Project acronym: AR3ST

Project title: “Landscapes, shapes and genes: The adaptive response of three-spine sticklebacks to long-term coastal evolution” (AR3ST-2)

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Discipline: Earth Sciences & Environment: Ecosystems & Biodiversity

Station(s): Greenland Institute of Natural Resources (GINR) (Greenland/Denmark)

Within this project, we investigate the adaptive response of threespine stickleback (Gasterosteus aculeatus) to millennial-scale environmental changes along the west coast of Greenland. Having a long-term understanding of coastal evolution, environmental variability, and the relative roles and timescales of adaptive mechanisms is crucial for predicting future species dynamics in the Arctic. The threespine stickleback is one of only four freshwater fish species in Greenland, and thus, plays a major role in structuring ecosystems and food webs. In summer 2022, we conducted a first explorative study at the Arctic Station on Qeqertarsuaq (Disko Island), and in 2023, conducted a comparative study in the area near Nuuk, using transnational access to the facilities of the GINR to continue this interdisciplinary project. During the first field campaign in 2022, we were able to sample stickleback from a marine, an anadromous, and a freshwater population, and our work confirmed that the conceptual framework of our study is valid, and the timescales of environmental dynamics are sufficient to trigger significant phenotypic change. Our sampling campaign in 2023 expanded on this by ascertaining repeatability of phenotypic changes and time-dependent patterns in the mechanisms driving them, using freshwater populations of various ages. The bedrock topography of the coastal lowlands of Akia (Nordlandet) is ideally suited for the formation of lakes with defined sill levels that allow the inference of lake ages. Therefore, we chose a selection of field sites along an age gradient covering thousands of years. Overall, we aim to identify all axes of change (phenotypic, genetic, and epigenetic) in stickleback and investigate the potential loss of phenotypic plasticity over time-scales of thousands of years.