



Drivers of dinoflagellate benthic cyst assemblages in the NW Patagonian Fjords System and its adjacent oceanic shelf, with a focus on harmful species

Camilo Rodríguez-Villegas ^{a,b,n}, Matthew R. Lee ^b, Pablo Salgado ^c, Rosa I. Figueroa ^d, Ángela Baldrich ^{a,b,n}, Iván Pérez-Santos ^{b,e,f}, Stephen J. Tomasetti ^g, Edwin Niklitschek ^b, Manuel Díaz ^h, Gonzalo Álvarez ^{i,j}, Sandra L. Marín ^k, Miriam Seguel ^l, Laura Farías ^m, Patricio A. Díaz ^{b,n,*}

^a Programa de Doctorado en Ciencias, Mención Conservación y Manejo de Recursos Naturales, Universidad de Los Lagos, Camino Chinquihue Km 6, Puerto Montt, Chile

^b Centro i-mar, Universidad de Los Lagos, Casilla 557, Puerto Montt, Chile

^c Centro de Estudios de Algas Nocivas (CREAN), Instituto de Fomento Pesquero (IFOP), Enrique Abello 0552, Punta Arenas, Chile

^d Centro Oceanográfico de Vigo, Instituto Español de Oceanografía (IEO), Subida a Radio Faro 50, 36390 Vigo, Spain

^e Centro de Investigación Oceanográfica COPAS Sur-Austral, Universidad de Concepción, Campus Concepción, Concepción, Chile

^f Centro de Investigaciones en Ecosistemas de la Patagonia (CIEP), Coyhaique, Chile

^g School of Marine and Atmospheric Sciences, Stony Brook University, Southampton, NY, USA

^h Programa de Investigación Pesquera, Instituto de Acuicultura, Universidad Austral de Chile, Puerto Montt, Chile

ⁱ Facultad de Ciencias del Mar, Departamento de Acuicultura, Universidad Católica del Norte, Coquimbo, Chile

^j Centro de Investigación y Desarrollo Tecnológico en Algas (CIDTA), Facultad de Ciencias del Mar, Larrondo 1281, Universidad Católica del Norte, Coquimbo, Chile

^k Instituto de Acuicultura, Universidad Austral de Chile, Puerto Montt, Chile

^l Centro Regional de Análisis de Recursos y Medio Ambiente (CERAM), Universidad Austral de Chile, Puerto Montt, Chile

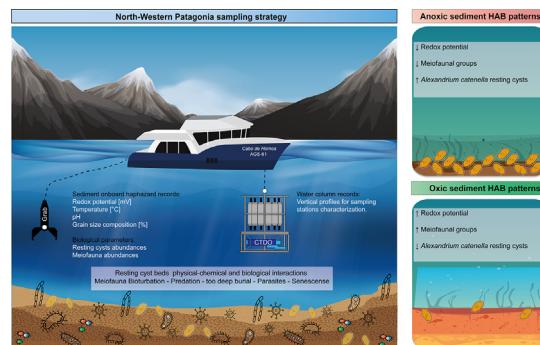
^m Department of Oceanography, Millennium Institute for Coastal Social Ecology (SECOS) and Center for Climate Research and Resilience (CR2), University of Concepción, Concepción, Chile

ⁿ CeBiB, Universidad de Los Lagos, Puerto Montt, Chile

HIGHLIGHTS

- Significant differences in cyst assemblages between the fjords and oceanic environments were found.
- Alexandrium catenella* showed a strong association with sediment oxygen concentrations.
- Highest cyst densities were found in anoxic areas and the lowest densities in oxygenated areas.
- Biological interactions between the meiofauna and dinoflagellate cysts were identified.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

Received 23 January 2021

Received in revised form 20 April 2021

Accepted 21 April 2021

Available online 27 April 2021

Editor: Lotfi Aleya

ABSTRACT

In recent decades, the alteration of coastal food webs (via aquaculture, fishing, and leisure activities), nutrient loading, and an expansion of monitoring programs have prompted an apparent worldwide rise in Harmful Algae Blooms (HABs). Over this time, a parallel increase in HABs has also been observed in the Chilean southern austral region (Patagonia fjords). HAB species like *Alexandrium catenella*—responsible for Paralytic Shellfish Poisoning (PSP)—are of great public concern due to their negative socioeconomic impacts and significant northward geographical range expansion. Many toxic dinoflagellate species (like *A. catenella*) produce benthic resting cysts, yet a holistic understanding of the physical-chemical and biological conditions influencing the distributions of cysts in this region is lacking. In this study, we measured a combination of hydrographic (temperature, salinity,

* Corresponding author at: Centro i-mar & CeBiB, Universidad de Los Lagos, Casilla 557, Puerto Montt, Chile.

E-mail address: patricio.diaz@ulagos.cl (P.A. Díaz).