into a canyon for transport downslope (turbidity flow).

The Biotic Ligand Model (BLM) is a regulatory tool to assess the potential metal toxicity (e.g. copper) for aquatic organisms. The BLM is used for predicting the bioavailability and toxicity of metals in a marine environment, utilising the interactions between metal ions and biological ligands (molecule that binds to a biological receptor). The three-step BLM evaluates the geochemical impact on biodiversity for site specific areas based on the water chemistry. Initially developed for freshwater ecosystems, progress has been made testing the BLM in marine environments for future risk assessments.

This project applies the BLM as a tool to determine and understand ecotoxicological presence in deep-sea. By combining spatial geochemical data and appropriate biological species to evaluate variation in ecological risk in existing and potential future climate scenarios from subsequent sediment disruption, changes to current placement process and establishing new mining activities. Initial work with the BLM for DSTP focusses on testing if the toxicity is 'likely/unlikely' based on accumulation of metal at the biotic ligand which is greater or equal to a critical threshold.

Additional Information (Limited References)

1. Cui, L., Li, X., Luo, Y., Gao, X., Wang, Y., Lv, X., Zhang, H. and Lei, K., 2023. A comprehensive review of the effects of salinity, dissolved organic carbon, pH, and temperature on copper biotoxicity: Implications for setting the copper marine water quality criteria. Science of the Total Environment, p.169587.
2. Morello, E.B., Haywood, M.D., Brewer, D.T., Apte, S.C., Asmund, G., Kwong, Y.J. and Dennis, D., 2016. The ecological impacts of submarine tailings placement. Oceanography and marine biology: an annual review, 54, pp.315-366.
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Acknowledgements

Thank you to SUPER DTP for funding the PhD studentship and to the supervisors on the project.

Additional Authors

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Call for Speakers and E-Posters

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SPEAKER

For speaker offers, please indicate which session you are interested in:

General Science Session

Antibiotic Resistance in Rivers: Comparing Urban and Agricultural Impacts

Full name: Fern Fairgrieve
E-mail address of lead presenter: fern.fairgrieve@napier.ac.uk
Organisation: Edinburgh Napier University

Abstract

The UK 5-year National Action Plan for Antimicrobial Resistance (AMR) highlights the contribution of the natural environment, especially surface water, to the transmission and evolution of AMR. However, inconsistent methods hinder cross-study comparability of AMR data. Several methods are used to monitor environmental AMR; however, there is no consensus as to which is the most appropriate. The Centre of Expertise for Waters Scotland highlights this gap and advocates for standardized methods.

In this study, five methods—both culture-dependent and independent—were evaluated: membrane filtration, AMR enrichment, and HT-qPCR to measure AMR abundance, and Bacteroidales 16S rRNA and metataxonomics sequencing to assess AMR source attribution. Over a four-week period, water samples were collected from the River Almond at two sites: one impacted by human wastewater and the other by agricultural land use.

Significantly higher levels of cefotaxime-resistant (CTX-R) *E. coli* were found at the wastewater-impacted site compared to the agricultural. Similarly, resistance to more high-priority, critically important antibiotics was detected in wastewater-impacted samples compared to agricultural. At both sites, *E. coli* levels were highest in week 3, coinciding with the highest river level. The lowest *E. coli* level occurred in week 4 for the wastewater-impacted site while in week 2 for the agricultural. The proportion of CTX-R *E. coli* at the wastewater-impacted site decreased from 1.4% to 1% across the four-week period.

AMR surveillance is vital for detecting threats and guiding interventions. These findings will inform future whole-river studies to deepen understanding of AMR abundance and sources and support standardized surveillance in Scotland.

Additional Authors

Dr Donald Morrison (D.Morrison2@napier.ac.uk), Prof Aimeric Blaud (A.Blaud@napier.ac.uk), Prof Fiona Henriquez-Mui (fiona.henriquez@strath.ac.uk), Dr Rob Briers (R.Briers@napier.ac.uk), David Findlay (david.findlay@sepa.org.uk)

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SPEAKER

For speaker offers, please indicate which session you are interested in:

General Science Session / Coastal Science

Light climate and diel vertical migration of Calanus finmarchicus in a CDOM-rich Scottish fjord: fine-scale observations and seasonal patterns

Full name: Kay Ihle
E-mail address of lead presenter: kay.ihle@sams.ac.uk
Organisation: SAMS
Student: Y

Abstract

Diel vertical migration (DVM) of zooplankton contributes significantly to the biological carbon pump and influences organisms that depend on zooplankton as food source. While the day-night cycle of light is known to drive DVM, recent research has shown that even small changes in irradiance can influence DVM. Many coastal waters are becoming darker due to an increase in coloured dissolved organic matter (CDOM) from freshwater runoff. However, the 'coastal darkening' effects of CDOM-rich freshwater in fjords remain largely understudied in this context.

