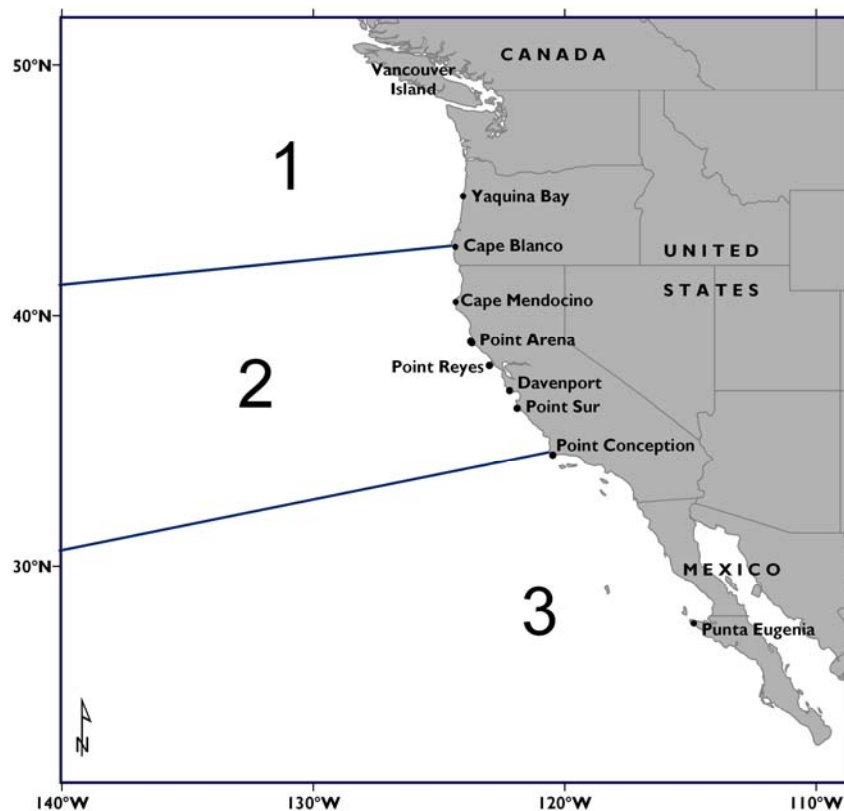


Climatic and Ecological Conditions in the California Current LME for January to March 2009

Summary of climate and ecosystem conditions for Quarter 1, 2009 (January 1 – March 31) for public distribution, compiled by PaCOOS coordinator Rosa Runcie (email: Rosa.Runcie@noaa.gov). Full content can be found by the links below.

CLIMATE CONDITIONS

- **El Niño Southern Oscillation (ENSO):** Atmospheric and oceanic conditions in the Northeast Pacific reflect La Niña condition. Based on recent trends in the observations and model forecasts, La Niña conditions are expected to gradually weaken during the spring 2009 in the Northern Hemisphere.
- **Pacific Decadal Oscillation (PDO):** The PDO remained in a negative phase. The January 2009 PDO index was the 17th consecutive monthly negative value. This is the longest continuous run since the 1998-2000 period when 20 consecutive months of negative PDO values were recorded.
- **Upwelling Index (UI):** In January, UI values were negative north of 48°N and weakly positive to the south. In February, UI values were weakly negative at Point Arena, CA (39°N) and north to the Gulf of Alaska (60°N). Off Baja California (24°-27°N), UI values and anomalies were moderately high.
- **Madden Julian Oscillation (MJO):** The MJO showed signs of strengthening in January. Mid-January, eastward propagation occurred and the MJO index increased considerably in amplitude. During the first week in February, the MJO index amplitude decreased with weak propagation. Early March, the MJO remained weak.
- **Temperature and Salinity at Newport Hydrographic Line, Oregon:** Bottom temperatures during the fall and winter, November through March, of 2008-2009 were the second coldest of the recent 12 year time series.



CCLME (~Vancouver Island to Punta Eugenia) and the three Eco-Regions as defined by U.S. GLOBEC (1992)

The summaries provided and the appearance of external links do not constitute an endorsement by the Department of Commerce/National Oceanic Atmospheric Administration of the information, products or services.

ECOSYSTEMS

- **California Current Ecosystem Indicators:**

1. **Copepods:**

November and February had higher than average copepod species richness, whereas the December, January and March were lower than average. The biomass of one cold water zooplankton species, *Pseudocalanus* spp, was relatively high in all samples, and abundances of *Neocalanus* species were only 10-20% of abundances observed during the prior two winters.

2. **Krill**

3. **Juvenile Rockfish**

4. **Coastal Pelagics:** (Market Squid, Pacific Sardine and Northern Anchovy)

Total California commercial fishery landings of coastal pelagic species were 102,788 metric tons (mt) in 2008. These included 57,736 mt of sardines, 14,038 mt of anchovies, 3,369 mt of Pacific mackerel, 264 mt of jack mackerel and 27,369 mt of market squid.

Sardine catches off the west coast of British Columbia were lower in 2008 compared to 2007, and may be attributed to lower sea surface temperature in 2008.

Jumbo Squid: Since 2003, jumbo squid have been regularly caught in the California Current and appear to move north along southern and central California during late spring and early summer, and to waters off Oregon, Washington and British Columbia during the late summer and early fall.

Sardine: Fall 2008, nearly all sardines had left the west coast of British Columbia.

5. **Salmon:**

Winter steelhead trout returns to northern California and Oregon Rivers were weaker than average in January and February 2009.

A survey of California coast monitoring projects indicate a more severe decline in adult Coho salmon returns this year than occurred last year.

Pacific Council News: The PFMC adopted three public review options for the 2009 salmon season off the West Coast of the United States. Commercial and recreational salmon fishing from Cape Falcon, Oregon to Humbug Mountain, Oregon and commercial salmon fishing from Humbug Mountain, Oregon to the Oregon/California boarder remain closed pending the setting of 2009 fishing regulations.

The PFMC closed commercial and most recreational salmon fisheries off the cost of California in response to the collapse of Sacramento River fall Chinook. The recommendation will be forwarded to the NMFS for approval by May 1, 2009.

6. **Groundfish**

7. **Pacific Hake**

8. **Midwater species**

9. **Sablefish**

10. **Cassin's Auklet**

- **Highly Migratory Species (tuna, sharks, billfishes)**

- **Invasive Species:** Non-native *Spartina* has become established along the West coast from British Columbia down to California. NERRS report is forthcoming.

- **Marine Mammals:** The NOAA fisheries marine mammal program participated on CalCOFI winter cruise 0901NH, using visual observers and acoustic methods to enumerate the abundance of mammals on stations and along the cruise tracks.

- **Harmful Algal Blooms:** Summaries are provided for two toxin-producing phytoplankton species *Pseudo-nitzschia* and *Alexandrium* activity. Reports from Oregon, Washington and California show no unusual events in the first quarter of 2009.

- **Dissolved Oxygen:**

Dissolved oxygen concentrations off Newport, Oregon are normal for the first quarter of 2009.

- **Quarterly Publications and Websites related to the California Current (see Appendix for cumulative list for 2008)**

Gomez-Valdes, J. and G. Jeronimo. 2009. Upper mixed layer temperature and salinity variability in the tropical boundary of the California Current, 1997-2007. *Journal of Geophysical Research-Oceans* 114: article number C03012.

