Phoebe Armitage

Arctic Benthic Ecologist
Environmental and Marine Biology
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Research Profile

I am a benthic (seafloor) ecologist specialising in trait-based community ecology. My research asks how biodiversity and environmental change shape ecosystem structure and function, particularly in rapidly changing Arctic seas. My training spans experimental marine ecology (University of Southampton), quantitative and statistical ecology (University of St Andrews) and Arctic benthic research (Åbo Akademi University), which lets me connect physical, chemical and biological processes. I combine expedition-based fieldwork, long-term datasets and quantitative modelling to link benthic biodiversity and traits to environmental drivers across space and time.

Research Interests

- Trait-based benthic ecology and functional diversity
- Environmental gradients and impacts on benthic distributions
- Arctic and ice ecosystems
- Benthic–pelagic coupling
- Carbon cycling
- Spatial ecology and multivariate modelling

Education

Post-Doctoral: Effects of annual sea ice scraping on Fucus and invertebrates in the Finnish Archipelago Islands

Key expertise: Fieldwork, annual sea ice data, meta-analysis and systematic reviews, and benthic ecology in the Baltic Sea system.

Åbo Akademi University, Finland; July 2026 – December 2027

Funded by Digital Waters

Supervisor: Associate Professor Christoffer Boström

PhD Environmental and Marine Biology (Honours)

Key expertise: Trait-based benthic ecology, Arctic marine ecology, multivariate and community analysis, carbon-related benthic processes, and integration of biological and environmental data across Arctic seascapes.

Åbo Akademi University, Finland; May 2021 – June 2026

Funded by EU Horizon projects ECOTIP and SEA-Quester

Thesis: Arctic Benthic Seascapes: A trait-based perspective on benthic invertebrates around Greenland (Kalaallit Nunaat)

Supervisors: Prof. Anna Törnroos and Prof. Marie C. Nordström

MSc Marine Ecosystem Management (Merit)

Key expertise: Long-term ecological analysis, functional trait approaches, benthic community dynamics, statistical ecology, and development of indicators for ecosystem monitoring.

University of St Andrews, UK; September 2019 – September 2020

Thesis: A 32-year trait analysis of benthic community dynamics and its application for monitoring marine ecosystem health.

Supervisors: Prof. David Paterson and Dr. Andrew Blight

BSc Marine Biology & Oceanography (First Class Honours)

Key expertise: Oceanography skills, marine ecology, experimental design, benthic ecosystem processes, bioturbation and bioirrigation, and links between environmental change and ecosystem functioning.

University of Southampton, UK; September 2016 – 2019

Thesis: A study on lugworm (*Arenicola marina*) and the effects of biomass and increased global temperatures on sediment reworking (bioturbation and bioirrigation).

Supervisors: Prof. Martin Solan

Publications

(20 citations, h-index = 2)

Armitage, P., Burrows, M. T., Rimmer, J. E., Blight, A. J., & Paterson, D. M. (2024). Multidecadal changes in coastal benthic species composition and ecosystem functioning occur independently of temperature driven community shifts. *Global Change Biology*, 30(8). https://doi.org/10.1111/gcb.17482

Armitage, P., Törnroos, A., Fredriksen, R., Bluhm, B. A., Weigel, B., Bonsdorff, E., Christiansen, J. S., & Nordström, M. C. (2025). Diverging benthic trait diversity and drivers across fjord to slope habitats of the High Arctic. *Estuarine, Coastal and Shelf Science*, 313, 109086. https://doi.org/10.1016/j.ecss.2024.109086

Armitage, P., Nordström, M. C., Oleszczuk, B., Legeżyńska, J., Włodarska-Kowalczuk, M., & Törnroos, A. (2026). Biogeographic diversity meets functional similarity: Trait convergence in benthic infauna from the Arctic ice covered north to ice free south. *Diversity and Distributions*, 32(4). https://doi.org/10.1111/ddi.70195

Nordström, M. C., Zhulay, I., Armitage, P., Norrbin, F., Bonsdorff, E., Christiansen, J. S., & Bluhm, B. A. (2026). Epibenthic food web structure across the Northeast Greenland seascape. *Marine Environmental Research*. https://doi.org/10.1016/j.marenvres.2026.108295

Under Review

Armitage, P. A., Nordström, M. C., Svensen, C., Oleszczuk, B., Legeżyńska, J., Włodarska-Kowalczuk, M., & Törnroos, A. (2026). From surface flux to seafloor function: Vertical carbon export and benthic communities in high latitude coastal systems. *Biogeosciences*. Submitted June 2026. https://doi.org/10.5194/egusphere-2026-3268

Contribution/outcome: Led integration of carbon export, sediment carbon and benthic traits, revealing spatial decoupling between carbon export and benthic biomass.

Niedzwiedz, S., Murray, A., Beckschulte, P., Monteiro, C., Ruiz, M. B., Descôteaux, R., Armitage, P., Boström, C., Havermans, C., Kuliński, K., & Bischof, K. (2026). Species communities along environmental gradients: A glimpse into the future of Arctic fjords. *Ecology and Evolution*. Major revisions requested, August 2026.

