The status of oceanic zooplankton in the eastern North Pacific in 2003

Sonia D. Batten
Sir Alister Hardy Foundation for Ocean Science
c/o 4737 Vista View Crescent,
Nanaimo, B.C., Canada. V9V 1N8
E-mail: soba@mail.pml.ac.uk

Dr. Sonia D. Batten is a biological oceanographer working in Nanaimo, British Columbia, Canada, for the Sir Alister Hardy Foundation for Ocean Science (a UK-based organisation). She studies large scale plankton dynamics in the North Pacific using data collected by the Continuous Plankton Recorder (CPR), currently focusing on the effects of environmental change on plankton communities. Sonia co-ordinates the Pacific CPR Program and is a member of the PICES CPR Advisory Panel.

Background

The Continuous Plankton Recorder (CPR) has been deployed on a transect from Prince William Sound, Alaska, to California routinely since 2000 (Fig. 1) to collect near surface plankton samples. The normal time taken to process the plankton samples and produce abundance data is about 1 year, because the Pacific samples are combined with the CPR samples collected in the north Atlantic and processed by the team at SAHFOS (Sir Alister Hardy Foundation for Ocean Science) in order of collection. In 2003, we decided to process a subset of the samples rapidly (within a few months of collection), and to publish summary data on the SAHFOS website at regular intervals to provide timely information on the status of the plankton populations. The impetus for this approach was provided by the recent recognition that 1999 saw a switch in plankton populations from a warm-water community to a cold-water community with consequent changes in various fish abundances (Peterson, W.T. and Schwing, F.B. (2003). A new climate regime in northeast Pacific ecosystems. *Geophys. Res. Lett.*, Vol. 30, 1896; Batten, S.D. and Welch, D.W. (2004, in press). Changes in oceanic zooplankton populations in the northeast Pacific associated with the possible climatic regime shift of 1998/1999. *Deep-Sea Res. II*). It is not known yet whether this change will persist for several more years and come to be called a regime shift with similar magnitude to that of 1976/77, or whether it is a short-term perturbation that will change back again after only a few years. The suggestion of a moderate El Niño in the latter part of 2002 also gave a reason to closely monitor the plankton through 2003 (*e.g.* www.noaanews.noaa.gov/stories/s1080.htm.).

Sampling in 2003

Five transects are usually sampled each year, spaced about 5-6 weeks apart to cover the spring and summer productive season. In 2003, sampling was carried out March 17-21, May 25-31, June 28-July 2, August 2-6, and the final one in early September. At the time of writing, subset data from the first 4 of these transects is available.

The subset consisted of about 20% of the samples that would normally be processed, spread evenly along the transect (10-13 samples each transect). Until all the samples from each transect have been processed, it would not be possible to determine how reliable the conclusions based on data from this sub-sample have been. However, the results show a consistent pattern for each month of 2003, suggesting a good representation of the 2003 plankton populations. The remaining samples are processed routinely by SAHFOS and should be available by mid-2004.

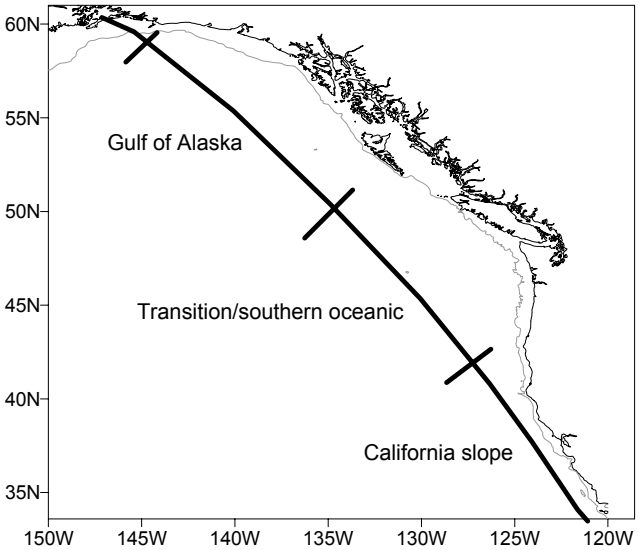

Fig. 1 The normal position of the CPR transect, subdivided into regions based on dominant currents and topography. The 1000 m isobath is also shown.

Data from 2003

The major currents and topography of the northeast Pacific have been used to divide the transect into regions (Fig 1). Data also exist from the Alaska shelf region at the north end of the transect, however, too few of the sub-samples were from this region to provide a meaningful summary. Visitors to the web site (www.sahfos.org and select "Pacific project") can view the plankton taxa recorded in each sample as well as the summaries of mesozooplankton abundance and biomass shown here. Figure 2 shows the time series of seasonal data for each region from 2000 through 2002 (mean and standard error) with the mean data from the sub-sampling in 2003 (usually 3 or 4 samples per region). Estimated biomass is shown in Table 1, where the mean biomass for each 2003 transect is compared to similar time periods from previous years. For all three regions, abundances appear to be generally lower in 2003 than in 2002, however, not outside the values found in 2000-2002.