Lindley, S. T., C. B. Grimes, M. S. Mohr, W. Peterson, J. Stein, J. T. Anderson, L. W. Botsford, D. L. Bottom, C. A. Busack, T. K. Collier, J. Ferguson, J. C. Garza, A. M. Grover, D. G. Hankin, R. G. Kope, P. W. Lawson, A. Low, R. B. MacFarlane, K. Moore, M. Palmer-Zwahlen, F. B. Schwing, J. Smith, C. Tracy, R. Webb, B. K. Wells, T. H. Williams. 2009. What caused the Sacramento River fall Chinook stock collapse? Pre-publication report to the Pacific Fishery Management Council. http://swfsc.noaa.gov/uploadedFiles/Operating_units/FED/Salmon_decline_report_March_2009.pdf

Coastwatch browser: <http://coastwatch.pfeg.noaa.gov/coastwatch/CWBrowser.jsp>

Oceanwatch: <http://oceanwatch.pfeg.noaa.gov>

PaCOOS Browser: <http://las.pfeg.noaa.gov/PaCOOS>

CLIMATE CONDITIONS

El Niño Southern Oscillation (ENSO):

Source: Bill Peterson, NOAA

Source: <http://www.cdc.noaa.gov/people/klaus.wolter/MEI/mei.html>

The MEI Index continues to be negative and has now been negative for 20 of 22 months since June 2007 (Figure 1).

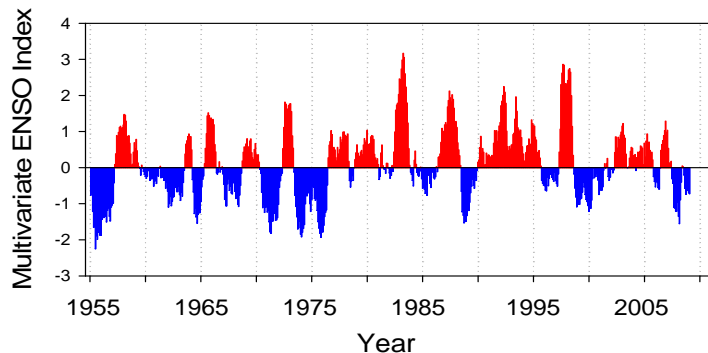


Figure 1. The Physical Sciences Division/NOAA attempts to monitor ENSO by basing the Multivariate ENSO Index (MEI) on the six main observed variables over the Pacific. These six variables are: sea-level pressure, zonal and meridional components of the surface wind, sea surface temperature, surface air temperature, and total cloudiness fraction of the sky.

Central & Eastern Equatorial Pacific Upper-Ocean (0-300 m) Heat Content Anomalies:

Source: *The Coast Watch* <http://coastwatch.pfel.noaa.gov/elnino.html> (Advisory 2008)

http://www.epc.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.doc (March 2009 report)

During December 2008, negative equatorial sea surface temperature (SST) anomalies strengthened across the central and east-central Pacific Ocean. Average temperatures in the upper 300m of the ocean also became increasingly negative as below-average temperatures at the thermocline strengthened in the central and eastern Pacific (Figure 2). During January, negative subsurface oceanic heat content anomalies persisted east of the International Date Line, but weakened as positive subsurface temperature anomalies from the western Pacific expanded eastward into the central Pacific. In February, negative subsurface oceanic heat content anomalies and temperature anomalies at thermocline depth weakened across the eastern half of the Pacific. Equatorial sea surface temperatures (SST) across the central and east-central Pacific Ocean remained below-average. Collectively, weaker negative oceanic and atmospheric anomalies reflect a weakening La Niña. Model forecasts for 5°N - 5°S, 170°W - 120°W show that La Niña may dissipate between May - July 2009. The exact timing of the transition to ENSO-neutral conditions is uncertain.

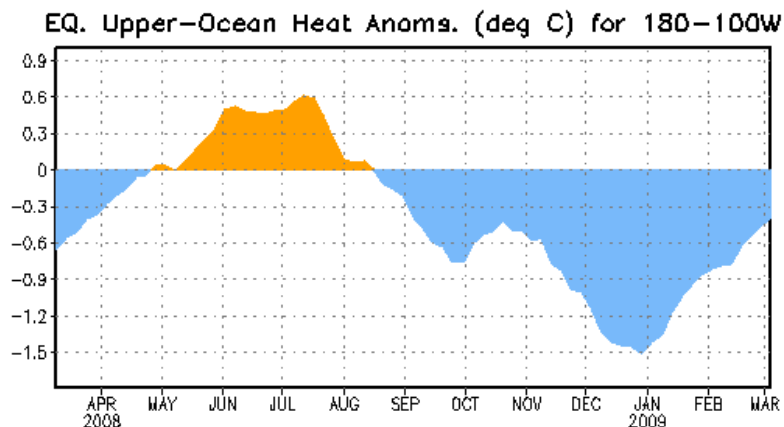


Figure 2. The upper ocean heat content was below-average across the eastern half of the equatorial Pacific Ocean between January and April 2008 and again since mid-August 2008. The negative heat content anomalies have weakened since late December 2008. Area-averaged upper-ocean heat content anomalies (°C) in the equatorial Pacific (5°N-5°S, 180°-100°W). Heat content anomalies are computed as departures from the 1982-2004 base period pentad means.

Pacific Decadal Oscillation (PDO):

Source: Jerrold Norton, NOAA (Jerrold.G.Norton@noaa.gov)

Environmental Research Division (ERD), NOAA, NMFS

http://www.pfeg.noaa.gov/products/PFEL/modeled/indices/upwelling/NA/data_download.html

<http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi> NMFS/SWFSC/ERD monthly coastal upwelling index

The Pacific Decadal Oscillation (PDO) remained in a negative phase and the February 2009 PDO index was the 18th consecutive negative value (Figure 3). This is the longest continuous run since the 1998-2000 period when 20 consecutive negative PDO values were recorded. However, the magnitude of the negative PDO values decreased after a high of -1.76 value in October 2008. During the period from February 2008 through January 2009 the equatorial Pacific Ocean has been generally cooler than average (ENSO negative or La Niña) east of 155°W

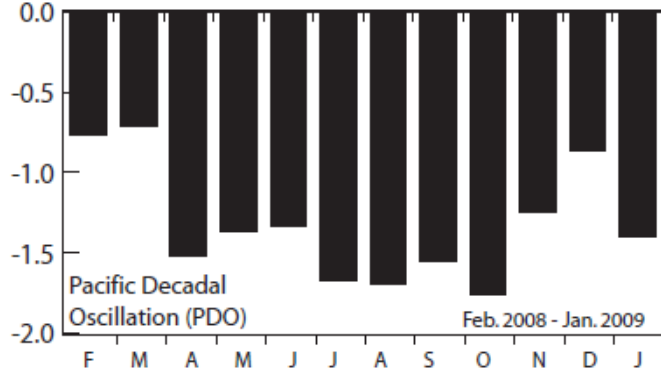


Figure 3. The graph shows the negative PDO values from February 2008 through January 2009. The PDO value for February 2009 has the same sign and similar magnitude (-1.55) as January 2009 (<http://jisao.washington.edu/pdo/>, <http://jisao.washington.edu/pdo/PDO.latest>).

The PDO and Sea Surface Temperature at Newport, Oregon:

Source: Bill Peterson, NOAA

<http://jisao.washington.edu/pdo/>, <http://jisao.washington.edu/pdo/PDO.latest>

Sea surface temperatures at NOAA Buoy 46050, located 22 miles off of Newport, continued to be anomalously cool throughout the fall and winter 2008/2009, with values around -1°C cooler than climatology.

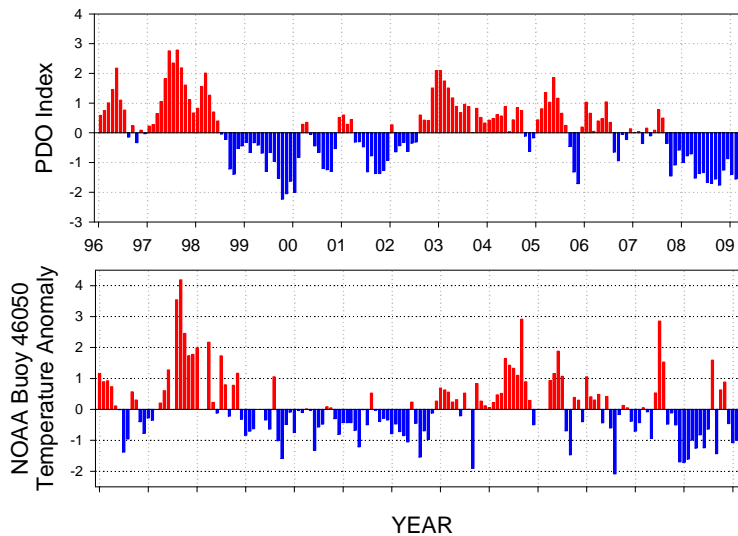


Figure 4. Time series of PDO (upper) and the monthly temperature anomalies at the NOAA Buoy 46050 (lower) since 1996.

