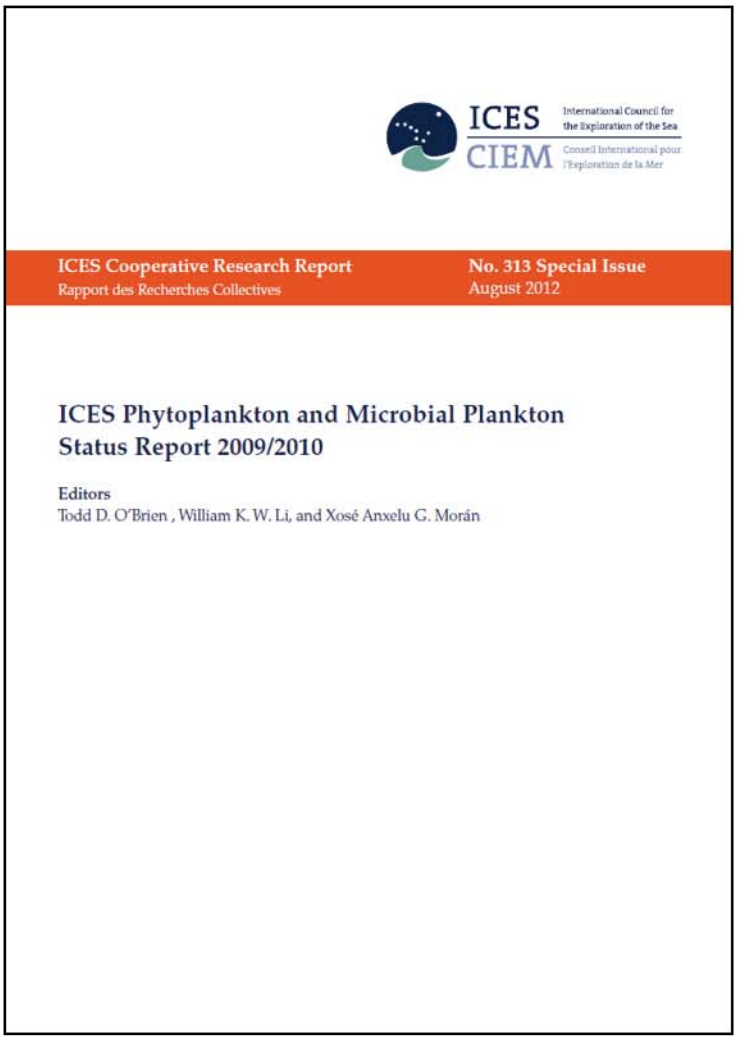

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O'Brien, T. D., Li, W. K. W., and Morán, X. A. G. (Eds). 2012.
ICES Phytoplankton and Microbial Plankton Status Report 2009/2010.
ICES Cooperative Research Report No. 313. 196 pp.

The time-series analyses and figures used in this report were created using COPEPODITE:
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8.3 Nervión River estuary (Site 51)

Emma Orive, Javier Franco, Aitor Laza-Martínez, Sergio Seoane, and Alejandro de la Sota

