9.2 Baleares Station (Site 57)

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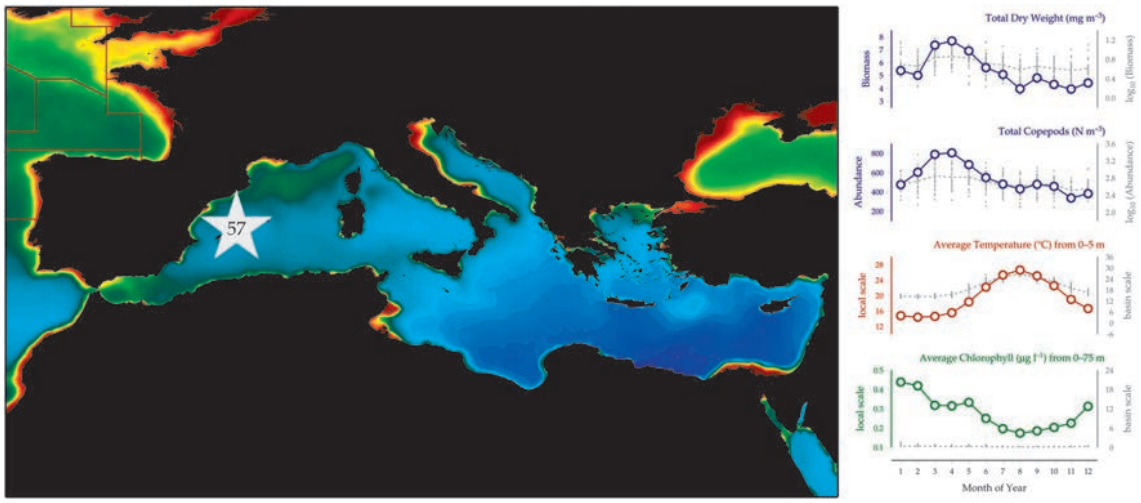

Figure 9.2.1
Location of the Baleares Station monitoring area (Site 57) plotted on a map of average chlorophyll concentration, and its corresponding seasonal summary plot (see Section 2.2.1).

The Balearic sampling site is located southwest of the island of Mallorca at 39°29′N 2°25′E and has a bottom depth of 77 m (Figure 9.2.1). Beginning in 1994, sampling of the station took place every 10 d until December 2005, after which it has been sampled seasonally four times a year. Zooplankton are sampled by means of oblique hauls from a depth of 75 m to the surface with a bongo net (40 cm diameter, 250 µm mesh). A full description of the methodology is given in Fernández de Puelles *et al.* (2007).

The Balearic Sea is characterized by complex mesoscale features resulting from the interaction between the saline and colder northern waters of the western Mediterranean and the southern, less-saline, and warmer water from the Alboran Sea. This ecologically important region encompasses major spawning areas of pelagic fish, possibly owing to an "island stirring" effect that may produce concentrated plankton biomass around the islands. Overall, the annual circulation pattern consists of cool, south-flowing waters of northern origin during the first part of the year, changing to warm, north-flowing waters of Atlantic origin in the second part. Circulation within the region becomes very complex because of the permanent mesoscale activity and the north Balearic front (Pinot *et al.*, 2002). Depending on the influence of these hydrographic structures, the region can undergo mixing or incursions of different water masses, forming frontal systems or eddies that drive the planktonic community dynamics (Fernández de Puelles *et al.*, 2004a, 2004b, 2007, 2009).

Seasonal and interannual trends (Figures 9.2.2–9.2.3)

Chlorophyll concentrations are highest from December through February (Figure 9.2.2) before the onset of warmer water temperatures and stratification. Seasonal temperature cycles indicate a mixing period during colder months and a stratification period from June to October. Mean surface water temperatures have a seasonal difference of up to 14°C, with a winter minimum of ca. 13°C and a summer maximum as high as 27°C. At a depth of 75 m, this seasonal difference is only 3°C: from 13°C (in March) to 16°C (in October). In general, this area has low nutrient concentrations and low primary production because of the development of the thermocline, which acts as a barrier to the supply of nutrients to the photic layer.

Zooplankton biomass (total dry weight; Figure 9.2.2) demonstrates a seasonal pattern, with higher mean biomass in the first half of the year (maximum in April) and lower biomass in the second half of the year (minimum in August). The Balearic area is characterized by the presence of relatively small-sized organisms. Large gelatinous zooplankton did not appear in great quantities in the samples. The zooplankton peak in March was related to a period of vertical mixing, when the cold, dense, nutrient-rich waters reach the surface, a widespread event in the Mediterranean. This early-spring zooplankton maximum seems to occur yearly in response to the previous winter phytoplankton bloom. During spring, when the thermocline is developing, the inputs of offshore waters and the proximity of frontal systems usually enhance zooplankton abundance.