Upwelling Index:

Source: *El Niño Watch, Advisory* <http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi>

January Upwelling Index (UI) values were negative north of 48°N and weakly positive to the south. North Pacific high atmospheric pressure system (NPH) circulation led to significant ocean forcing from 24°N to 42°N during the first five and the last 12 days of January (Figure 5). The NPH and coastal upwelling weakened.

February UI values, were weakly negative at 39°N and north to the Gulf of Alaska (60°N). Between 42° and 60°N positive UI anomalies persisted from December 2008 through February 2009 (Figure 5). Off Baja California (24°-27°N), UI values and anomalies were moderately high ([_NMFS/SWFSC/ERD monthly coastal upwelling index](#)).

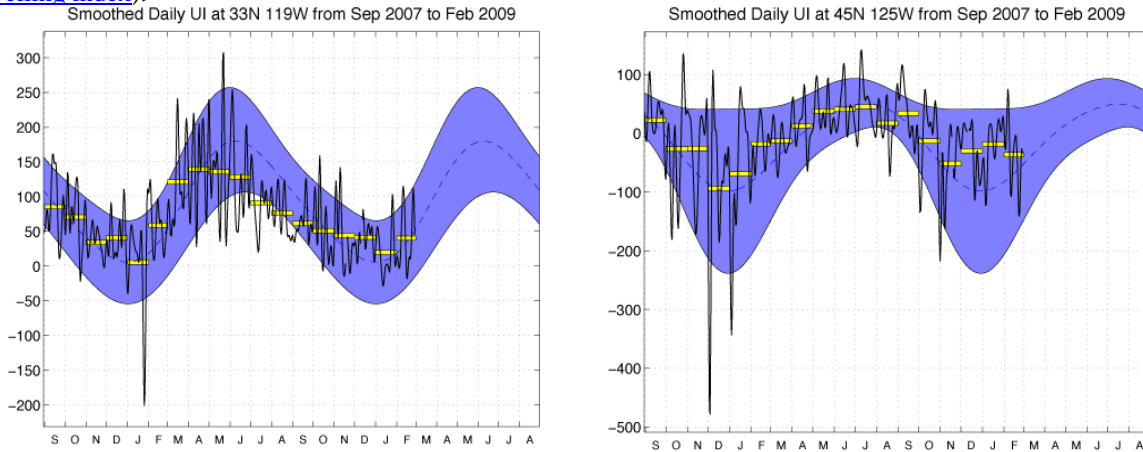


Figure 5. Left panel is recent 18 month record of upwelling for 33°N. Right panel is same for 45°N. Positive values are upwelling; negative values are downwelling.

Regional Oceanic Conditions:

Source: *El Niño Watch, Advisory* <http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi>

Monthly mean NOAA AVHRR sea surface temperature (SST) fields showed that in the ocean area east of 135°W and between 30°N and 50°N SST anomalies were negative or near seasonal averages. A coastal area of negative SST anomaly, that intensified during February, was 100 to 300 kilometers (km) wide and extended from the California boarder (42°N) poleward beyond Vancouver Island (50°N). Small areas of positive SST anomaly grouped around 127°W, 37°N persisted in the January and February fields (Figure 6).

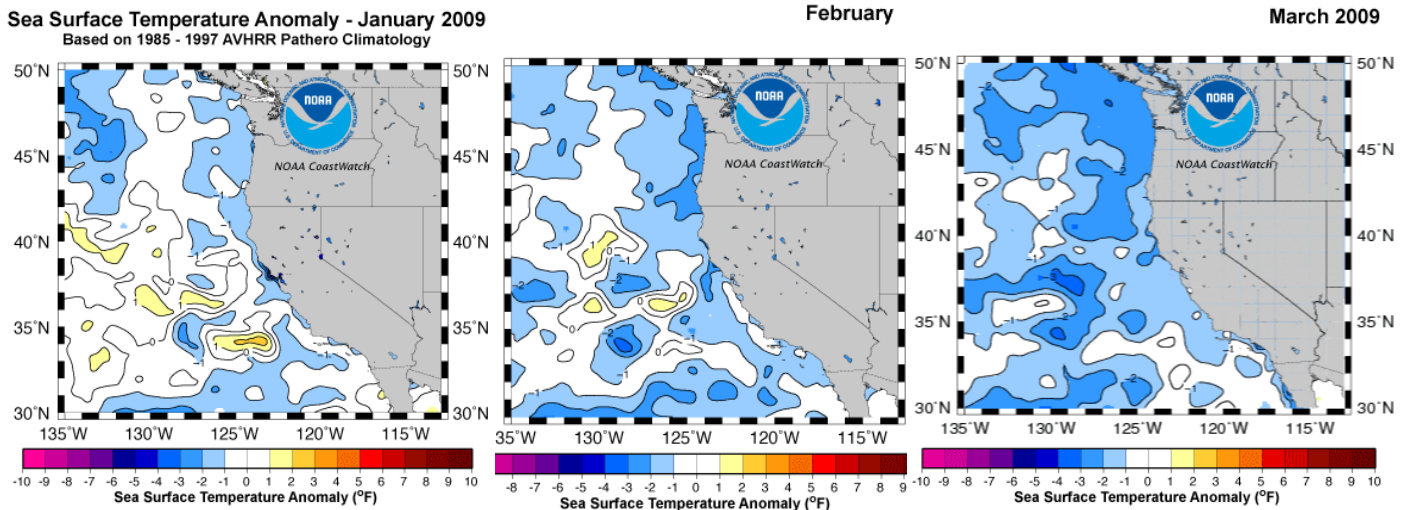


Figure 6. Regional oceanic conditions along the California current.

Madden Julian Oscillation (MJO):

Source: <http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml> (Expert Discussions)
<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/ARCHIVE/> (summaries)

January through early March:

The MJO showed signs of strengthening in the first Quarter of 2009. 200-hPa westerly zonal wind anomalies strengthened in mid-November near the Date Line and persisted through December. These anomalies are consistent with La Niña conditions. Mid-January, eastward propagation of 200-hPa zonal wind anomalies occurred and the MJO index increased considerably in amplitude. Late January, the MJO index indicated a continuing signal with eastward propagation. During the first week in February, the MJO index amplitude decreased with weak eastward propagation. 850-hPa easterly wind anomalies persisted across the equatorial western and central Pacific. Mid-February, the 200-hPa velocity potential anomalies decreased and became nearly stationary. Late-February, the MJO index briefly increased in amplitude but the MJO remained weak. Early March, the MJO amplitude decreased.

Deep Water Temperature and Salinity at Newport Hydrographic Line, Oregon:

Source: *Bill Peterson, NOAA*

Bottom temperatures during the fall and winter (November through March) of 2008-2009 were the second coldest of the recent 12 year time series, averaging 9.61°C; salinities were relatively fresh, averaging 32.72 (Figure 7). Last winter (2007-2008) was the coldest of the time series at 8.85°C and among the saltiest (33.00).

