State of the Northeast Pacific into Early 2009

by William Crawford and James Irvine

The average temperature of near-surface waters in 2008 along Line P near the Pacific coast of Canada was the coldest in more than 50 years of observations, and the cooling extended through all seasons of 2008. The position of Line P is noted in Figure 1, and temperature anomalies are plotted in Figure 2. This cooling came only three years after the warmest measured temperatures along Line P. This cooling is associated with weather patterns typical of La Niña and of the local cold phase of the Pacific Decadal Oscillation (PDO). By May 2009, when La Niña had abated along the equator, the negative temperature anomalies of the Northeast Pacific Ocean were confined to a relatively narrow strip of coastal waters off western Canada and the lower 48 States.

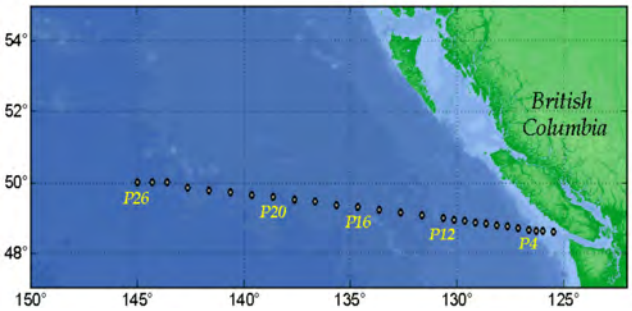

Fig. 1 Position of Line P sampling stations, where water properties have been sampled regularly for over 50 years by Canadian scientists.

Surface phytoplankton and zooplankton concentrations were the highest in a decade of observations across the Gulf of Alaska, in August and September 2008 (Fig. 3). The cause is as yet uncertain, but injection of iron by winds or currents is suspected (iron is a limiting nutrient in this region), along with higher levels of nitrate and silicate in spring. Ship-based sampling for phytoplankton in Juan de Fuca Strait revealed high near-surface concentrations in early September. Deep-sea and coastal zooplankton populations continued their recent shift to cold-water species and delayed spring blooms.

In the Gulf of Alaska, the ocean mixed-layer depth was relatively deep in early 2008, and surface oxygen concentrations were relatively high in early 2009. However, oxygen concentrations have generally declined in deep waters along the continental slope over the past several decades. A sudden decline in bottom-water oxygen concentrations in 2008 on the continental shelf of western Canada was likely due to denser water with naturally low oxygen levels moving up onto the shelf in this year, rather than due to anomalous winds and currents. This oxygen drop may have been a factor in the movement of some groundfish species to shallower depths in 2008 in this region.