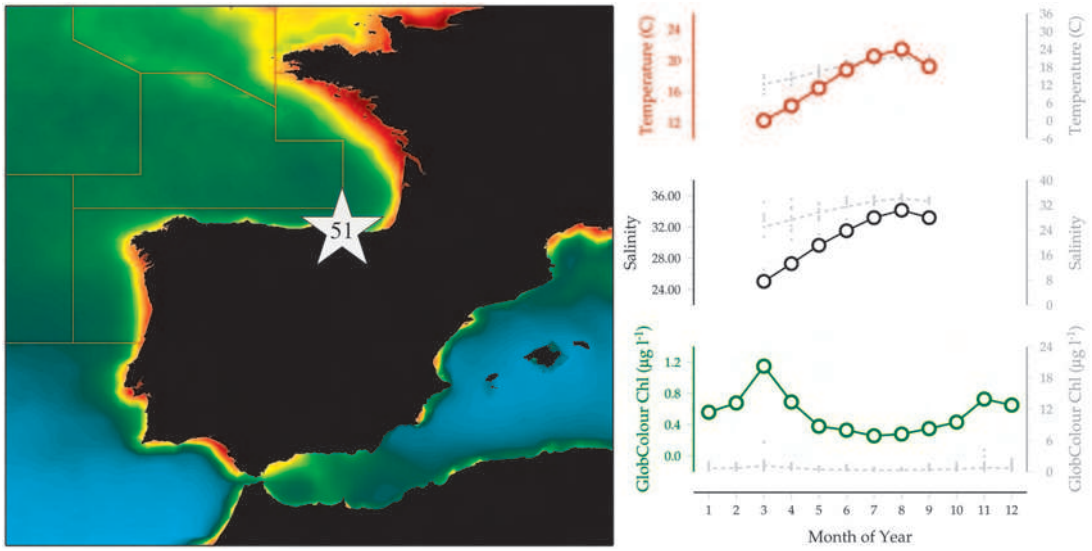

Figure 8.3.1
Location of the Nervión River Estuary plankton monitoring area (Site 51), plotted on a map of average chlorophyll concentration, and its corresponding environmental summary plot (see Section 2.2.1).

The Nervión River estuary (also named Nervión–Ibaizabal estuary) has been monitored for phytoplankton taxonomic composition and abundance since 2000. The Nervión catchment is densely populated, and this study forms part of a broader monitoring programme performed to follow the water quality evolution after the implementation of a sewerage scheme in the area (García-Barcina *et al.*, 2006). Phytoplankton samples are taken aproximately monthly from March to September at eight stations (1–8, from the outer to the inner estuary) located along the longitudinal axis. Samples are analysed for cell identification and counted with the Utermöhl method; in addition, individuals from selected genera among those forming blooms or known to contain harmful species are isolated from live samples and grown in cultures for a more detailed morphological and genetic characterization. Stations 1 and 2 are located in the outer estuary (Abra of Bilbao), which, with a width of ca. 3 km and a maximum depth of ca. 30 m, contains most of the estuarine water. This estuarine area is dominated by marine water during most of the monitoring period and phytoplankton species are mainly of marine origin.

Seasonal and interannual trends (Figure 8.3.2)

The apparent increase in total diatoms and flagellates from 2000 to 2010 can be attributed to the improvement in water quality during this period, and is likewise evident in the diatoms:diatoms+dinoflagellates ratio. Dinoflagellates are relatively scarce in the estuary, as determined by signature pigments from estuarine phytoplankton (Seoane *et al.*, 2005). Fucoxanthin is usually the dominant pigment in the total phytoplankton. Haptophytes are almost always present in the outer estuary (Seoane *et al.*, 2009), and blooms of *Apedinella spinifera* and *Heterosigma akashiwo* have been observed. Diatoms seem to constitute the bulk of chlorophyll *a* among fucoxanthin-containing microalgae. Alloxanthin is also relatively abundant, in agreement with the abundance of cryptophytes, which form frequent blooms both in the outer and inner estuary (Laza-Martinez, 2012). However, in the picoplankton, chlorophyll *b* is almost always the dominant pigment (Seoane *et al.*, 2006). FISH analysis (unpublished data) revealed the dominance of prasinophyceans in this size fraction.

Cell density can be high in spring in the outer estuary because of the spring diatom bloom in adjacent coastal waters. During this period, which can be very short and start at different times each year, the outer estuary is dominated by large marine diatoms responsible for the annual maxima of chlorophyll *a*. However, the maximum abundance for most phytoplankton classes, in terms of cell numbers, is generally registered in summer. The size of the cells, generally larger in spring, can account for the absence of a clear relationship between chlorophyll *a* values and the number of cells. Summer maxima in cell numbers can be partially attributed to the

export to the outer estuary of eurihaline taxa that reach bloom proportions in the inner and middle estuary. In summer, these estuarine segments are a source of small centric diatoms and flagellated forms, belonging to Chlorophyta, Cryptophyta, and Haptophyta, to the outer estuary (Seoane *et al.*, 2006; Laza-Martinez *et al.*, 2007). In addition to these eurihaline species, the outer estuary contains marine forms which grow better in this area during summer than in the oligotrophic coastal waters (Orive, 1989; Orive *et al.*, 2010).

The shift between flagellates and diatoms in the outer estuary in summer is driven by river run-off after rainy periods and by stability of the water column. The raphidophycean *Heterosigma akashiwo*, which is known to support high irradiance levels without experiencing photoinhibition (Martinez *et al.*, 2010), has been observed in bloom proportions in the outer estuary coinciding with very sunny days and elevated temperatures.