Copepods were the most abundant and perennial group in the zooplankton samples (56% of the total). Other important groups were gelatinous zooplankton (23%, consisting primarily of 17% appendicularians, 5% doliolids, and 1% salps), cladocerans (10%), and meroplankton (4%). In addition, siphonophores (3%), chaetognaths (2%), ostracods (1%), and pteropods (1%) were also found in the area. More than 80 copepod species were identified during the entire study period, ten of which accounted for 60% of the total. The group of *Clausocalanus* was the most abundant (*C. arcuicornis, C. furcatus, C. pergens*, and *C. paululus*; 27%), followed by *Oithona* spp. (25%). Some species had very low abundance during short periods, such as *Calanus helgolandicus* in winter or *Acartia danae* in late summer.

The SSTs in the region have been above the 100-year average since 1985 and, since 2000, have often been the warmest seen in the region for the past 100 years (Figure 9.2.3). Although no significant zooplankton biomass decrease was observed during this time-series, a correlation of copepods with temperature (negative) and salinity (positive) indicated their direct relationship with the presence of the different surface water masses; when colder and saltier Mediterranean waters prevailed in the area, higher zooplankton biomass values were observed.

Although factors other than temperature and salinity could contribute to the plankton pattern observed, the recognition of large-scale dependence on the physical environment is a first and necessary step towards understanding zooplankton distributions in the western Mediterranean.

