Climatic and Ecological Conditions in the California Current LME for April to June 2008

Compiled by Rosa Runcie
Email: Rosa.Runcie@noaa.gov

Summary – Full content can be found by the links below.

EVENTS

- PaCOOS Board of Governors meeting was held at La Jolla, California, May 21-22, 2008 http://pacoos.org/Meetings.htm
- SCCOOS held a science advisory meeting
- Memorandum: Pacific Coast Collaborative (see appendix)

CLIMATE CONDITIONS

- **El Nino Southern Oscillation (ENSO):** A transition from La Nina to ENSO-neutral conditions is expected during June-July 2008.
- **Madden Julian Oscillation (MJO):** In April the MJO signal increased in amplitude but remained weak. The MJO continued to strengthen in May and then decreased in amplitude from mid-May into June.
- **Pacific Decadal Oscillation (PDO):** The PDO Index has remained negative since September 2007. The last incidence of eight consecutive negative values was in 2001.
- **Upwelling Index (UI):** The monthly coastal upwelling index showed upwelling favorable conditions between 24°- 42°N in March and April. A particularly strong upwelling episode occurred May 20-24 between 24°N to 45°N, with a maximum intensity at 39°N.
- **Temperature and Salinity at Newport Hydrographic line, Oregon:** Temperature and salinity through June 08 is colder than any summer since CTD data collection began in 1997; given the strong winds observed in July 2008, we are on track for the coldest summer since at least 1997.

ECOSYSTEMS

- **California Current Ecosystem Indicators:**
  1. Copepods The *Neocalanus* species have been present at extraordinarily high levels in winter/spring 2008 (Newport Hydrographic (NH) line, Oregon).
  2. Krill
  3. Rockfish juveniles
  4. Coastal Pelagics (Market squid, Pacific sardine, Northern anchovy):
     In 2007, Pacific sardine was the largest fishery in the state at nearly 81,000 t. The total 2008 California landings of sardines was 17,600 metric tons (mt) by mid-April. In 2007, market squid was second in landings at over 49,000 t, and was the highest valued fishery in California. About 170 mt of market squid were landed in May 2008 from waters around the southern California bight and Channel Islands; this was about three times the May 2007 harvest.
  5. Salmon: Thus far, the count of spring chinook at Bonneville Dam, Oregon is only about 25% of the ten-year average cumulative total for May 31.
  6. Groundfish: California's commercial groundfish harvest for 2007 was over 10,000 t, a 13% decrease over 2006 landings.
  7. Pacific Hake
  8. Sablefish
  9. Midwater species (Watson) from tropic & Central jack mackerel: In 2007, jack mackerel landings represented less than 1% of the total catch of coastal pelagic species in California with 632 t landed.
  10. Cassin's Auklet: Seabird observations indicate a recent and continuing increase in the at-sea abundance of Cassin's Auklet.

- **Invasive Species:**
- **Marine Birds:** In the past year, seabird observations surveys indicate climate change related observations: (1) continuing low abundance of trans-hemispheric migrants in the California Current including Sooty (and some Short-tailed) Shearwaters, and (2) a recent and continuing increase in the at-sea abundance of Cassin's Auklet.
- **Harmful Algal Blooms:** *Pseudo-nitzschia* began increasing in the Santa Barbara, California region the last two weeks of May. Low levels of domoic acid were detected in shellfish from this region. Low levels of the Paralytic Shellfish Poisoning (PSP) toxins persisted in the Santa Barbara region as well.
  Also, recent mussel samples taken from the North, Central and South Oregon cost indicate levels of PSP toxins have risen above the alert level.
- **Low Dissolved Oxygen:** Oxygen data generated during the last CalCOFI cruise (24 March- 9 April) revealed reduced oxygenation of inshore waters, particularly along the southern lines.

