

Hydrography and Zooplankton Off the Central Oregon Coast During the 1997-1998 El Niño Event

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Monitoring of hydrography and zooplankton at stations 2, 5, 9, 18 and 28 km off Newport, Oregon was initiated in May of 1996. The purpose of this effort was to compare present ocean conditions to conditions observed in the 1970s at these same stations. Sampling is conducted at fortnightly intervals. In this paper, we describe conditions that prevailed during the summer of 1997.

Ocean conditions in 1997 in the Oregon upwelling zone began in a "normal" fashion: upwelling was initiated with an early spring transition (late March); this was followed by a boom in zooplankton production during April -- copepod densities were the highest that have ever been observed for that time of the year. Biological production began to slow during the first week of May due to a weakening in upwelling, and surface waters began to warm. Zooplankton numbers declined at the same time, and continued to do so throughout the summer. A brief but strong upwelling event occurred from 12 July through 19 August with little biological response; after that, upwelling ceased altogether (Fig. 1). As a result of weak upwelling in early summer, sea surface temperatures on the shelf warmed from 12° to 17°C (May until mid July), cooled to 10°C during the upwelling event, but warmed in late August to a record temperature of 18.5°C (Fig. 2). This is warmer by 1 degree than any observation made during the 1983 El Niño event. Secchi depths were deep during both the early and late summer warm event, averaging 10 m during June and July and exceeding 15 m during the late-summer warming event (Fig. 3). Usual secchi depths are on the order of 3-5 m during the summer upwelling season.

Given that upwelling was weak during the summer of 1997 and that the copepod species captured in shelf waters were a mixture of shelf species and species with offshore affinities (Table 1), we suggest that the warming in 1997 was due solely to onshore advection of warm offshore waters. The scientific question is: "Were the atmospheric pressure patterns that lead to coastal upwelling off Oregon affected by the redistribution of atmospheric pressure systems along the equator as a result of the El Niño event?" We know that extremely anomalous sea surface temperatures were observed in the Gulf of Alaska and the Bering Sea during the summer of 1997. Was warming in the North Pacific due to anomalous meteorological events that were in turn linked to equatorial events through an atmospheric teleconnection?

Sampling completed on 5 March 1998 showed that zooplankton species with southern affinities dominated the shelf waters. However, sampling on 18 March 98 revealed that the zooplankton was dominated by the usual neritic coastal cool water species (Table 1) suggesting that the El Niño has abated and that an early spring transition may occur this year.

