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Original Article

Niche differentiation of *Dinophysis acuta* and *D. acuminata* in a stratified fjord

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ABSTRACT

Dinophysis acuta and *D. acuminata* are associated with lipophilic toxins in Southern Chile. Blooms of the two species coincided during summer 2019 in a highly stratified fjord system (Puyuhuapi, Chilean Patagonia). High vertical resolution measurements of physical parameters were carried out during 48 h sampling to i) explore physiological status (e.g., division rates, toxin content) and ii) illustrate the fine scale distribution of *D. acuta* and *D. acuminata* populations with a focus on water column structure and co-occurring plastid-bearing ciliates. The species-specific resources and regulators defining the realized niches (*sensu* Hutchinson) of the two species were identified. Differences in vertical distribution, daily vertical migration and *in situ* division rates (with record values, 0.76 d^{-1}, in *D. acuta*), in response to the environmental conditions and potential prey availability, revealed their niche differences. The Outlying Mean Index (OMI) analysis showed that the realized niche of *D. acuta* (cell maximum 7×10^3 cells L^{-1} within the pycnocline) was characterized by sub-surface estuarine waters (salinity 23 – 25), lower values of turbulence and PAR, and a narrow niche breath. In contrast, the realized niche of *D. acuminata* (cell maximum 6.8×10^3 cells L^{-1} just above the pycnocline) was characterized by fresher (salinity 17 – 20) outflowing surface waters, with higher turbulence and light intensity and a wider niche breadth. Results from OMI and PERMANOVA analyses of co-occurring microplanktonic ciliates were compatible with the hypothesis of species such as those from genera *Pseudotontonia* and *Strombidium* constituting an alternative ciliate prey to *Mesodinium.* The *D. acuta* cell maximum was associated with DSP (OA and DTX-1) toxins and pectenotoxins; that of *D. acuminata* only with pectenotoxins. Results presented here contribute to a better understanding of the environmental drivers of species-specific blooms of *Dinophysis* and management of their distinct effects in Southern Chile.

1. Introduction

Species of *Dinophysis* have drawn attention worldwide due to their capacity to produce two groups of lipophilic toxins. The first group, okadaic acid (OA) and its derivatives, the dinophysistoxins (DTX), cause diarrhetic shellfish poisoning (DSP) (Gestal-Otero, 2014; Reguera et al., 2014; Yasumoto et al., 1980); the second group, the pectenotoxins (PTX), are hepatotoxic in cellular assays (Munday, 2014), and cause

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