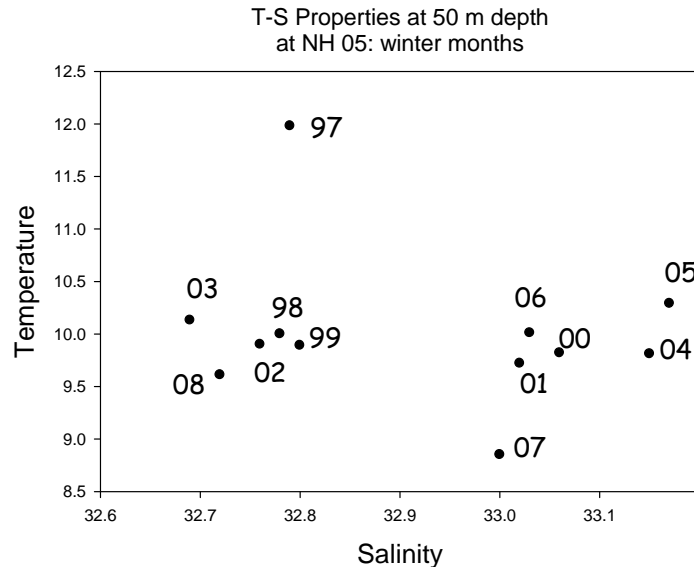


Figure 7. Temperature vs. salinity measured at depth of 50 m at station NH 05 (water depth 62 m), averaged for the months of November through March. Averages for each winter are identified, e.g., 97 indicates the winter of 1997-1998.

ECOSYSTEMS

California Current Ecosystem Indicators:

Copepods:

Source: Bill Peterson, NOAA

The 2008-2009 winter-time zooplankton assemblage is usually a “warm water community” made up of a mixture of both subtropical neritic species carried north with the Davidson Current, and subtropical oceanic species transported onshore with the winter-time downwelling winds. Thus, the community composition is a function of both the strength of the Davidson Current and frequency and intensity of southwesterly storms.

There was nothing exceptional about copepod species richness during the winter of 2008-2009. November and February had higher than average species richness, whereas the December, January and March were lower than average (Figure 8). The sample taken on 24 March 2009 had only 5 species in it, all of which were northern species, suggesting that the Davidson Current has disappeared and flows from the north have already begun. If this condition holds, then we will conclude that the spring transition began in mid-March, much earlier than usual, suggesting that the year 2009 will be characterized by an early transition to cold, productive conditions.

Two notable observations of the zooplankton species composition during this winter is that the biomass of one cold water species, *Pseudocalanus* spp, was relatively high in all samples, and abundance of *Neocalanus* species were only 10-12% of abundances observed during the prior two winters.

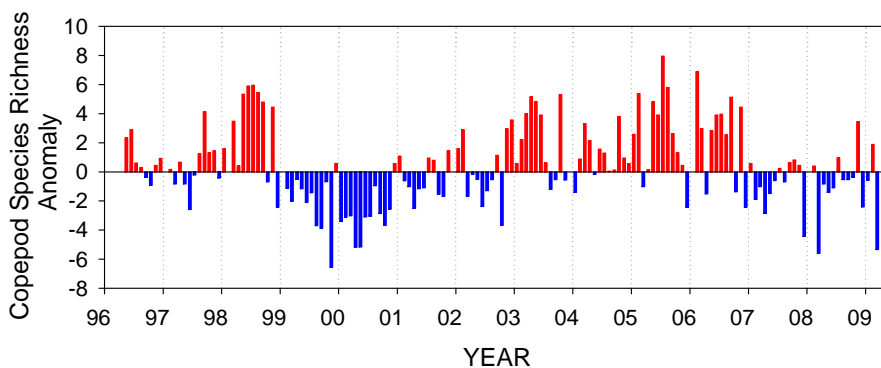


Figure 8. Time series of the copepod species richness, taken from Newport Hydrographic (NH) line, Oregon.

Coastal Pelagics:

Source: El Niño Watch, Advisory <http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi>

Total California commercial fishery landings of coastal pelagic species were 102,788 metric tons (mt) in 2008. These included 57,736 mt of sardines, 14,038 mt of anchovies, 3,369 mt of Pacific mackerel, 264 mt of jack mackerel and 27,369 mt of market squid. The market squid total was the lowest number since 1998 when, under El Niño influence, only 2,880 mt were landed. Market squid landings for January and February 2009 were 21% and 56% lower, respectively, than landings in 2008. Dungeness crab landings have continued at rates much lower than in the preceding two years, but the populations appear healthy.

Jumbo Squid:

Source: John C. Field (John.Field@noaa.gov) NOAA Fisheries, Southwest Fisheries Science Center, Santa Cruz, CA

Jumbo squid in the California Current for 2008:

Prior to the 1997/98 El Niño jumbo squid (*Dosidicus gigas*) were an infrequent visitor to the U.S. waters of the California Current System (CCS). Since 2003, these animals have been regularly encountered in large numbers throughout the CCS in both the U.S. and Canada, and as far north as Southeast Alaska. Although mature adults from both sexes have been encountered throughout this period, egg surveys have provided no evidence that squid are spawning in the U.S. waters of the CCS. Based on a qualitative interpretation of

trends in catch rates from various fisheries and surveys throughout the California Current ecosystem, jumbo squid appear to move north along southern and central California during late spring and early summer, showing up in surveys and commercial fisheries off of Oregon, Washington and British Columbia during the late summer and early fall. Jumbo squid are frequently encountered as bycatch in the Pacific hake fishery. They are observed off of California during late fall and early winter, presently as they travel to Baja California to spawn. However, precise confirmation of these movement patterns is lacking, and the distribution and timing vary from year to year, and region to region.

Patterns in 2008 were consistent with previous years, with observations of squid in offshore waters of California in May and June on the NOAA fisheries juvenile rockfish survey. A NOAA fisheries Protected Resources survey for marine mammals failed to encounter squid off of the Oregon and Washington coasts in July and August 2008. Large numbers were observed off of southern Oregon in the September 2008 survey, as well as in Pacific hake fisheries and trawl surveys in the Pacific Northwest from late September through October, off of the West Coast of Vancouver Island. Additionally, there were several widely publicized strandings in Washington State and a brief recreational fishery in Grays Harbor, Washington in October of 2008. Squid were also observed from the Delta submersible in coastal waters in central and northern California during this period, including large numbers in Monterey Bay during groundfish surveys. As in previous years significant recreational catches of squid took place off of Central California from October through December of 2008. An abrupt cessation of catches occurred in Central California, with only a handful of squid caught despite considerable effort by recreational anglers in January of 2009. Recreational anglers in Southern California caught large numbers of squid through January and February of 2009.

Although comparable range expansions have taken place in the past, notably in California during the mid 1930s, both the spatial and temporal extent of the ongoing range expansion appears to be unprecedented in the historical record. There is growing interest, and some concern among stakeholders and researchers, about the potential impacts, both positive and negative, of the ongoing range expansion, on commercially and ecologically important species. There is evidence that the simultaneous poleward range expansion in the southern hemisphere (off of the Chilean coastline) is having negative impacts on Chilean hake and other fisheries. The role of an apparent expansion of the oxygen minimum zone (OMZ) throughout the CCS and elsewhere in the Northeast Pacific may represent a potential mechanism of the ongoing range expansion (Bograd et al. 2008). The Proceedings of the 2007 CalCOFI Symposium on jumbo squid invasions provides a summary of additional information regarding the ongoing range expansion, ecology and trophic interactions of jumbo squid in both the California Current and the Southern Hemisphere (online at www.calcofi.org).

Sardine:

Sardine Catches off the West Coast of British Columbia for 2008

Source: Marc Trudel, Pacific Biological Station, Fisheries and Oceans Canada, Nanaimo, BC

The Canadian Program on High Seas Salmon has been conducting integrated epipelagic ecosystem surveys from the west coast of British Columbia to Southeast Alaska since 1998 to assess the effects of ocean conditions and climate change on the distribution, migration, growth and survival of Pacific salmon, and to forecast salmon returns to British Columbia. These surveys are usually conducted in late spring-early summer (June-July) and in the fall (October-November). In addition, these surveys have been conducted during winter (February-March) since 2001 to assess the effects of winter conditions on the ecology, bioenergetics, and survival of juvenile salmon.