  In Newport Hydrographic line, Oregon low oxygen values were first observed in early May but values have not yet fallen below 1.4 ml L^{-1}. Hypoxia is expected July 2008.
- **Publications: California Current Related (cumulative)**
  Brodeur, R., C. Suchman, D. Reese, T. Miller, E. Daly. 2008. Spatial overlap and trophic interactions between pelagic fish and large jellyfish in the northern California Current. Marine Biology 154(4): 649-649.
  http://www.springerlink.com/content/a6m3472t1h835342/fulltext.pdf

  Jahncke, J., B.L Saenz, C.L. Abraham, C. Rintoul, R.W. Bradley, and W.J. Sydeman. 2008. Ecosystem responses to short-term climate variability in the Gulf of the Farallones, California. Progress in Oceanography 77: 182-193.
  http://www.science-direct.com/science?_ob=MImg&_imagekey=B6V7B-4S62RHD-1-K&_cdi=5838&_user=4429&_orig=browse&_coverDate=06%2F30%2F2008&_sk=999229997&view=c&wchp=dGLbVzW-zSkWA&md5=5bfa2873bd57ae50f6b23f8220c30313&ie=/sdarticle.pdf

  Suchman, C.L., E.A. Daly, J.E. Keister, W.T. Peterson, R.D. Brodeur. 2008. Feeding patterns and predation potential of scyphomedusae in a highly productive upwelling region. Marine Ecology Progress Series 358: 161-172.
  http://www.int-res.com/articles/meps2008/358/m358p161.pdf

CLIMATE CONDITIONS

El Nino Southern Oscillation (ENSO):
Source: The Coast Watch **http://coastwatch.pfel.noaa.gov/elnino.html** ***(submit year and month).***
April:
Regional monthly average sea surface temperature (SST) fields for April 2008, derived from NOAA satellites, showed below-average monthly SST in the north Pacific east of 145°. The negative SST anomalies formed a broad coastal band, thousands of km wide, between 22°N and 50°N, in patterns that have persisted since December 2007. This band extends offshore in the north into subarctic areas, and in the south colder SSTs extend west and southwest to include tropical and equatorial regions. This band of negative SST anomalies was less developed in April 2008 than it had been in March 2008.

May:
Regional monthly average sea surface temperature (SST) fields for May 2008, derived from NOAA satellites, showed below-average monthly SST in the north Pacific east of 145°. The negative SST anomalies formed a broad coastal band between 25°N and 50°N, in patterns that have persisted since December 2007. This band extends offshore in the north into subarctic areas, and in the south colder SSTs extend west and southwest to include tropical and equatorial regions. This band of negative SST anomalies appears to be weakening and narrowing, offshore between 35°N and 45°N and along the coast of Baja California (23°N - 33°N).

Source: Regional Integrated Sciences & Assessments **http://www.climate.noaa.gov/cpo_pa/risa/**
http://www.cpc.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.doc
La Niña continued to weaken during May 2008, reflected mainly by changes in sea surface temperatures (SSTs) across the equatorial Pacific Ocean. Negative SST anomalies in the central and east-central equatorial Pacific weakened, while the region of positive SST anomalies increased in the eastern Pacific.

Positive oceanic heat content anomalies (average temperatures in the upper 300m of the ocean; Fig.1) reflected the continuation of above-average temperatures at thermocline depth in the west-central and eastern equatorial Pacific. However, a shallow layer of negative anomalies (between the surface and 100m in the central Pacific) continue to be sufficiently cool to maintain the below-average SSTs, which support the atmospheric anomalies associated with La Niña. Enhanced low-level easterly winds and upper-level westerly winds continued across the central equatorial Pacific, while convection remained suppressed throughout the central equatorial Pacific and enhanced over the far western Pacific. Collectively, these atmospheric and oceanic conditions continue to indicate an ongoing, but gradually weakening, La Niña. A transition from La Niña to ENSO-neutral conditions occurred during June 2008, as sea surface temperatures (SSTs) returned to near-average across the central and east-central equatorial Pacific Ocean (Fig. 1).