Contribution: Editing, writing, and data collection for benthic macroalgae and eDNA community analysis in Svalbard.

In Preparation

Armitage, P. & Boström, C. Ice as an overlooked disturbance regime: global impacts of annual sea-ice scraping on macroalgal and benthic communities, ecosystem functioning, and coastal carbon.

Contribution: Leading a meta-review on the global state of ice scouring and its impacts on seafloor communities and ecosystem functioning.

Sanders, T., Solan, M., Garcia, C., Williams, T., Armitage, P., Godbold, J.A., Bremner, J., Cooper, K., Gogina, M., Marzloff, M., Mouillot, D., Törnroos, A., Villnäs, A. What functional traits are relevant to seafloor ecosystem functioning?

Contribution: Conducting a meta-synthesis of functional traits linked to seafloor ecosystem functioning as well as editing and figure design.

Total Scientific Articles = 8

Research Expedition Experience

ECOTIP (EU Horizon project) Arctic Expeditions (West Greenland 2021 & Northeast Greenland 2022)

- Responsible for benthic box core sampling, recovery, sieving, and preservation
- 24-hour rotational monitoring of multibeam and Parasound surveys in collaboration with Aarhus University
- Marine Mammal Surveyor during emergency cruise plan adjustments
- Conducted additional kelp and benthos sampling for Bremen University, including collection, preparation and preservation.

SEA-Quester (EU Horizon project) Svalbard Expedition (2024)

- Two-person scientific team managing full sampling workflow
- Multi-method benthic sampling including grabs, traps, trawls, and macroalgal fauna surveys and Sample collection for isotope and community analyses
- Quantitative seabed imaging and video documentation

Conference Presentations

International Conferences

2026 Armitage, P. (presenter), Nordström, M. C., Oleszczuk, B., Legeżyńska, J., Włodarska-Kowalczuk, M., & Törnroos, A. *Biogeographic overlap and species turnover but limited trait diversity in Arctic shelf infauna: Evidence of strong environmental filtering across a West Greenland gradient.* Poster, Ocean Sciences Meeting, ASLO/AGU, Glasgow, UK.

2023 Armitage, P. (presenter), Zhulay, I., Fredriksen, R., Cautain, I., Bluhm, B. A., Bonsdorff, E., Christiansen, J. S., Nordström, M. C. *Epibenthic communities in Northeast Greenland: Taxonomic, functional, and trophic structure.* Oral, Towards the New Arctic Ocean, Past, Present, Future, Nansen Legacy Symposium, Tromsø, Norway.

2022 Armitage, P. (presenter), Törnroos, A., Fredriksen, R., Bluhm, B. A., Weigel, B., Bonsdorff, E., Christiansen, J. S., & Nordström, M. C. *Distinct trait combinations and functional diversity patterns across a high Arctic continental shelf.* Poster, Arctic Frontiers Conference, Tromsø, Norway.

2021 Armitage, P. (presenter), Törnroos, A., Fredriksen, R., Bluhm, B. A., Weigel, B., Bonsdorff, E., Christiansen, J. S., & Nordström, M. C. *An introduction to East Greenland's functional structure: An epibenthic community assessment and their associated traits and drivers.* Oral, International Conference for Young Marine Researchers (ICYMARE), Germany (online due to COVID-19).

2021 Armitage, P. (presenter), Törnroos, A., Fredriksen, R., Bluhm, B. A., Weigel, B., Bonsdorff, E., Christiansen, J. S., & Nordström, M. C. *The warming of Arctic marine environments and the implications to seafloor biodiversity and ecosystem functioning: An investigation of East Greenland's current ecological structure and mechanistic drivers.* Oral, Aura Symposium, Turku, Finland.

Consortium Meetings

2024–2026 SEA-Quester (EU Horizon project) Meetings – Multiple oral presentations (presenter)

2021–2024 ECOTIP (EU Horizon project) Annual Meetings – Multiple oral presentations (presenter); session chair

Invited

2023 Armitage, P. (presenter), Törnroos, A., Fredriksen, R., Bluhm, B. A., Weigel, B., Bonsdorff, E., Christiansen, J. S., & Nordström, M. C. *Investigations of seafloor biodiversity and their roles in Arctic marine ecosystems.* Oral, Aurum Day, Faculty of Science and Engineering, Åbo Akademi University.

Teaching Experience

2025 – Invited lecture, University of Helsinki – MSc, Arctic benthic trait ecology
2025 – Invited lecture, Åbo Akademi University – MSc, Arctic and Antarctic benthic systems
2022 – Invited lecture, Åbo Akademi University – MSc, Functional Biology

2022 – Teaching Assistant, MSc-level Statistics Course, Åbo Akademi University

Student Supervision and Mentoring

2023–2025 – Assisted supervision of two MSc students on benthic invertebrate theses on functional diversity and Arctic food webs, specifically statistical and spatial analyses (MSc Michaela Sandström, MSc Elin Blomgren)
2023–2024 – Organising member, R Coffee Club (BSc and MSc coding skills development for R software)
2022–2024 – Trained and supervised two laboratory interns in benthic sample processing, including macrofaunal sorting, identification, and laboratory data management.