In 2008, epipelagic ecosystem surveys were conducted using the *FV Viking Storm* in February-March 2008 and June-July 2008, and using the *CCGS W.E. Ricker* in October-November 2008. These surveys conducted scientific operations off the west coast of Vancouver Island, in Queen Charlotte Sound, in Hecate Strait, in Dixon Entrance, and on the shelf region off the coast of Southeast Alaska. Scientific operations were also conducted in inside waters of the west coast of Vancouver Island, Strait of Georgia, British Columbia, and Southeast Alaska. A total of 412 fishing stations, 405 oceanographic stations, and 405 zooplankton stations were completed in 2008.

Overall, sardine catches were lower off British Columbia in 2008 compared to 2007 (Figure 9), and may be attributed to lower sea surface temperature in 2008. No sardines were caught in February-March 2008, whereas a few sardines were caught off the west coast of Vancouver Island in 2005, 2006, and 2007 at this time of the year. Catch-per-unit effort was also lower in June-July 2008. In addition, sardines were primarily distributed south of Brooks Peninsula during that summer (51°05' N). By fall, nearly all the sardines had left the west coast of British Columbia in 2008. In contrast, they were still abundant off the west coast of Vancouver Island in previous years, as well as in the central coast of British Columbia in 2005, presumably due to unusually warm waters during that year.

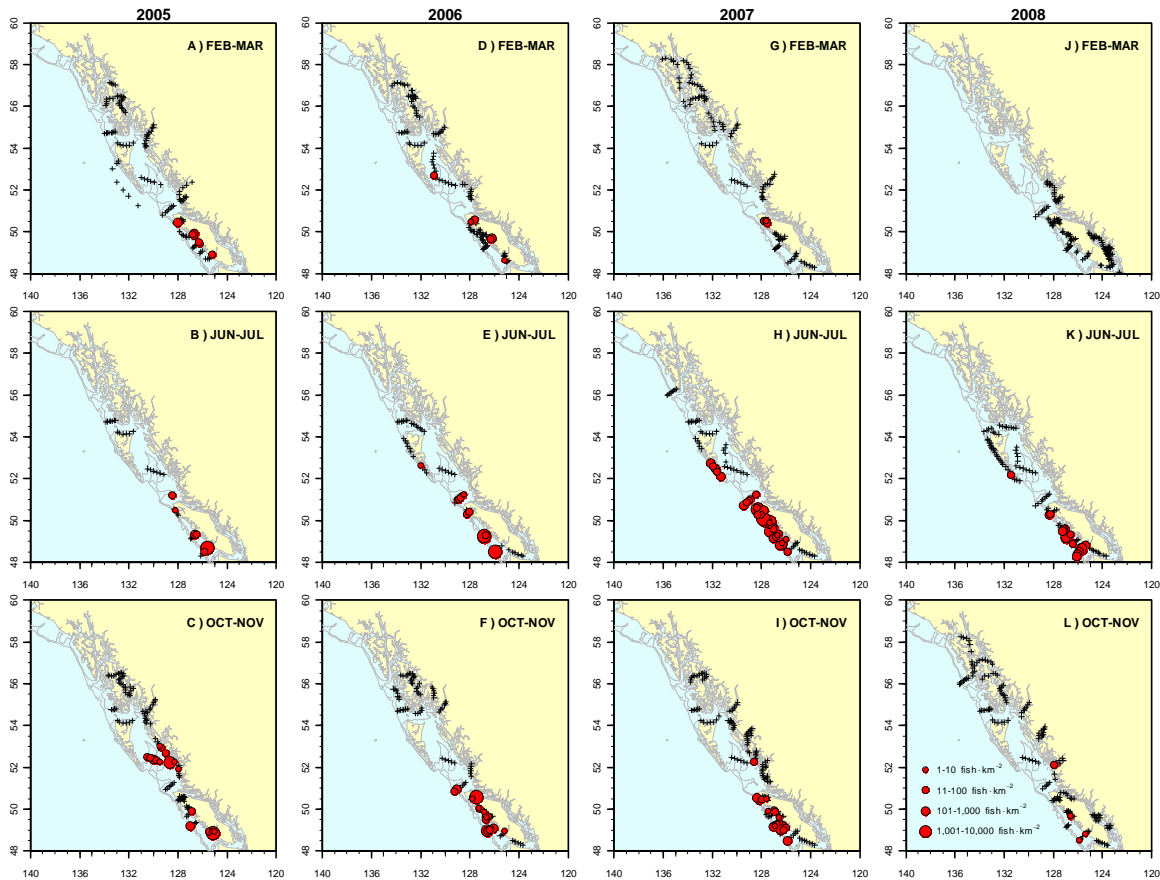


Figure 9. Distribution of sardines caught in British Columbia and southeast Alaska during winter (February-March), summer (June-July), and fall (October-November) 2005-2008. Sardines were caught using a rope trawl towed at the surface for 30 minutes at 5 knots. Except for a few stations, sampling effort was limited to the continental shelf.

Sardine Landings into California Ports:

Source: *El Niño Watch, Advisory* <http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi>

Sardine landings into California ports reached 22,006 mt in February. This equaled the first sardine allocation for 2009. Directed sardine harvest will resume on July 1 when a 25,293 mt allocation becomes available to west coast fishers.

Salmon:

Salmon Returns to Northern California and Oregon Rivers:

Source: *El Niño Watch, Advisory* <http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi>

Winter steelhead trout returns to northern California and Oregon rivers were weaker than average in January and February 2009, but recreational anglers had occasional good days on the Chetco, Smith, Elk, and Siusaw Rivers. Total Sacramento River adult Chinook salmon return for 2008 was about 66,300 fish, which is far

below any other return--year in the last 38 years. Returns were also low in 2007. Chinook salmon returns to the Klamath River have been better during 2006--2008 than the lows of the 1990-1992 period, but still not as robust as the 2000-2003 period. Salmon runs in the Columbia River were relatively strong in 2008, exceeding predictions for several distinct runs ([Fish Passage Center, Portland, OR](#)).

California Coast Coho Salmon Continue to Decline

Fisheries Ecology Division, Southwest Fisheries Science Center, NOAA <http://swfsc.noaa.gov/news.aspx?id=14472>

As the 2008/09 Coho salmon spawning season nears an end, a survey of monitoring projects on the California coast indicate that the decline in adult Coho salmon returns was worse this year than last year (2007/08), when there was a 73% reduction relative to their parental returns in 2004/05. Reports from eight coastal streams, from the Trinity River to Scott Creek, found an 85% decline in spawner returns compared to parental returns in 2005/06.

Pacific Fishery Management Council chooses options for 2009 Salmon Season: Fisheries in North Improve; Fisheries in South Still Limited

Source: Pacific Fishery Management Council

http://www.pcouncil.org/newsreleases/salmon_packet/0309press_release_FINAL.pdf

The Pacific Fishery Management Council adopted three public review options for the 2009 salmon season for sport, commercial and tribal fisheries.

Commercial salmon fishing from Cape Falcon, Oregon to Humbug Mountain, Oregon (Newport/Tillamook and Coos Bay subareas), and from Humbug Mountain, Oregon to the Oregon/California Border (Oregon KMZ subarea) previously scheduled to open March 15, 2009 will remain closed pending the setting of 2009 fishing regulations.

Recreational salmon fishing from Cape Falcon, Oregon to Humbug Mountain, Oregon, previously scheduled to open March 15, 2009 will remain closed pending the setting of 2009 fishing regulations.