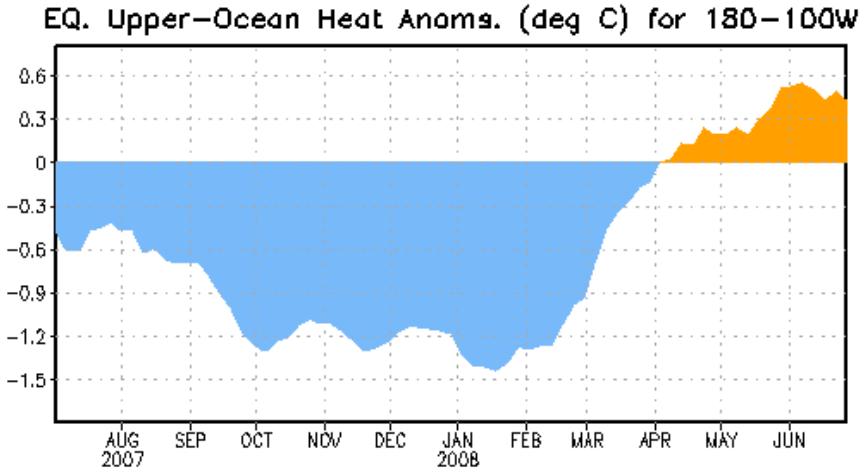


Figure 1. Area-averaged upper-ocean heat content anomalies (°C) in the equatorial Pacific (5°N-5°S, 180º-100ºW). Heat content anomalies are computed as departures from the 1982-2004 base period weekly means.

June:
Regional monthly average sea surface temperature (SST) fields for June 2008, derived from NOAA satellites, showed below-average monthly SST over much of the north Pacific east of 145°W. However, the broad coastal band of negative SST noted in May weakened and began to breakdown in June. Positive anomalies developed along the coast south of 35°N and offshore east of 135°W. Areas of negative SST anomaly extend offshore north of 40°N and into the subarctic Pacific and Gulf of Alaska. SST anomaly trends were toward higher anomalies.

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)***
Predictions for April: The MJO in part may contribute to enhanced tropical rainfall across eastern equatorial Africa and the western Indian Ocean during week 1 and later the eastern Indian Ocean during week 2.
Predictions for May: It is not expected that the MJO will contribute largely to patterns of tropical rainfall.
Predictions for June: During week 1, the MJO will contribute to dry conditions across sections of Indonesia and wet conditions across parts of the eastern Pacific, the Caribbean, and equatorial Africa and the Indian Ocean. Wet conditions are expected across the Indian Ocean during week 2. Also, During Week 1, enhanced convection is expected for parts of India, extreme southeast China and the Bay of Bengal. Drier than average conditions are anticipated for Central America and the eastern Pacific Ocean.

April:
Early April, weak easterly 850-hPa wind anomalies remained across the western Pacific and westerly 850-hPa wind anomalies continued across parts of the eastern Pacific. 200-hPa westerly wind anomalies were identified across the central and eastern Pacific. The MJO signal remained weak with a slight eastward propagation. Mid-April, westerly 200-hPa zonal wind anomalies stretch across much of the Pacific Ocean with strong cross-equatorial flow near the Date Line. Late April, Easterly 850-hPa wind anomalies continue across the western Pacific. The MJO signal increased in amplitude but remained weak.

May:
Early May, easterly (westerly) 850-hPa zonal wind anomalies continue across the central (eastern) Pacific Ocean associated with La Nina conditions. Westerly 200-hPa zonal wind anomalies increased east of the Date Line. Mid and late May, easterly (westerly) 850-hPa vector wind anomalies in the western (eastern) Pacific decreased (increased). The MJO strengthened during May as 200-hPa velocity potential anomalies increased with some eastward propagation. Late May westerly anomalies decreased some across the eastern Pacific.

June:
Early June, westerly 850-hPa vector wind anomalies continue across the eastern Pacific. Westerly 200-hPa vector wind anomalies over the central Pacific Ocean increased. The MJO index has decreased in amplitude since mid-May. Mid June, 200-hPa zonal westerly wind anomalies have shifted from the eastern to western hemisphere. 850-hPa vector westerly wind anomalies became weak easterly anomalies. 200-hPa vector westerly wind anomalies over the central Pacific Ocean decreased. Overall, the MJO index continues to weaken near the eastern Maritime Continent.