Loch Etive is a Scottish fjord with a large watershed compared to its sea surface area, and supports a numerically dominant population of *Calanus finmarchicus*, a key North Atlantic mesozooplankton species. Consequently, Loch Etive provides an ideal natural laboratory to study how CDOM-rich freshwater influences the migration depth of this species, offering insights into the potential impact of darkening in fjords. Measurements from a series of recent cruises and historic data are used to examine DVM across daily and seasonal scales, using zooplankton samples, active acoustics, environmental measurements, and a hyperspectral light model.

We hypothesize that CDOM (besides celestial cycles) is the dominant driver of Loch Etive's underwater light climate, which is further modified by shading of surrounding mountains, phytoplankton, and clouds. If coastal darkening influences *Calanus finmarchicus* DVM, we expect a clear relationship between freshwater-driven light variability and DVM depth, though tides, hydrography, chlorophyll and weather conditions may complicate this relationship. Finally, we will discuss the suitability of using a pumped sampling system for fine-scale DVM studies.

Optional - Acknowledgements
Besides SUPER DTP, this project has been supported with funding from the Swan Digital Bursary Fund and the Thomas and Margaret Roddan Trust Bursary.

Optional - Additional Authors
Authors who have contributed to this abstract and the work described are Kim Last, Laura Hobbs, David McKee, Sören Häfker, and Håkon Sandven.

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Call for Speakers and E-Posters

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SPEAKER
General Science Session

Characterising separate king scallop stocks in Scotland: results from a combined Dynamic Energy Budget and Lagrangian particle tracking approach

Full name: Rhei Ammaturo
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Organisation: University of Strathclyde
Student: Y

Abstract

This talk covers advances in modelling Scottish king scallop stocks by combining Dynamic Energy Budget (DEB) theory with Lagrangian Particle Tracking (LPT) into an age-structured metapopulation dynamic model.

Adult king scallops are thought to live in patchily distributed groups with limited mobility, while their larvae can travel tens of kilometres before settling. Because of the larval transport, separate stocks must be considered within a metapopulation context, with connectivity playing an important role in the recruitment and re-population processes.

In this project we used data on fishing activity and from surveys to identify 12 zones of interest around Scotland inhabited by potentially interconnected populations of scallops. We then developed a metapopulation model for this network, combining DEB theory and outputs from LPT simulations. The DEB theory model, fitted to Scottish scallop data, simulates the growth trajectories and spawning of individual scallops subject to a varying temperature and food conditions in each zone. The LPT simulates the contributions of larval production in each zone to the recruitment in every other zone to generate incoming generations in the metapopulation model.

Experiments with the metapopulation model highlight which zones were acting as net sources of recruits to elsewhere, and which were net sinks, dependent on external recruitment. The results offer some guidance on an integrated management plan for the network of scallop fishing patches around Scotland.

Optional - Additional Information

1. Kooijman B. *Dynamic Energy Budget Theory for Metabolic Organisation*. 3rd ed. Cambridge University Press; 2009.

Optional - Acknowledgements
The authors would like to thank the Marine Directorate for providing data and for their continued support throughout this project. We further wish to thank the Natural Environmental Research Council for their contribution toward the financial costs of undertaking this project.

Optional - Additional Authors
Heath, M., Kaiser, M., Speirs, D., Dobby, H.

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SPEAKER

For speaker offers, please indicate which session you are interested in:

General Science Session

Changes in the Return Timing of Atlantic Salmon to the River Tweed Between 1840 and 1951

Full name: Finn Cowell
E-mail address of lead presenter: EX01FC@uhi.ac.uk
Organisation: University of the Highlands and Islands
Student: Y

Abstract

The Atlantic salmon (*Salmo salar*) is a migratory species of fish whose individuals typically return to their natal rivers to reproduce. The time of year that they return from the sea to the river can vary enormously and, in Scotland, salmon can return at virtually any time of year, even though spawning occurs in the late autumn and early winter. Since official records of commercial catches began in 1952, there has been a sharp decline in the number of salmon returning in the early fishing season in the spring. Less is known about the period that precedes this. My colleagues and I used historical catch records from a major salmon fishing company on the River Tweed to explore 111 years of records prior to official records beginning. We found that for most of the River Tweed's history, large catches of spring fish have been a rarity, suggesting that official records may have coincidently been recorded from an anomalous point in time.