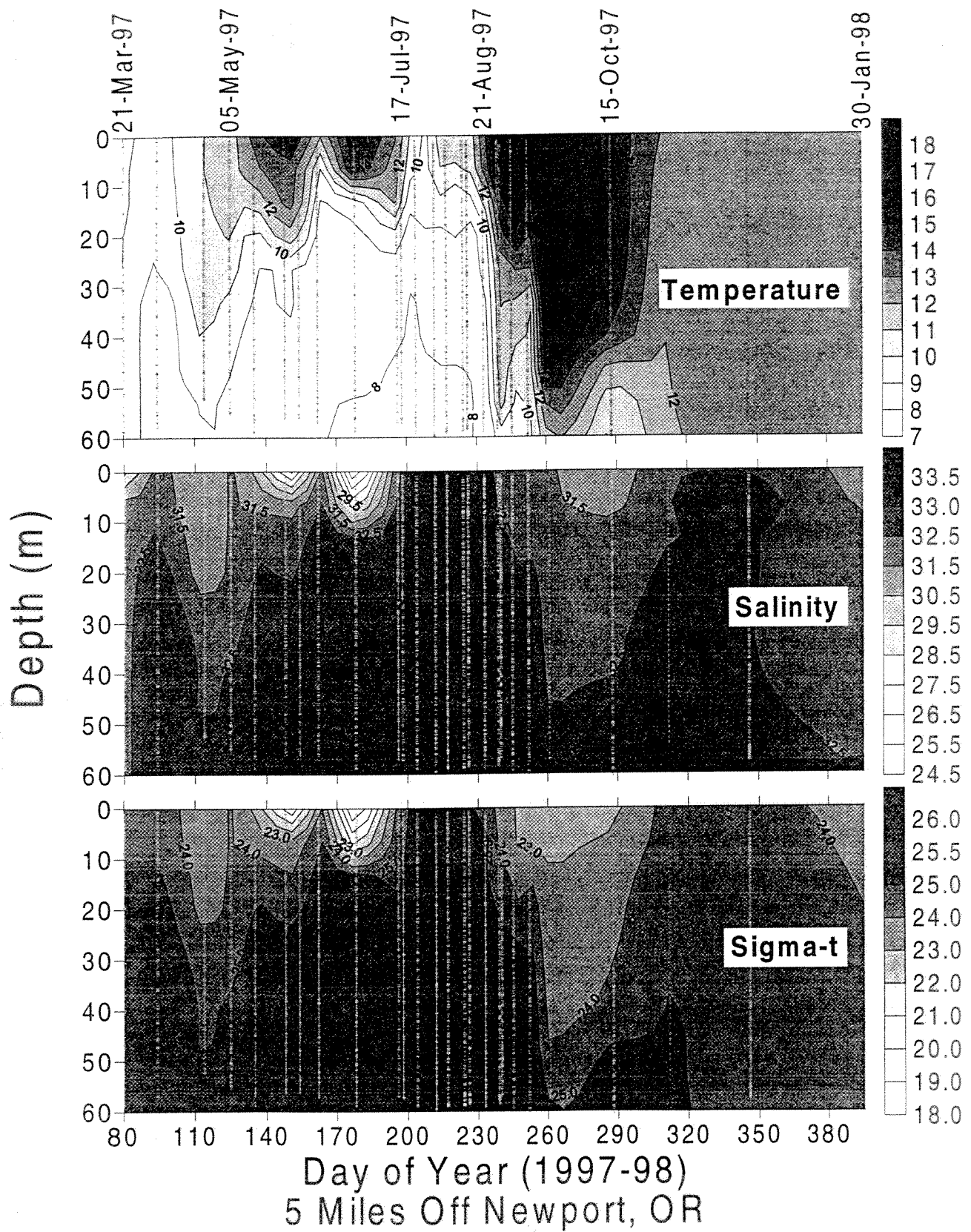


Fig. 1. Time-depth plot of temperature, salinity, and density measured with a Seabird SBE-19 CTD at the five mile station (9 km from shore; water depth 60 m) off Newport Oregon from 21 March 1997 until 30 January 1998. Note that the upwelling season extended for only five weeks during the summer of 1997 (as indicated by the presence of cool salty water in the upper layers of the water column).

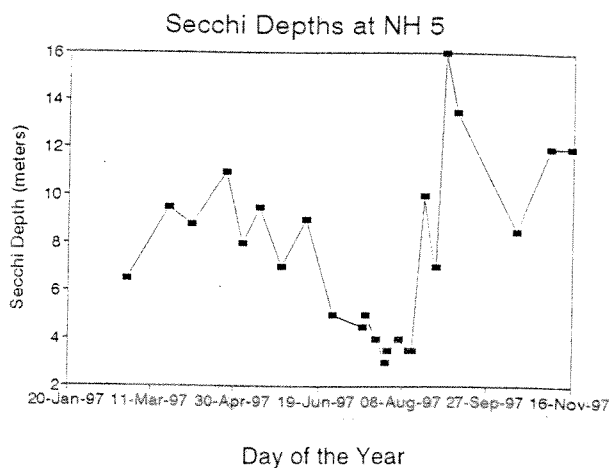
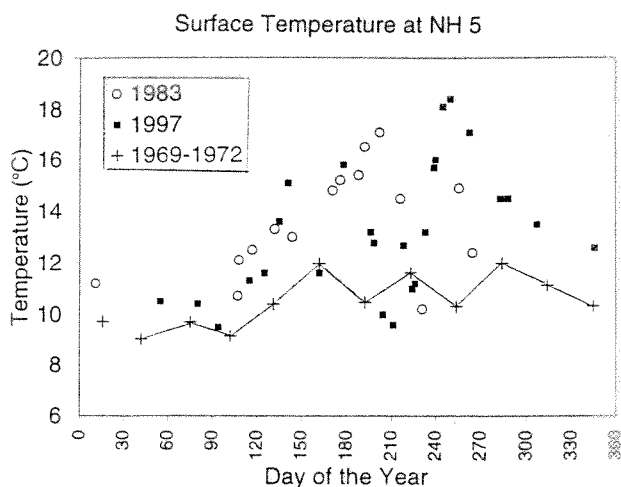


Fig. 2. Surface temperatures at the station NH 5 (9 km shore) during 1997 compared to the El Niño of 1983 and to monthly averaged surface temperatures measured in 1969-1972 at the same stations.

Fig. 3. Secchi depths at NH 5 measured in 1997.

Table 1. Density of zooplankton species collected at a station 9 km off Newport, OR (water depth 60 m) with a 1/2 m diameter, 202 micrometer mesh plankton net hauled vertically from 58 m to the surface, during the summer of 1997. The "warm event" began on 20 August and reached a maximum in late September.

	Date (June through September) in 1997									
	6/27	7/15	7/23	7/30	8/6	8/14	8/21	8/28	9/2	9/9
COOL WATER SPECIES										
<i>Calanus marshallae</i>	17	49	125	31	46	553	559	61	5	0
<i>Pseudocalanus mimus</i>	461	1470	1719	678	207	796	987	173	184	22
<i>Paracalanus parvus</i>	159	219	1218	130	84	103	102	555	495	710
<i>Centropages abdominalis</i>	168	1138	72	157	103	73	17	17	0	0
<i>Acartia longiremis</i>	0	0	54	104	65	225	204	113	25	4
<i>Oithona similis</i>	537	601	1737	574	245	474	493	113	709	372
<i>Metridia pacifica</i>	0	0	0	31	8	24	0	0	0	0
WARM WATER SPECIES										
<i>Calanus pacificus</i>	0	4	0	0	0	0	0	17	36	32
<i>Calanus tenuicornis</i>	0	0	0	10	4	0	0	9	5	2
<i>Eucalanus californicus</i>	0	0	0	0	4	0	0	52	15	0
<i>Ctenocalanus vanus</i>	0	0	0	0	0	0	17	9	15	10
<i>Clausocalanus spp.</i>	0	0	0	0	0	0	34	9	10	8
<i>Acartia danae</i>	0	0	0	0	0	0	0	0	15	6
<i>Corycaeus anglicus</i>	0	0	0	0	0	0	0	26	76	64
<i>Doliioletta gegenbaurii</i>	0	0	0	0	0	0	0	130	71	22
<i>Oikopleura sp.</i>	352	422	734	182	103	182	1684	312	684	26