Pacific Decadal Oscillation (PDO):
Source: Jerrold Norton, NOAA (Jerrold.G.Norton@noaa.gov)
Source: Environmental Research Division, NOAA, NMFS
Major changes in northeast Pacific marine ecosystems have been correlated with phase changes in the PDO; warm eras (positive index values) have seen enhanced coastal ocean biological productivity in Alaska and inhibited productivity off the west coast of the contiguous United States. Cold PDO eras (negative index) have seen the opposite north-south pattern of marine ecosystem productivity.
http://jisao.washington.edu/pdo/ The PDO Index has remained negative since September 2007, when it was -0.36 (Fig. 2). The last incidence of eight consecutive negative values was in 2001.

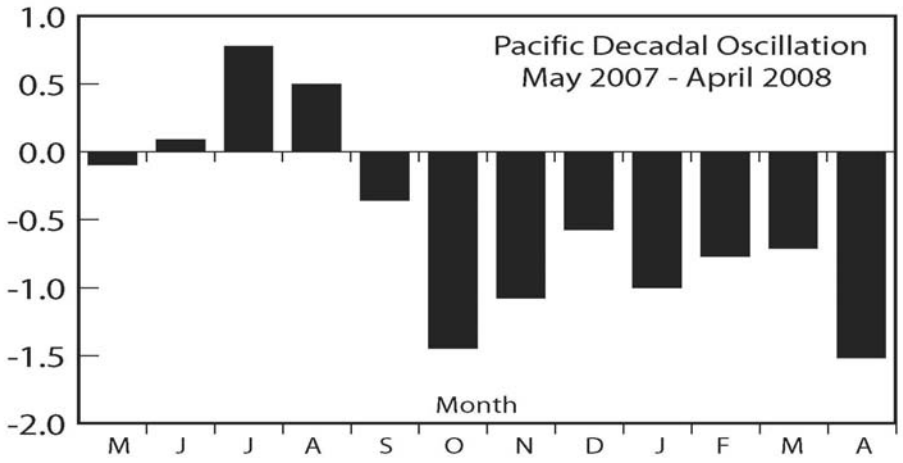


Figure 2. The graph presents monthly values for the PDO index. Please see description in summary above.

Upwelling Index:

Source: **http://www.pfel.noaa.gov/products/PFEL/modeled/indices/upwelling/NA/daily_upwell_graphs.html**

Solid lines denote the daily Upwelling Index (Fig. 3). The daily indices have been smoothed using a 3-day, 3rd order, forward-reverse Butterworth filter. The dashed curve is a biharmonic fit to the daily upwelling indices for the period 1967-1991. The shaded area around the biharmonic curve denotes one standard error, calculated for each Julian day. The yellow bars denote monthly mean of the Upwelling Indices based on the daily values. The units are metric tons per second per 100 m of coastline (or equivalently cubic meters per second per 100 meters of coastline). These units may be thought of as the average amount of water upwelled through the bottom of the Ekman layer each second along each 100 m of a straight line directed along the dominant trend of the coast on a scale of about 200 miles.