Optional - Acknowledgements
Super DTP, Tweed Foundation.

Optional - Additional Authors
Ronald N.B. Campbell, James Hunt, Victoria L. Pritchard

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Abstract Submission

SPEAKER

For speaker offers, please indicate which session you are interested in:
General Science Session

Patterns and Trends in the Scottish Pelagic Fishing Fleet: A Spatial-temporal Perspective

Full name: Maria Iohara Quirino-Amador
E-mail address of lead presenter: iohara.quirino@uhi.ac.uk
Organisation: University of the Highlands and Islands; SUPER DTP

Abstract

Understanding spatio-temporal changes in the fisheries sector provides a basis to evaluate the sustainability of high value species exploitation such as Atlantic mackerel (*Scomber scombrus*). Assessing these dynamics is particularly relevant in Scotland, where the pelagic fleet plays a strategic role in food security and the local economy. Here, we investigate patterns and trends in the activity of the Scottish pelagic fleet over a 24-year period (1999 to 2023), focusing on how maritime space was utilised to target mackerel. Analyses draw on a novel industry dataset, combining fishing tracks and marks, together with haul data from a self-sampling programme led by University of Highland and Island with industry partners. Vessel tracks provide precise spatial records of fishing activity, with positional fixes at intervals of up to two seconds, enabling fine scale coverage of fleet operations. This level of detail allows us to capture fishing activities with higher accuracy, enabling the identification of long-term spatial patterns. To evaluate whether the fleet's fishing activities have changed over time, we integrated statistical and geospatial approaches to quantify the distribution of fishing tracks. The application of multiple metrics, combining spatial structure and concentration, has the potential to reveal long-term consistencies, abrupt shifts linked to specific events, and atypical areas of operation. These findings improve our understanding of how exploitation patterns have shifted in space and time, providing valuable information for management, and a robust basis from which to investigate drivers of spatio-temporal change.

Optional - Additional Authors

Katie Brigden, Steve Mackinson, Campbell Pert, Beth Mouat

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SPEAKER/E-POSTER

For speaker offers, please indicate which session you are interested in:

General Science Session / Multiple Stressors / Coastal Science / Technological Innovation in Environmental Monitoring / Marine Mammals / Applied Marine Bioacoustics

Catching Up: Shetland as a Case Study for Sandeel Spatiotemporal Abundance Trends

Full name: James Harris
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Organisation: Sea Mammal Research Unit, University of St Andrews.

Abstract

Sandeel are essential prey fish in ecosystems around the world, being a major component in the diets of a wide range of marine predators. However, there is long-standing uncertainty surrounding the environmental influences driving the abundance and health of sandeel populations. Further, there is a general paucity of long-term, high resolution sandeel abundance data that would help elucidate these mechanisms, particularly in the North Sea. We present Shetland as a case study, due to its global importance to major sandeel predators and its historic sandeel fishery. Further, no concerted sandeel monitoring has taken place there since the late 1990s. We replicated these historic surveys and conducted the first new sandeel trawl surveys since 1999. Abundance of two sandeel species was modelled as a function of space, as well as length (as a proxy for age). There was fine-scale spatiotemporal variation in sandeel abundance, but we did not find evidence of significant recovery in Shetland sandeel populations since the end of exploitation and implementation of protection measures. Further, we provide new evidence of a dramatic shift in the species composition of sandeel since the late 1990s, with implications for marine predators that synchronise breeding with sandeel abundance peaks. These results suggest that fine-scale monitoring data is a key starting point in uncovering ecological mechanisms driving sandeel abundance trends. A

stronger understanding of sandeel populations and their ecosystem-level importance to marine predators would benefit from a concerted effort to generate such datasets.

Optional - Acknowledgements
With thanks to The North Atlantic Fisheries College (NAFC) and the University of Highlands and Islands in Shetland (UHIS) as well as the ACTNOW project and the University of St Andrews.

Optional - Additional Authors
Dr. Debbie Russell
Dr. Shaun Fraser