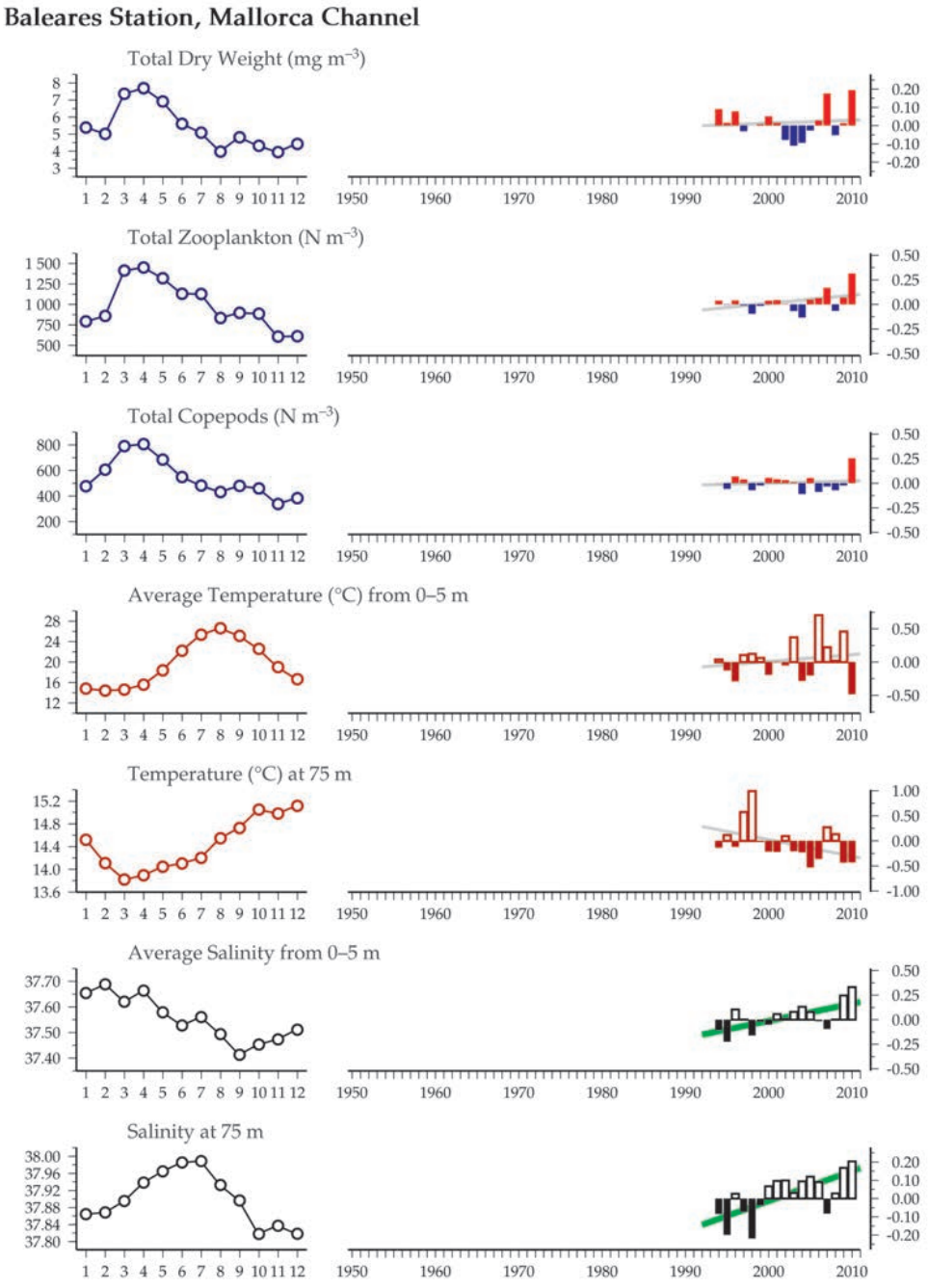

Figure 9.2.2
Multiple-variable comparison plot (see Section 2.2.2) showing the seasonal and interannual properties of select cosampled variables at the Baleares Station monitoring area.

Additional variables are available online at: http://WGZE.net/time-series.

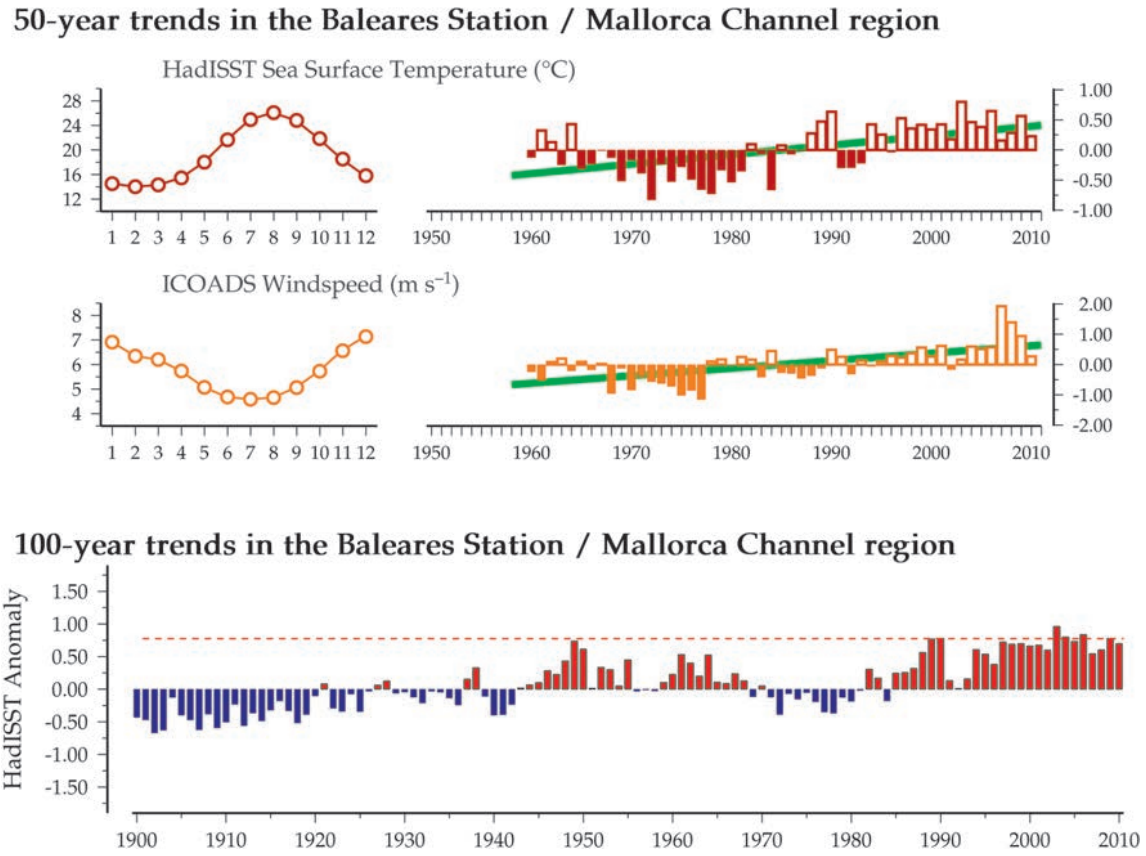

Figure 9.2.3
Regional overview plot (see Section 2.2.3) showing long-term sea surface temperatures and windspeeds in the general region surrounding the Baleares Station monitoring area.