



Primary production and phytoplanktonic biomass in shallow marine environments of central Chile: Effect of coastal geomorphology

Luis A. Henríquez^{a,b}, Giovanni Daneri^{c,d}, Carlos A. Muñoz^a, Paulina Montero^d,
Rodrigo Veas^e, Alvaro T. Palma^{a,b,*}

^a Departamento de Ecología, Pontificia Universidad Católica de Chile, Alameda 340, Casilla 114-D, Santiago, Chile

^b Center for Advanced Studies in Ecology and Biodiversity, P. Universidad Católica de Chile, Chile

^c Centro de Investigación en Ecosistemas de la Patagonia (CIEP), Bilbao 449, Coyhaique, Chile

^d Centro de Ciencias y Ecología Aplicada (CEA), Universidad del Mar, Campus Valparaíso, Carmen 446, Placeres, Valparaíso, Chile

^e Departamento de Oceanografía, Universidad de Concepción, Casilla 160-C, Concepción, Chile

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Abstract

Fluctuations were identified and quantified, on a local spatial scale, in net primary production (NPP), phytoplanktonic biomass (Chl *a*), and photosynthetic parameters (P_{\max}^B and α^B) of natural phytoplankton assemblages in coastal environments of central Chile. The measurements, besides those of a series of environmental parameters, were carried out at two locations: once a month from August 2003 to February 2004 at a location on the Hualpén Peninsula (HP) (36°44') and five times during February 2005 at a location on the Quintay Peninsula (QP) (33°11'). The measurements at both the locations were carried out simultaneously, at exposed and protected sites at similar distances from the coast and the tip of each peninsula, to ascertain whether any physical characteristics of the protected environments favor the retention of phytoplankton, which, in turn, translates into greater NPP and higher values of P_{\max}^B and α^B . Photosynthetic parameters were estimated through the analysis of *P* vs. *I* curves drawn from incubation in closed systems in the laboratory with light intensity ($\mu\text{E m}^{-2} \text{s}^{-1}$) as the independent variable and maximum gross primary production (P_{\max}^B expressed as $\mu\text{g C } \mu\text{g Chl } a^{-1} \text{ h}^{-1}$) and the initial slope of the curve (α^B expressed as $(\mu\text{g C } \mu\text{g Chl } a^{-1} \text{ h}^{-1})/(\mu\text{E m}^{-2} \text{ s}^{-1})$) as the dependent variables. The results were as follows: (1) in most cases, P_{\max}^B , α^B , and NPP were greater at the protected site on HP; (2) P_{\max}^B was greater only in two instances at the protected site on QP whereas α^B did not differ between the two sites; (3) the concentration of subsurface Chl *a* at QP was always higher at the protected sites on both the peninsulas while surface Chl *a* did not exhibit a clear pattern at either peninsula; (4) the Secchi depth was greater at the exposed sites on both peninsulas, and (5) the average thermal stratification of a water column was greater at the protected sites. We propose that coastal geomorphology, through contrasting circulation patterns related to the occurrence of upwelling events, favors higher NPP, Chl *a*, P_{\max}^B , and α^B at the protected sites on both peninsulas. These remarkable differences occurred at sites that were only a few hundred meters apart, which underlines the importance of factors that affect hydrographical variations at those scales.

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1. Introduction

The high levels of primary production reached in the coastal zone of central Chile have been suggested to sustain important littoral fisheries (Cubillos et al., 1998). This primary production (PP), defined as the amount of carbon fixed photosynthetically over time, and the biomass of phytoplankton expressed as chlorophyll *a* (Chl *a*) have been quantified in

* Corresponding author. Departamento de Ecología, Pontificia Universidad Católica de Chile, Alameda 340, Casilla 114-D, Santiago, Metropolitana, Chile.

E-mail address: apalma@bio.puc.cl (A.T. Palma).