Effects of the 1997-98 El Niño on the
Oceanographic Conditions and
Zooplankton Community Structure in
the Coastal Upwelling System Off
Northern Chile*

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Changes in oceanographic conditions and zooplankton community structure were
investigated during a five year period, which included the 1997-98 El Niño (EN), in the
coastal region off Antofagasta (23ºS), northern Chile. We aimed at examining the
changes in abundance and size composition of zooplankton, as well as the main
oceanographic changes associated with the onset and evolution of the EN.

During January 1997, upwelling events were recorded in the coast (indicated by the rise
of the 13ºC isotherm). The SSW (Subtropical water) and SAAW (Subantarctic water)
occupied a narrow layer near the surface (0-20 and 20-40 m depths, respectively), while
the ESSW (equatorial subsurface water) dominated below 40 m depth and reached the
surface during the upwelling events. During July 1997 and January 1998 a conspicuous
deepening of the isotherms was recorded in the coastal zone, predominating over the
SSW in the upper 150 m of the water column (Table 1, Fig. 1).

Table 1. Average depth (m) of the 13°C and 1 ml O2 l-1 isolines
in coastal waters off Mejillones.

<table>
<thead>
<tr>
<th>Date</th>
<th>Average depth (m) of the 13ºC isoline.</th>
<th>Average depth (m) of the 1 ml O2 l-1 isoline.</th>
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<tr>
<td>11-16 January 1997</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>22-26 January 1997</td>
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<td>40</td>
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<td>01-04 July 1997</td>
<td>230</td>
<td>80</td>
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<td>27-29 January 1998</td>
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<td>125</td>
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<td>17-22 October 2000</td>
<td>16</td>
<td>35</td>
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<td>06-11 February 2001</td>
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<td>42</td>
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<td>01-07 October 2001</td>
<td>51</td>
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<td>El Niño</td>
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During the study period, the integrated (upper 100 m of the water column) zooplankton biomass (mgC m\(^{-2}\), Fig. 2a), showed high values (ranging between 21 and 28 mgC m\(^{-2}\)), with the exception of July 1997, when a remarkable decrease was noted (4 mgC m\(^{-2}\)). We suggest that the onset of the EN event combined with other factors, such as suppression of the nutrient fertilization of the productive layer during the winter period, might be partially responsible for such a reduction in biomass. However, during the most intense stage of EN (January 1998), the zooplankton biomass attained "average" values for the study area.

The size-spectrum distribution of the zooplankton (separated into euphausiids, large calanoid copepods, small calanoid copepods, cyclopoid copepods and appendicularians) showed a distinct shift towards small sized species during the EN event. Euphausiids contributed 73% of the total zooplankton carbon before the EN event (January 1997), decreasing to 27% during the maximum peak of EN (January 1998) and increasing their contribution up to 56% after three years with no EN. In contrast, the small-size groups of the zooplankton (small calanoids and cyclopoid copepods, and appendicularians) increased their contribution to the total zooplankton carbon significantly during EN (Fig. 2b). This, together with a decrease in the concentration of chlorophyll-a and POC, may have a direct impact on the carbon flux through the pelagic food web suggesting that during EN conditions a larger amount of the PP generated was channelled through ingestion by small-size animals than during non-EN conditions.
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