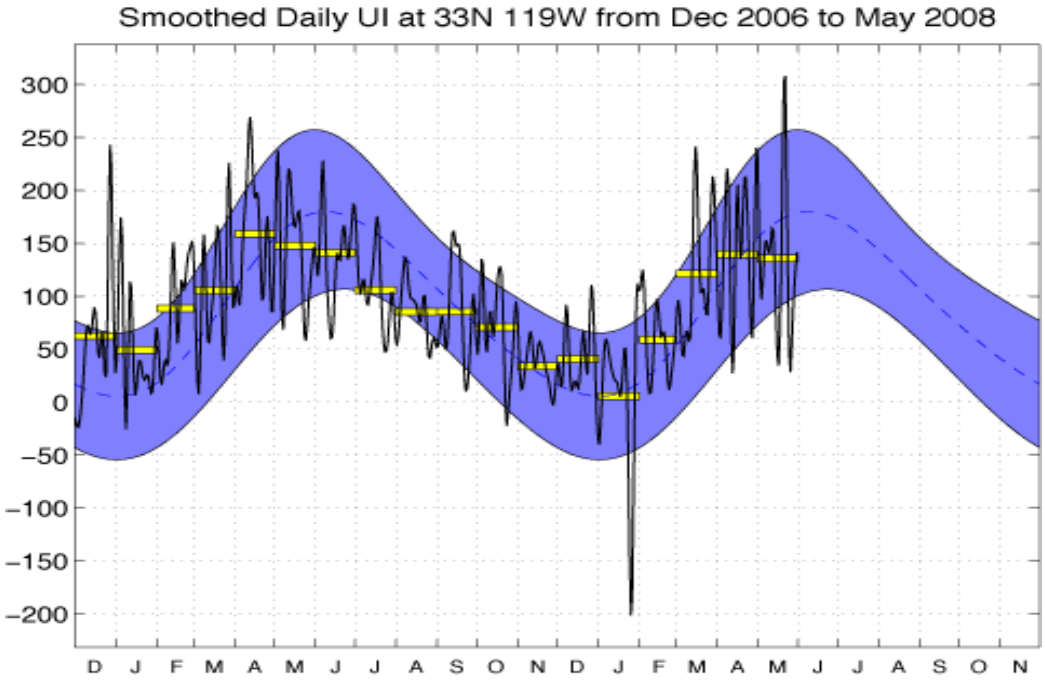


Figure 3. Currently the most recent upwelling index data provided is up through May 2008 (NOAA, NMFS).

April:

Source: **http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi**

The subtropical high atmospheric pressure system (STH) dominated atmospheric forcing between Cape Flattery (48°N) and Cape San Lucas (23°N). In the monthly mean wind stress field the STH was centered near 35°N, 140°W. Strong southeastward, upwelling favorable, wind stress and positive wind stress curl (WSC) occurred along the coast between Cape Scott (51°N) and Cape San Lucas (23°N), a pattern also seen in March 2008. The largest area of positive, upwelling favorable, WSC was found within and adjacent to the Southern California Bight from 31°N to 34°N. Strongly negative WSC was observed near-shore between Cape Mendocino (40°N) and Point Reyes (38°N). Upwelling favorable conditions were also observed outside of the San Francisco Bay. The NMFS/SWFSC/ERD monthly coastal upwelling index showed upwelling favorable conditions between 24°- 42°N in March and April 2008, with values about a third higher than the average monthly values.

There were three particularly strong upwelling episodes: 15-17 April 2008 between 24°N to 48°N; 16-20 April 2008 between 33°N to 58°N; 28-30 April 2008 between 30°N to 48°N

May:

Source: **http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi**

The subtropical high atmospheric pressure system (STH) dominated atmospheric forcing between Cape Flattery (48°N) and Cape San Lucas (23°N). In the monthly mean wind stress field the STH was centered near 34°N, 143°W. Strong southeastward, upwelling favorable, wind stress occurred along the coast between Cape Blanco (43°N) and Point Santa Eugenia (28°N) in patterns also seen in March and April 2008. A particularly strong upwelling episode occurred May 20-24 between 24°N to 45°N, with a maximum intensity at 39°N, as indicated by the NMFS/SWFSC/ERD monthly coastal upwelling index.

June:

Source: **http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi**

The North Pacific high atmospheric pressure system (NPH) dominated atmospheric forcing between Cape Flattery (48°N) and Cerros Island (28°N). In the monthly mean wind stress field the STH was centered near 36°N, 144°W. Strong southeastward, upwelling favorable, wind stress occurred along the coast between Cape Blanco (43°N) and Point Baja (30°N) in patterns also seen in March, April and May 2008. Upwelling indices, computed from monthly mean fields, showed weak and variable wind forced upwelling north of 45°N, anomalously strong upwelling at 39°N and 42°N, and weaker than average upwelling from 36°N to 27°N.

