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The contribution of nano- and micro-planktonic assemblages in the surface layer (0–30 m) under different hydrographic conditions in the upwelling area off Concepción, central Chile

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Abstract

In the highly productive region off central Chile, the structure and temporal and spatial variability of planktonic assemblages, and the factors that determine changes in this structure are poorly understood. In the region, wind-driven upwelling, heating by solar radiation and freshwater inputs are highly seasonal processes, which, together with higher frequency events, can promote changes in the planktonic communities, especially in the upper layer. This study focuses on the structure of nano- through to micro-planktonic assemblages (2–200 μm) of unicellular organisms (protists) in surface waters (0–30 m) during different hydrographic conditions. Samples were taken from a fixed shelf station off Concepción (COPAS time series Station 18) on eight occasions between September 2003 and August 2004. The nano-plankton flagellate-dominated fraction was numerically important during the whole period. Maxima in flagellate abundance and biomass occurred during the upwelling period (November–April samplings) but these maxima appear to be unrelated to the degree of water column stratification. The micro-plankton diatom-dominated fraction was usually the largest component in terms of biomass during the study period and the diatoms made important numerical contributions during the upwelling period, with maxima in abundance and biomass when water column stability was lowest. The dominant genera and morphotypes in each functional group were found throughout the study period, with maxima in abundance and biomass co-occurring under similar environmental upwelling conditions. The mean macro-nutrient concentrations (nitrate and silicate) were relatively high in the top 30 m during both upwelling and non-upwelling periods, and did not explain the maxima in plankton or functional group replacements. The persistence of the dominant taxa in the planktonic assemblages suggests a high degree of flexibility, though probably not at the specific level, to withstand the highly variable environmental conditions in this upwelling area.

Regional index terms: SE Pacific; Central Chile; Bio-Bio region; Concepción

Keywords: Nano- and micro-plankton structure; Temporal variability; Coastal upwelling; Humboldt current system; Chile

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1. Introduction

Coastal upwelling systems support relatively large plankton standing stocks and high productivity, the formation of phytoplankton blooms usually being attributed to the enrichment of surface waters with newly upwelled nutrients (e.g. Pitcher, 1988; Avaria et al., 1989; Chavez et al., 1991; Hutchings et al., 1995; Wilkerson et al., 2000). The planktonic structures of these systems, as well as those of other nearshore systems in temperate regions, have frequently been described as being dominated by large cell-sized netplankton, mostly chain-forming and colonial diatoms of a few cosmopolitan genera (reviews in Hutchings et al., 1995; Kudela et al., 2005). Diatom bloom formation has been explained by the ability of diatoms to achieve higher specific

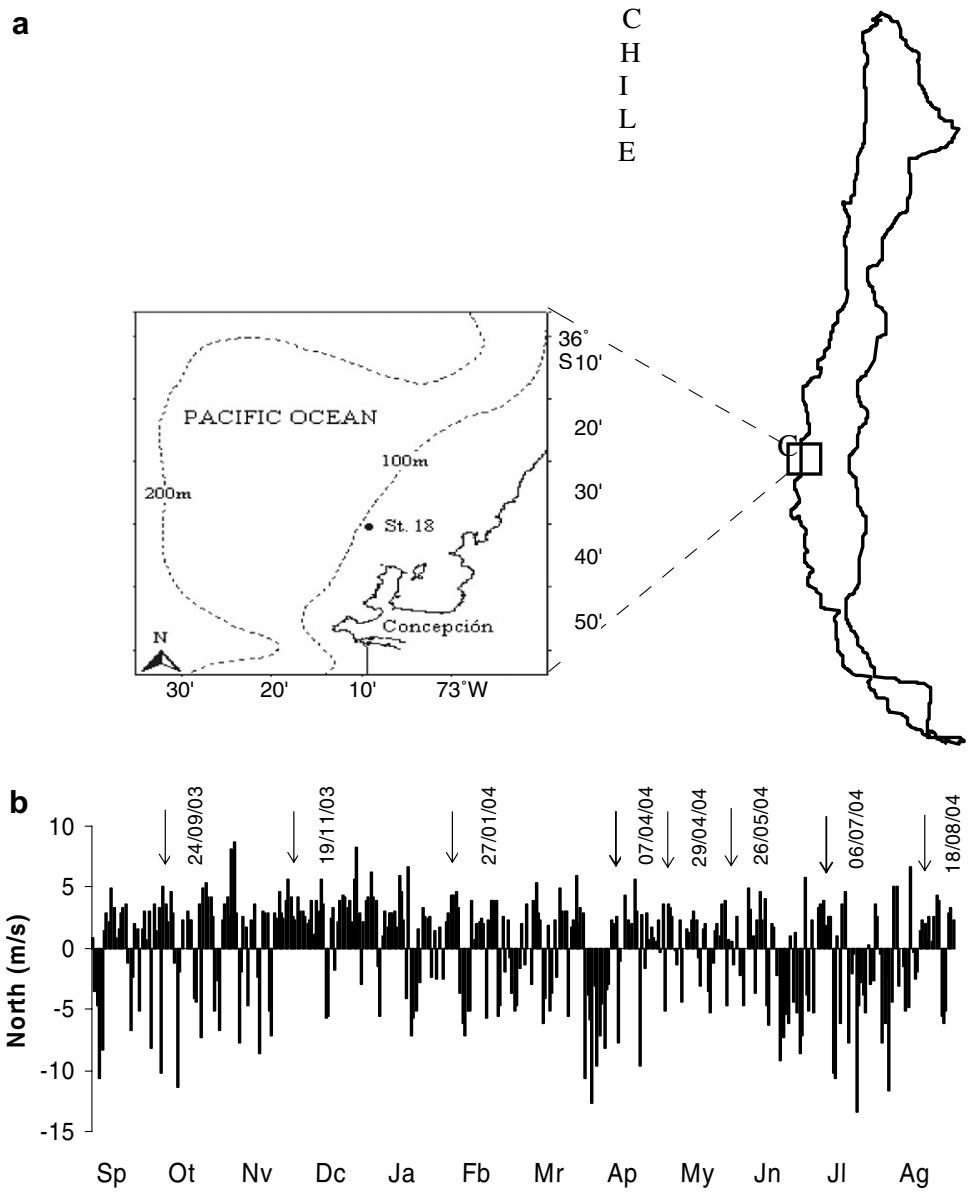

Fig. 1. (a) Study area and location of Station 18 on the shelf (Itata terrace) off Concepción, central Chile, and (b) the northern component of wind velocity (equatorward) for the study period (September 2003–August 2004). Wind data were derived from the meteorological station at Carriel Sur and represent mean daily values of north–south hourly values (positive equatorward) taken four times a day (every 6 h).