Sympatric Calanus Species: A High Temporal Resolution of Reproductive Timing and Stage Composition

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Abstract : Members of the genus Calanus are key species in the North Atlantic and Arctic marine ecosystems due to their vast abundance and their ability to accumulate high amounts of lipid. As a link between primary producers and higher trophic levels, the temporal presence of each Calanus species is important in a time of changing communities and northward distribution shifts. This study focused on the temporal niches of the sympatric species Calanus helgolandicus, Calanus finmarchicus, Calanus glacialis, and Calanus hyperboreus in Skjerstad fjord, a Norwegian fjord (67°14'N, 14°44'E). Three depth intervals were sampled monthly over a year, targeting copepodite stages of the genus Calanus. Species determination was carried out genetically using insertion/deletion markers. In addition, during the reproductive season (Jan-May), weekly samples of the upper 50 meters of the water column targeting nauplii and 5 depth intervals targeting copepodites were collected. Nauplii samples were sorted into two groups (NI-NIII and NIV-NVI), and species were genetically identified. Specimens from stage CIV to adults from each depth interval of copepodite sampling were photographed in order to generate a supporting timeline of visual traits, including gonad maturation stage, presence of stomach content, and total lipid content. The most abundant species were Calanus finmarchicus and Calanus glacialis, followed by Calanus hyperboreus. These species were present in the water column throughout the year, whereas Calanus helgolandicus, the least abundant species, was only present during the summer and autumn period. Each species showed distinct temporal niches, with Calanus finmarchicus occupying the upper 50 meters longer than any of the other species. Calanus hyperboreus dominates in abundance early in the spring but are outnumbered by Calanus glacialis and Calanus finmarchicus after spring bloom sets in. In Skjerstad fjord, Calanus hyperboreus is a clear capital breeder with a long period of nauplii presence before the spring bloom. Calanus glacialis and Calanus finmarchicus both utilize income breeding, with Calanus glacialis developing to the larger nauplii stages quicker than Calanus finmarchicus, but also having a shorter reproduction period. Indeed, the "traditional Arctic" species Calanus hyperboreus and Calanus glacialis appear to end their reproduction period earlier than the North Atlantic Calanus finmarchicus.

Keywords : calanus, depth distribution, reproduction, stage composition, temporal niches Conference Title : ICMBO 2022 : International Conference on Marine Biology and Oceanography Conference Location : Oslo, Norway Conference Dates : June 23-24, 2022

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