Average Temperature and Salinity (May-September) measured at 50 m depth, at Newport Hydrographic (NH) line 05, Oregon (Figure 4 *Source: Bill Peterson, NOAA*):

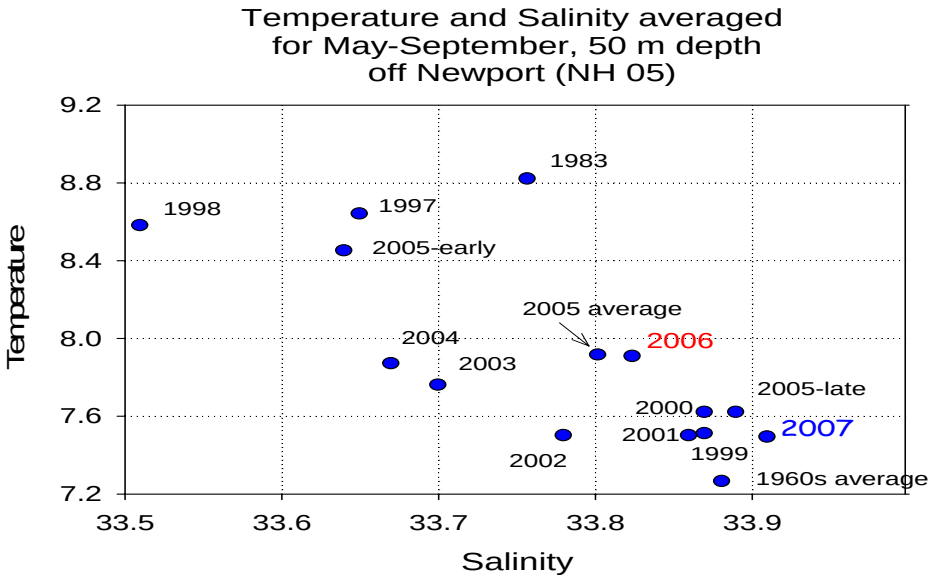


Figure 4. Temperature and salinity through June 08 averages 7.31 and 33.91 respectively which is colder than any summer since the group began taking CTD data in 1997; given the strong winds observed in July 2008, we are on track for the coldest summer since at least 1997. If winds remain strong through September, we will likely see conditions that have not been observed since the 1960s.

ECOSYSTEMS

California Current Ecosystem Indicators:

Copepods:

Source: Bill Peterson, NOAA, NMFS (Status through June 2008)

PDO, MEI and Copepod Species Richness: station NH 05

In late February, an early transition of copepods to cold water species occurred. Cold water copepod species have dominated since then (Fig. 5). The *Neocalanus* species have been present at extraordinarily high levels in winter/spring 2008. This marks the second spring in a row with order of magnitude more biomass of these copepods (which dominate the Gulf of Alaska and Bering Sea). High recruitment of sablefish and rockfish in the northern California Current could result from this event; Cassin's auklets at Triangle Island should be happy as well.