Academic Service & Leadership

2025 – Organising Committee Member, Åbo Akademi University Researcher Days Annual Event
2022–2024 Organising Committee Member, ECOTIP (EU Horizon project) Annual Meetings
2022 Organised and delivered department-level two-part workshop on open science practices, focusing on R Markdown and GitHub for collaborative FAIR research
2021–2023 – Open Science Coach Programme Award, Åbo Akademi University
2021–2022 – Åbo Akademi University Department (EMB) PhD Representative
2018–2019 Founding President of the University of Southampton student sector (SUMEST) of the Institute of Marine Engineering, Science and Technology (IMarEST, UK) for professional networking, academic support initiatives, and industry engagement.

Peer Review

Reviewer for

- Ecology and Evolution (2023, 1 manuscript)
- Estuarine Coastal and Shelf Science (2025-2026, 5 manuscripts)
- Frontiers in Marine Science (2026, 1 manuscript)
- Scientific Reports (2026, 1 manuscript)

Technical Expertise

Quantitative Methods

Ecological modelling in R: Bayesian Hierarchical Modelling of Species Communities (HMSC), random forests, structural equation modelling, multivariate ordination, distance-based approaches, species diversity & functional metrics, Generalised Latent Variable Modelling (gllvm), Generalised Additive Modelling (GAMs), and other advanced statistical approaches.

Spatial & Oceanographic Tools

- Global Information Systems (GIS) and spatial analysis
- Ocean Data Viewer (oceanographic and other geo-referenced profiling analysis)
- SigmaPlot (statistical analysis and scientific data visualisation)
- MATLAB (numerical computing and custom data analysis workflows)
- Multibeam and Parasound survey operations (bathymetric profiling)
- Caris HIPS/SIPS (analysis of multibeam bathymetric data)
- Petrel (3D visualisation and interpretation of seabed and subsurface structure)

Field & Laboratory

- Benthic sampling methods, sediment processing, and macrofaunal identification Arctic histology workflow including dissection, fixation, embedding, sectioning, staining, and microscopy
- Mesocosm experimental design and maintenance (bioturbation and macrofauna-climate interactions)
- Coral reef research and fish stock surveys (Fiji); scuba-based quantitative surveys contributing to Marine Protected Area designation

Other Tools

- InkScape (vector graphics editor)
- NVivo (Qualitative Data Analysis Software)

Funding

2022 Open Science Coach Programme Award (€1000) for delivering department-level 2-part workshop on open science practices (specifically R-Markdown and GitHub)

2021 University Travel Grant (€500)

Advanced Training besides graduate classes

2025 Multivariate methods for ecologists (SLU, Sweden)
2023 Community Ecology (SLU, Sweden)
2022 Teledyne ParaSound Sub Bottom Profiling Training (Bremen, Germany)
2022 Research Data Management (ÅAU, Finland)
2021 Introduction/Fundamentals of Bayesian Data Analysis statistics using R (FBDA01)
2021 Bayesian approaches to regression and mixed effects models using r and brms (barm01)
2021 CSC High-Performance Computing: Finland's National Supercomputers Mahti / Puhti

Science Communication & Outreach

2021-2026 10+ university and school invited talks (ages 3+)
2025 SEA-Quester (EU Horizon project) Podcast interview and Instagram Reels with GRID-Arendal.
2023 Baltic Sea Day public engagement with the general public, showcasing aquaria and sharing knowledge about the state of the Baltic Sea.
2022 GRID-Arendal (ECOTIP - EU Horizon project) interview on Arctic benthic invertebrates and life as an early career scientist.
2021 Multimedia Training for Scientists (GRID-Arendal, Norway)

Relevant Professional Experience outside of Academia

Office Manager and Consultant, Solomon UK | 2024-current

Solomon Software has been an international distributor for Microsoft accounting systems since 2001, supporting Microsoft Partners and their clients across the USA, Canada, Australia, Europe, and the Middle East. In this family-owned business, I manage administrative and operational activities, as well as consultancy and client support for Microsoft Dynamics SL, working directly with software partners and clients. This part-time role, outside of my scientific work (approximately 10 hours per week), has provided professional experience in commercial operations, accounting, project coordination, stakeholder communication, problem-solving, and client-facing software environments, complementing my academic research career.

Languages

2001 – 2010 French (B1)
2021 – 2022 Finnish (A2)
2022 – 2026 Swedish (B1)

Professional Certifications

2012 – present PADI Open Water Scuba Instructor (including Dry Suit, Nitrox, RNLI Sea Survival, Coral Reef Researcher, and 4 other speciality certifications)
2017 – ORCA Marine Mammal Surveyor Certification (UK)
2017 – 2024 Sea Survival and First Aid at Sea (multiple courses and countries)
2011 – Driving Licence