The PFMC closed commercial and most recreational salmon fisheries off the coast of California in response to the collapse of Sacramento River fall Chinook. The recommendation will be forwarded to the NMFS for approval by May 1, 2009. All other restrictions and regulations remain in effect as announced for 2008-2009 ocean salmon fisheries and previous inseason actions. The council will officially post an announcement, please check the PFMC link: <http://www.pcouncil.org/>

Invasive Species:

Source: Amy Vierra (Boone), Ocean and Coastal Policy Analyst, California Natural Resources Agency

Four species of *Spartina* have become established along the West Coast: "*Spartina alterniflora* is prevalent in San Francisco Bay, where it threatens to extirpate the native (Pacific) cordgrass (*Spartina foliosa*) by competition and hybridization. In Humboldt Bay, *Spartina densiflora* dominates over 90% of the remaining marsh habitat, and smaller infestations have taken root in Baynes Sound, British Columbia; Grays Harbor, and Puget Sound in Washington; and Tomales and San Francisco Bays in California. *Spartina patens* occurs in all three states, where it forms dense monocultures and has proven difficult to eradicate. *Spartina anglica*, deemed one of the world's 100 worst invasive alien species, is found mainly in Puget Sound but is also established in San Francisco Bay, as well as Boundary Bay and Fraser River delta in British Columbia."

Source: Kerstin Wasson, Research Coordinator, Elkhorn Slough National Estuarine Research Reserve, California
Elkhorn Slough, California harbors over 60 species of non-native invertebrates, a handful of non-native fish and algae, and over 30 species of non-native upland weeds in the upper salt marsh. All of these are already too widespread and well-established to make eradication possible, but an early detection program for new invasions is now in place. If new invasive species on the estuary's "least wanted" list appear, attempts will be made to eradicate them before they become established.

Marine Mammals:

Marine Mammals:

Source: Lisa Munger, Dominique Camacho, Andrea Havron, Greg Campbell, and John Hildebrand

The NOAA fisheries marine mammal program participated on the CalCOFI winter cruise 0901NH, using visual observers and acoustic methods to enumerate the abundance of mammals on stations and along the cruise tracks. Species diversity and number of sightings overall were higher than usual for a winter cruise. Sightings are summarized in Table 1 and plotted on a bathymetric map in (Figure 10a, 10b).

During daylight transits, the group towed a six-element hydrophone array with recording bandwidth of 3 to 96 or 250 kHz for recording odontocete clicks and whistles. At about 1-2 nm distance from each daylight station, the group deployed an omnidirectional Navy sonobuoy with recording bandwidth of ~5 Hz to 22 kHz for recording baleen whale calls and low-frequency odontocete sounds such as whistles.

Delphinid clicks and whistles were detected on the towed array at offshore ends of lines 93, 90, 87, and 83, and inshore on lines 90, 87 and 77 (Figure 11a). Species sighted during acoustic detections included common dolphins, bottlenose dolphins, Risso's dolphin, and killer whales. Dall's porpoise were also sighted along lines 87 and northward, but data have not yet been reviewed for acoustic detection of Dall's porpoise clicks.

During sonobuoy deployments, humpback whales were detected at the majority of offshore stations (16 of 30 sonobuoys) on all lines (Figure 11b). Fin whale calls were detected on two sonobuoys, 93 inshore and line 87 about midway offshore. Sperm whale clicks were detected on four sonobuoys, three of which were midway out on lines 90 and 87.

Table 1. Summary of cetacean sightings, CC0911NH.

Species code	Species	Number of sightings	Number of animals
Ba	Minke whale (<i>Balaenoptera acutorostrata</i>)	2	2
Bp	Fin whale (<i>Balaenoptera physalus</i>)	5	6
Dc	Long-beaked common dolphin (<i>Delphinus capensis</i>)	3	280
Dd	Short-beaked common dolphin (<i>Delphinus delphis</i>)	16	348
Dsp.	<i>Delphinus</i> spp.	10	205
Er	Grey whale (<i>Eschrichtius robustus</i>)	8	17
Gg	Risso's dolphin (<i>Grampus griseus</i>)	1	15
Mn	Humpback whale (<i>Megaptera novaeangliae</i>)	9	18
Oo	Killer whale (<i>Orcinus orca</i>)	2	7
Pd	Dall's porpoise (<i>Phocoena dalli</i>)	12	103
Pm	Sperm whale (<i>Physeter macrocephalus</i>)	1	1
Tt	Bottlenose dolphin (<i>Tursiops truncatus</i>)	4	57
Tt/Dsp.	Bottlenose/delphinus mixed group	1	108
UD	Unidentified dolphin	6	131
ULW	Unidentified large whale	6	8

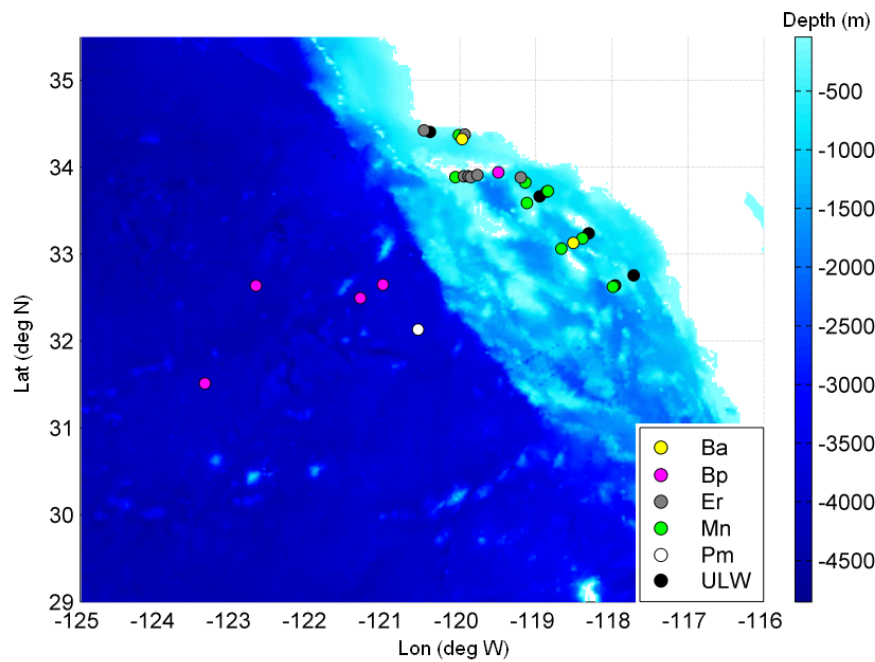


Figure 10a. Large whale visual detections, CC0901NH.

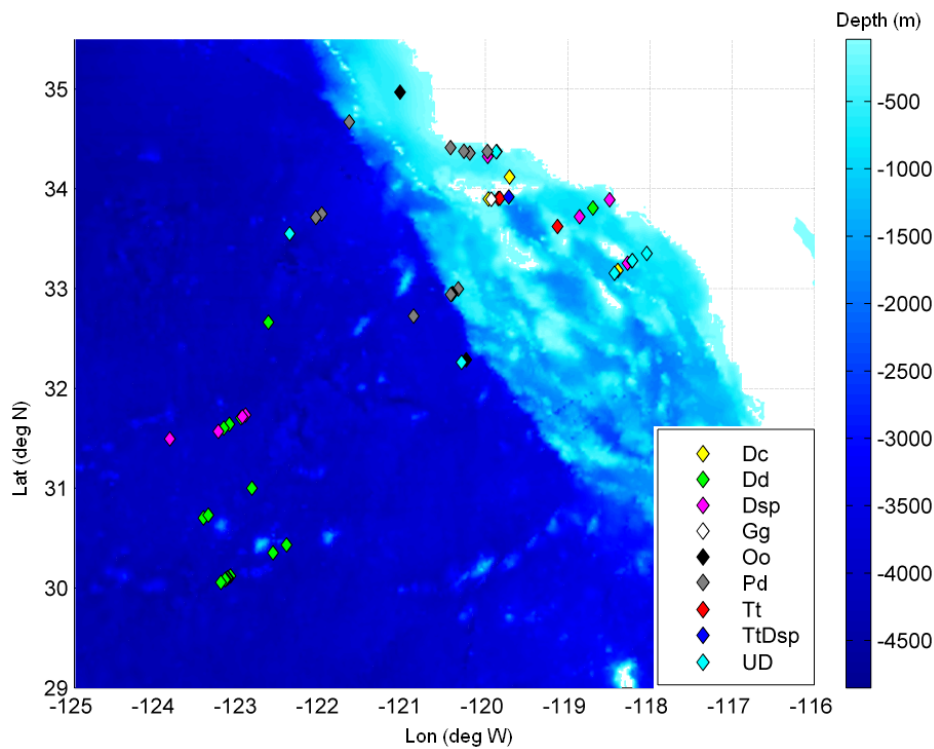


Figure 10b. Delphinid/porpoise visual detections, CC0901NH.