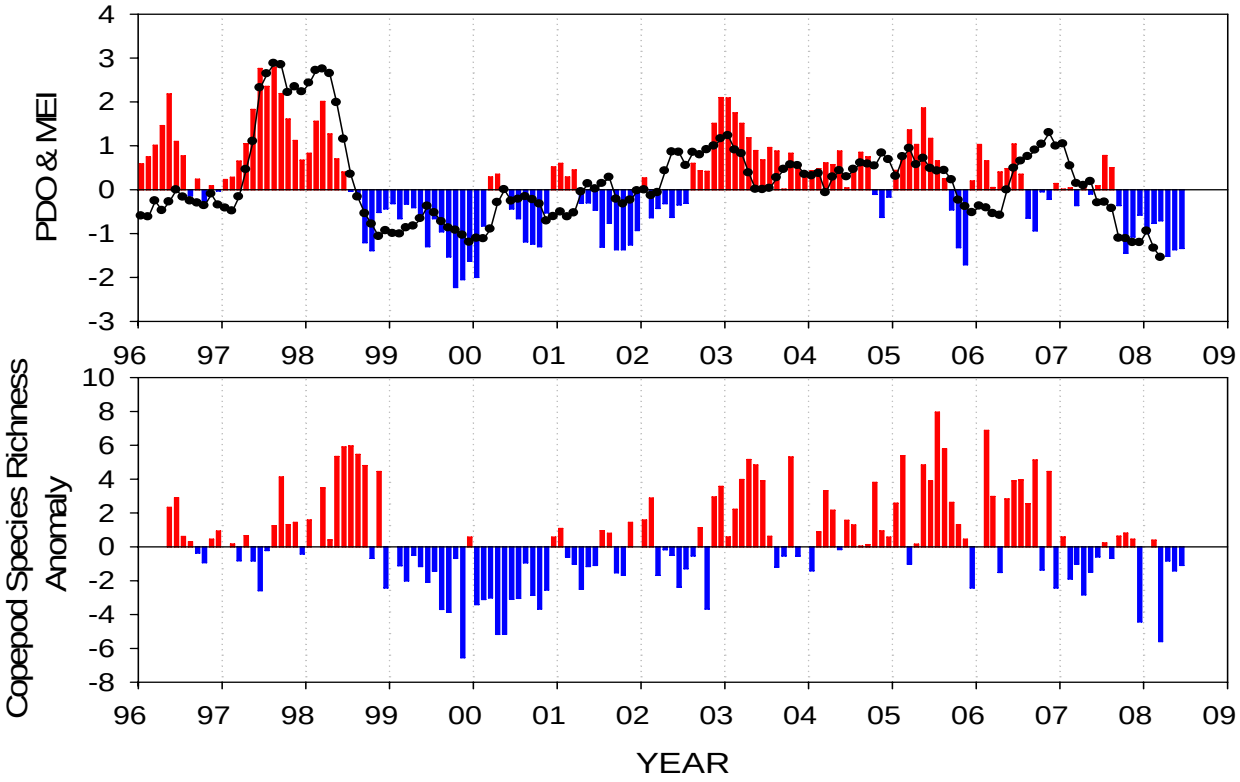


Figure 5. Winter-spring-summer 2008 continues to be very cold with a strong La Nina pattern, negative PDO and negative copepod species richness anomalies. Cold water lipid-rich copepod species dominate.

Coastal Pelagics:

Sardines and Squid:

April:

Source: **http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi**

The total 2008 California landings of sardines was brought to 17,600 metric tons (mt) by mid-April, with the majority landed in ports south of Point Conception. At this catch rate, the first of three catch allocations (28,000 mt) will be exceeded before the second allocation is made available on July 1. The total sardine harvest guideline for 2008 is 80,000 mt, which is about half the harvest guideline for 2007. About 75 metric tons of market squid were landed in April 2008, all from waters around San Pedro; this was a small catch but the squid are reported to be in good condition. (California Department of Fish and Game, Marine Region, Los Alamitos, CA).

May:

Source: **http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi**

The coast-wide sardine fishery was officially closed by Pacific Fishery Management Council at the end of May due to the success of the fishery in harvesting the first of three harvest allocations. This allocation is about half the first allocation of 2007, but the catch rate was similar in both years. About 170 mt of market squid were landed in May 2008 from waters around the southern California bight and Channel Islands; this was about three times the May 2007 harvest. (California Department of Fish and Game, Marine Region, Los Alamitos, CA).

Review of some California Fisheries for 2007: Coastal Pelagic Finfish and Market squid.
DRAFT ONLY DO NOT CITE- ***Source: CDFG, CalCOFI & Dale Sweetnam***

Coastal Pelagic Finfish:

The combined landings of Pacific sardine for California, Oregon, and Washington totaled 127,597 t, up 47% from the 86,682 t landed in 2006. In California, 2007, the total quantity of Pacific sardine landed (80,950 t) was 73% greater than in 2006 (46,762 t). This is the largest amount of Pacific sardine landed in California since the late 1960's. Commercial landings of sardine averaged 50,236 t over the ten-year period from 1998–2007. Nearly all (96%) of California's 2007 sardine catch was landed in Los Angeles (53%, 42,966.2 t) and Monterey (43%, 34,755.8 t) port areas.

The steady increase of sardines landed in Oregon seen since 1999 may have leveled off or slowed in the last 3 years (Fig.6). Oregon landings of sardine totaled 42,144 t in 2007, a slight increase over 2006 (35,648 t). Washington landings of Pacific sardine have decreased to 4,665 t in 2007 since a peak in 2000 (15,832 t) (Fig.6). This is only slightly higher than 2006 (4,362 t). The 2008 proposed harvest guideline (HG) is 89,093 t or 42% less than the HG for 2007. Because of the potential of the fishing industry to meet or exceed the HG, a 10% set-aside for an incidental fishery was adopted.