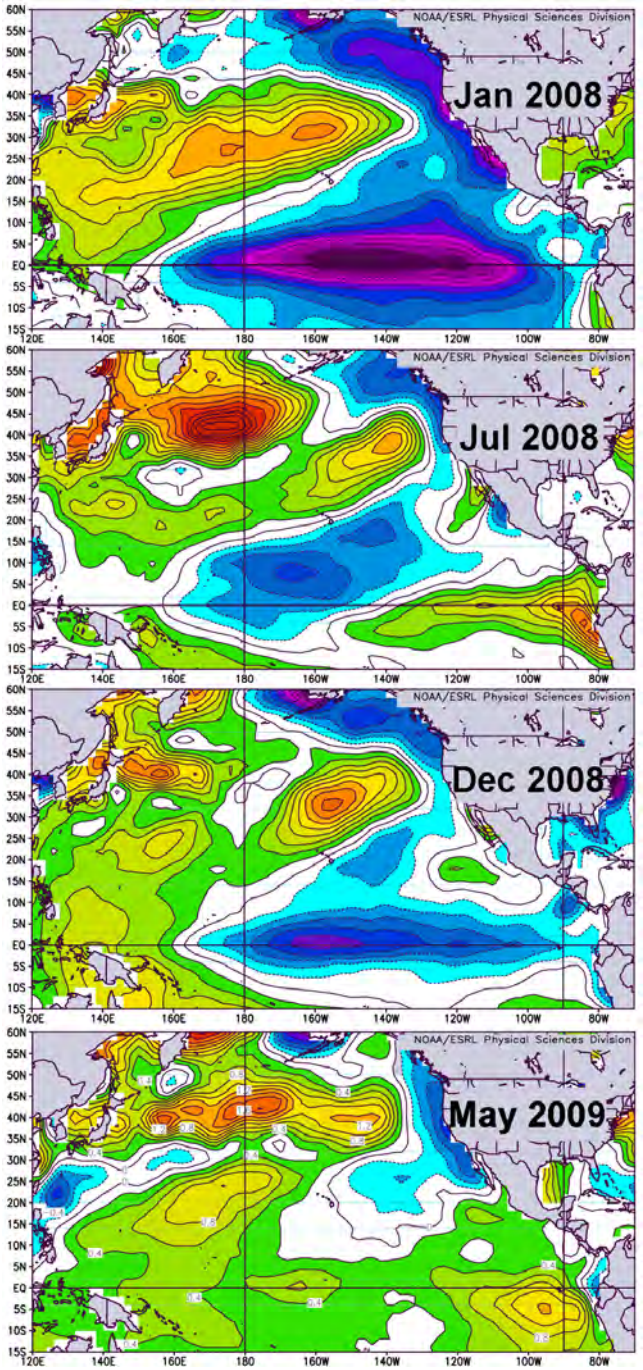

Fig. 2 Monthly ocean temperature anomalies in °C. White regions denote zero anomalies and contours are at 0.2°C intervals. Reference years are 1968 to 1998. Source: NOAA Environmental Studies Research Laboratory, Physical Sciences Division.

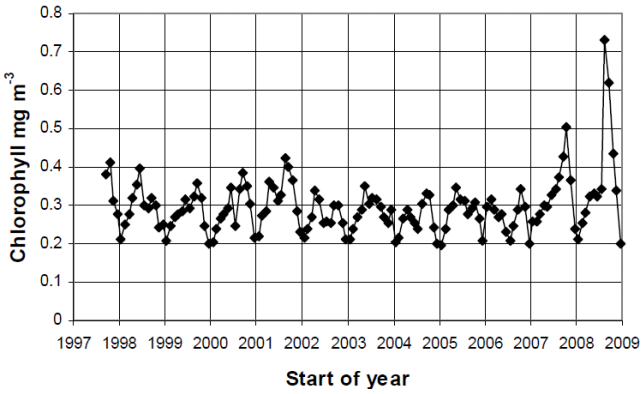

Fig. 3 Time series of monthly chlorophyll anomalies for the area 44° to 55°N, 134° to 155°W in the Gulf of Alaska for all months since the launch of SeaWiFS. Data for 2008 are from MODIS on Aqua and are available at http://oceancolor.gsfc.nasa.gov/. Figure courtesy of J. Gower (Institute of Ocean Sciences, Fisheries and Oceans Canada).

Cool marine conditions generally improve marine survival for salmon. However, despite relatively cool ocean conditions in 2007 and 2008, many western Canada populations remain depressed due to low numbers of brood-year spawners, partially attributed to warm oceans in 2003 to 2005. Canadian sockeye returns remain generally low coast-wide, with one notable exception being Okanagan sockeye that returned in record numbers in 2008. High pre-spawn mortality was observed for many Fraser River watershed sockeye populations in 2008, and river entry of returning adults was generally early. Coho populations in southern British Columbia remain extremely depressed, while northern coho populations have improved. For chinook, the situation is somewhat reversed – northern populations continue to decline while the status of southern chinook is highly variable, and large numbers of adults returned to southern Canadian waters in 2009.

Herring biomass has declined recently for all five major British Columbia stocks. In the Georgia Basin of western Canada, where herring biomass was at record high levels earlier this century, the biomass declined almost to the fishery-closure limit in 2008. Three other Canadian herring stocks were at or below the fishing limit. Eulachon populations remain depressed. Although there was no wide-scale hake survey in 2008, their numbers on the British Columbia continental shelf, particularly on the traditional fishing grounds around La Pérouse bank, appear to have been very low, continuing a trend that began developing around 2003–2004. Smooth pink shrimp and English sole along the west coast of Vancouver Island increased in numbers in 2008.

For many of our fish species, including salmon, Pacific Ocean conditions have been improving since the extremely poor year of 2005. Cool water generated bottom-up changes to the food web that have contributed to improving marine survival for many juvenile fish. Linkages between ocean conditions and fish survival are not completely understood and additional exploration of existing data is warranted.

Much of this information is extracted from a recently published 129-page report on conditions of Canadian West Coast waters in 2008 and early 2009, with links to Alaskan ocean summaries: Crawford, W.R. and J.R. Irvine. (2009). State of physical, biological, and selected fishery resources of Pacific Canadian marine ecosystems. DFO Canadian Science Advisory Secretariat Research Document 2009/022. vi + 121 p. (www.dfo-mpo.gc.ca/CSAS/Csas/Publications/ResDocs-DocRech/2009/2009_022_e.htm).

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