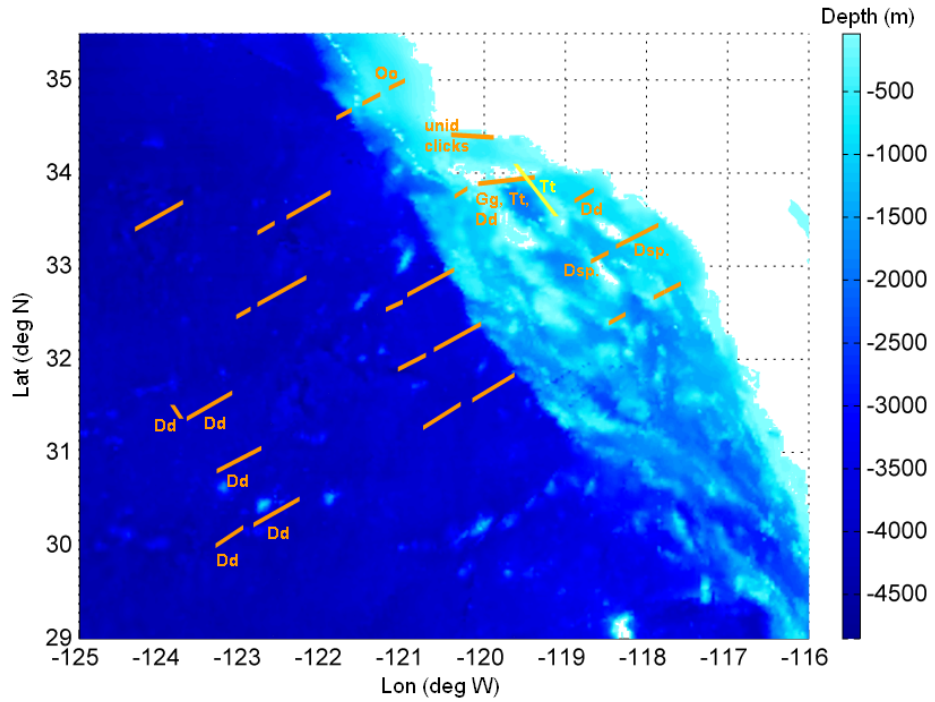


Figure 11a. Towed array acoustic detections, CC0901NH.

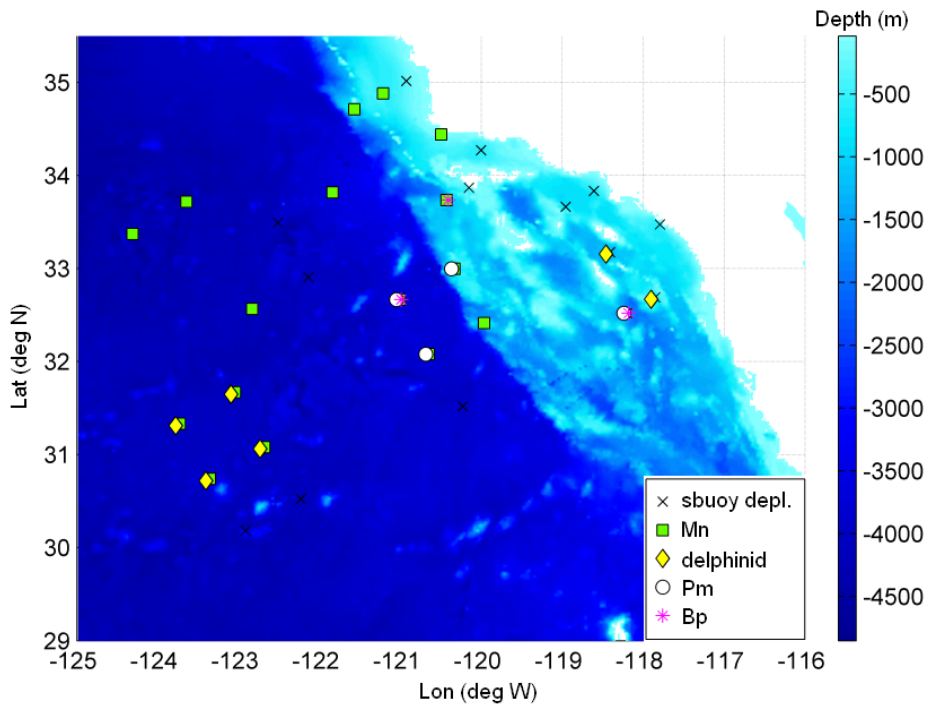


Figure 11b. Sonobuoy acoustic detections, CC0901NH.

Harmful Algal Blooms:

This section provides a summary of two toxin-producing phytoplankton species *Pseudo-nitzschia* and *Alexandrium* activity. *Alexandrium* is the dinoflagellate that produces paralytic shellfish poisoning (PSP), and *Pseudo-nitzschia* is the diatom that produces domoic acid.

Washington HAB Summary

Source: WA Department of Fish and Wildlife <http://www.wdfw.wa.gov/fish/shellfish/razorclam/levels/levels.htm>

The Washington Department of Fish and Wildlife (WDFW) provides the latest information on domoic acid levels from five major management zones, which include Long Beach, Twin Harbors, Copalis Beach, Mocrocks, and Kalaloch. Regular samples of both razor clams and Dungeness crab are collected by WDFW and are tested for domoic acid levels. The level of domoic acid determined to be unsafe for human consumption by the Federal Food and Drug Administration (FDA) is 20 ppm in shellfish meat tissue. No unusual events were reported in Quarter 1. Please visit the WDFW website for the most current information on domoic acid levels and closures.

Oregon HAB Summary

Source: Oregon Department of Agriculture Food Safety Division http://egov.oregon.gov/ODA/FSD/shellfish_status.shtml

Paralytic shellfish poisoning (PSP)

Mussel sampling for evaluation of shellfish toxin levels are done frequently by the Oregon Department of Agriculture. No unusual events were reported in Quarter 1. The shellfish safety toll-free hotline (1-800-448-2474) provides the most current information regarding shellfish safety closures for Oregon.

Source: Oregon Department of Fish and Wildlife <http://www.dfw.state.or.us/MRP/shellfish/razorclams/plankton.asp>

Source: Zach Forster, Phytoplankton Sampling Coordinator. MOCHA Project, Shellfish Project

Marine Resources Program, Oregon Department of Fish and Wildlife

Oregon's Harmful Algal Bloom (OHAB) monitoring project monitors ten sites along the coast of Oregon (three along Clatsop Beach, one on Cannon Beach, two on the central coast and four sites on the south coast, Figure 12) for any potential signs of the phytoplankton species *Pseudo-nitzschia* and *Alexandrium*. Samples collected the second week in March indicate presence of *Pseudo-nitzschia* along the Clatsop beaches with the highest cell counts (12,000 cells/liter) at the cove in Seaside. All other sites remain below 5,000 cells/liter (Figure 12).

Domoic acid results continue to be in safe range in Oregon.

Source: Oregon Department of Agriculture Food Safety Division http://egov.oregon.gov/ODA/FSD/shellfish_status.shtml

Most recent information is at the Oregon Dept. of Agriculture shellfish toll-free hotline (1-800-448-2474) which should be consulted prior to harvesting shellfish.