Lately, much attention is being paid to potentially toxic epiphytic dinoflagellates, which can appear in the water column as part of the phytoplankton. In addition to several species of the genera *Coolia* and *Prorocentrum*, toxic forms of the genus *Ostreopsis* have been found in the outer estuary and other localities of the southeastern Bay of Biscay that constitute the upper reported limit for the distribution of this pantropical genus in the Atlantic Ocean (Laza-Martinez *et al.*, 2011).

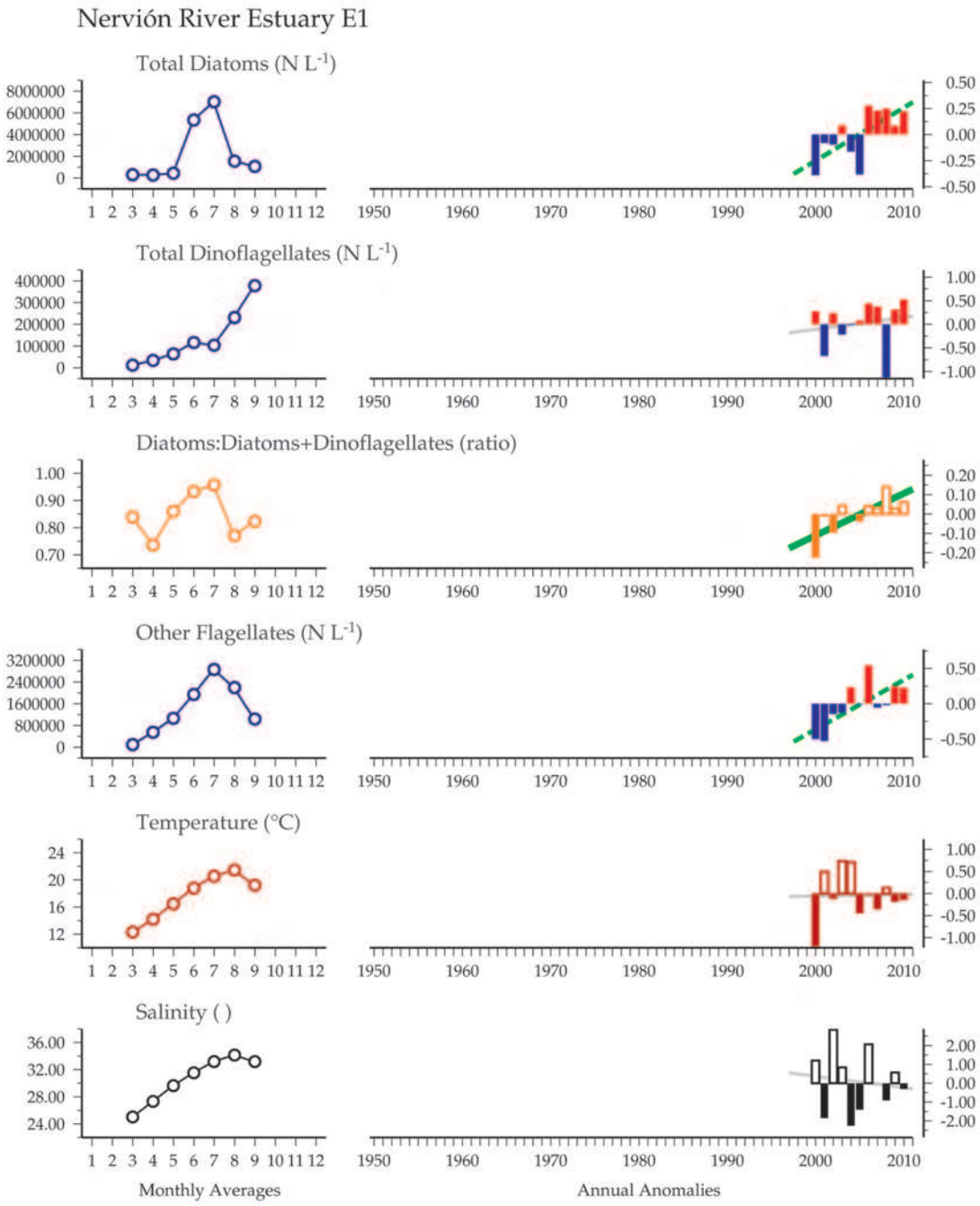

Figure 8.3.2
Multiple-variable comparison plot (see Section 2.2.2) showing the seasonal and interannual properties of select cosampled variables at the Nervión River estuary plankton monitoring site. Additional variables from this site are available online at http://wgpme.net/time-series.