Gulf of Alaska: Both abundance and biomass are lower than 2002 in the Gulf of Alaska, and similar to 2001. The seasonal cycle is more evident in the biomass values and is similar to previous years, with an increase after the first transect to a peak in early summer and a decline for the last transect.

Table 1 Mean mesozooplankton biomass (mg dry weight per sample) for 2003 transects together with closes (in time) from each previous year for all sampling regions: Gulf of Alaska (I), Transition/southern oceanic (II) and California slope (III).

Date	I	II	III
Mar-03	15.9	25.5	79
Mar-00	22.3	20.6	22.8
Apr-01	30.5	67.5	32.2
Apr-02	48.3	113.7	21.4
May-03	40.0	321.2	15.4
Apr/May-00	24	45	6
May-01	82	125	37
May/Jun-02	141	71	28
Jun/Jul-03	42.0	63.5	99.3
Jun-00	50	58	26
Jun/Jul-01	84	76	81
Jun-02	68	23	24
Aug-03	13.3	10.08	9.8
Jul/Aug-97	43.3	36.8	53.1
Aug-00	22	18	26
Aug-01	81	4	8
Aug-02	19	14	51

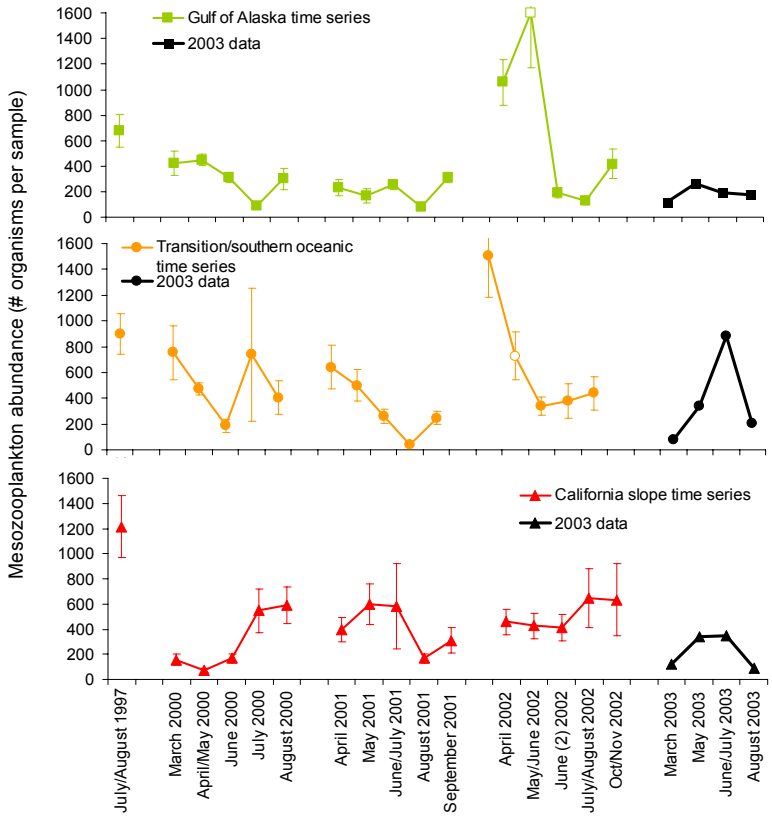

Fig. 2 Mean mesozooplankton abundance (± s.e.) for each CPR transect sampled. Unfilled points in May/June 2002 indicate when the transect was much further east than normal.

Transition/S. oceanic: The transition region has a high abundance peak in June/July 2003, that is the result of a single sample with exceptionally high abundance/biomass (the highest ever recorded in all years). Previous years show this region to be quite variable, even so, the normal seasonal cycle has been a decline from spring through summer with an increase again in late summer. This pattern is not evident so far in 2003.

California slope: The California slope region has shown an increase in abundance in mid-summer in previous years, as small copepods become numerous later in the season. This does not seem to have occurred yet in 2003. However, in 2001 there was a spring increase and a second, small increase quite late (in September). 2003 seems to be following this pattern so far and it may be that the final transect of 2003 will show a similar increase.

A pilot transect was sampled in July/August 1997, before the recent noted change in the ocean ecosystem, and previous studies have shown that the plankton composition of this transect was quite different from the plankton found in 2000 through 2002 at the same point of the season (Batten and Welch, in press). The plankton was dominated by large numbers of small species (as sampled by the CPR, principally small copepods). As shown in the extreme left of Figure 2 and the last block of Table 1, this caused a very high abundance value but biomass estimates were not very different from subsequent years. Although 2003 looks somewhat different from 2002, there is no evidence that the plankton is more similar to the pre-1999 regime and the oceanic communities are still dominated by larger sub-arctic species.

The final transect from 2003 will be posted on the website as soon as the data are available, and this approach will be continued through the 2004 sampling. Comments on the type of data or information that would be useful are welcome (soba@mail.pml.ac.uk).