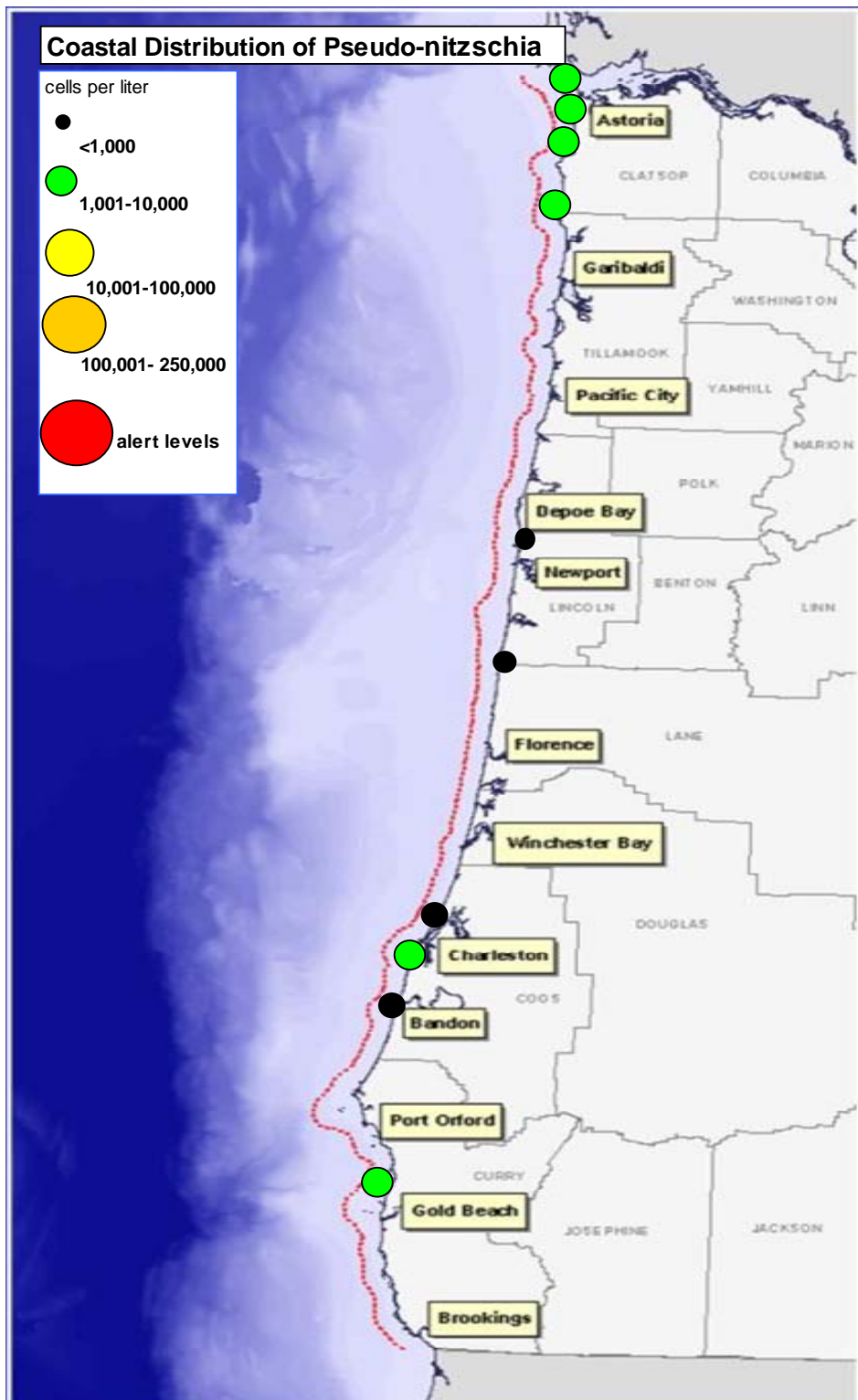


Figure 12. Oregon’s Harmful Algal Bloom monitoring project in conjunction with Oregon Department of Agriculture is working to monitor ten sites along the Oregon coast. The coastal distribution of *Pseudo-nitzschia* (cells per liter) for March, 2009 are shown.

California HAB Summary

October:

Source: Gregg W. Langlois, Senior Environmental Scientist, CA Department of Public Health

<http://www.cdph.ca.gov/healthinfo/environhealth/water/Pages/Shellfish.aspx>

Southern California Summary for Paralytic Shellfish Poisoning (PSP) and Domoic-Acid:

Alexandrium was observed at several sampling stations along most of the southern California coast during January. These observations represent a slight increase in the geographic distribution of this dinoflagellate when compared to observations in December. Overall the cell numbers were quite low, with the greatest relative abundance observed in a sample collected from Pismo Beach Pier on Jan 29. PSP toxins were generally absent during January. *Pseudo-nitzschia* was detected at sites between San Luis Obispo and San Diego counties in January, but was absent from sites along Orange County. The distribution and relative abundance of this diatom increased compared to observations in December. Cell numbers were low at most sites, with the highest relative abundances observed in samples from offshore of Palos Verdes (Jan 13), Cayucos Pier (Jan 15), and Imperial Beach Pier (Jan 13). Domoic acid was not detected in any shellfish samples collected along the southern California coast in January.

Pseudo-nitzschia increased quickly along sections of the southern California coast earlier in March. The most recent samples indicate a decline in *Pseudo-nitzschia* numbers and relative abundance. However *Pseudo-nitzschia* remains common at a number of locations. Domoic acid has only been detected at moderate levels (but below the federal alert level) in shellfish at only one location offshore of Santa Barbara.

Northern California Summary for Paralytic Shellfish Poisoning (PSP) and Domoic-Acid:

Alexandrium numbers and geographic distribution remained very low at stations along northern California coast in January. Observations of this dinoflagellate were restricted to sites in Monterey Bay (Santa Cruz Pier, and Monterey Commercial Pier). *Pseudo-nitzschia* was observed along most northern California counties in January. In general the relative abundance decreased slightly in most regions compared to observations in December.

Dissolved Oxygen:

Source: Bill Peterson, NOAA

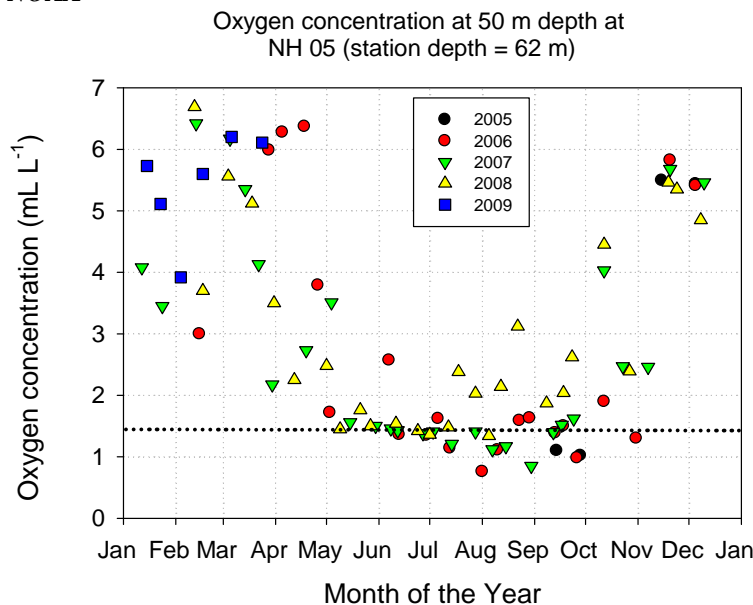


Figure 13. Oxygen concentrations at station NH-05 (five miles off Newport, Oregon, along the Newport Hydrographic Line), at a depth of 50m are high during winter months due to wind-mixing. The winter 2008-2008 average of approximately 6.0 ml L⁻¹ was similar to concentrations the past three winters.

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