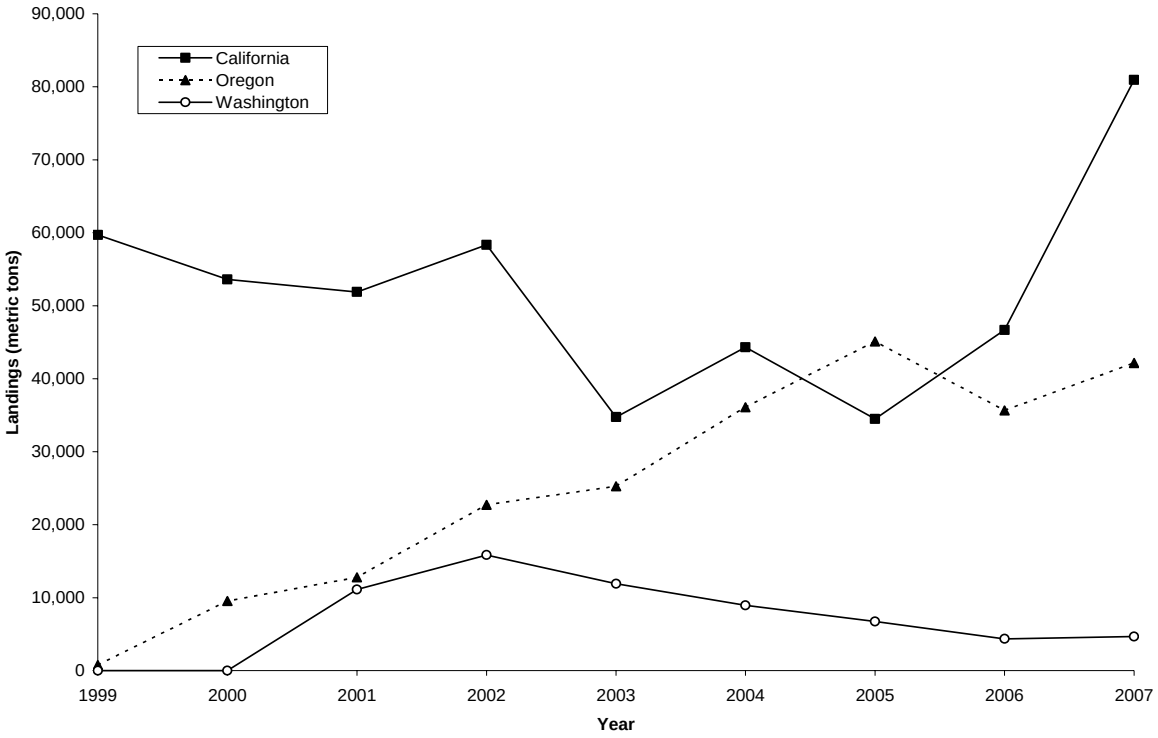


Figure 6. Commercial landings of Pacific sardine (*Sardinops sagax*) in California, Oregon, and Washington, 1999-2007.

California Market Squid:
During the 2007-2008 season 45,813 t of market squid were landed, a 32% increase from the 2006-2007 season (34,809 t). There was a 90% decline in catch from the northern fishery near Monterey in the 2007-2008 season with only 53 t landed (Fig.7) and was likely influenced by the La Niña Southern Oscillation event. Low landing numbers in this region often coincide with La Niña events. However, this landing total is exceptional because it is the lowest since the 1998-99 landings (24 t). Although the northern region harvests steadily climbed after the 1998-1999 season to peak at 25,242 t in the 2002-2003 season, the low harvests for the northern region during the 2007-2008 season is a concern for management.

In contrast, landings of market squid in California were almost exclusively taken from the southern California region during the 2007-2008 season, accounting for 99.9% of the total catch with 45,759 t landed (Fig.7). At the start of the 2007-2008 season squid fishing was centered off northern Channel Island coastlines of Santa Cruz and Santa Rosa. However, at the end of the season, fishing was centered on the west coast of Santa Catalina Island and along the coastline of La Jolla. This varies from the 2006-2007 season where major landings were absent from Santa Catalina and La Jolla.

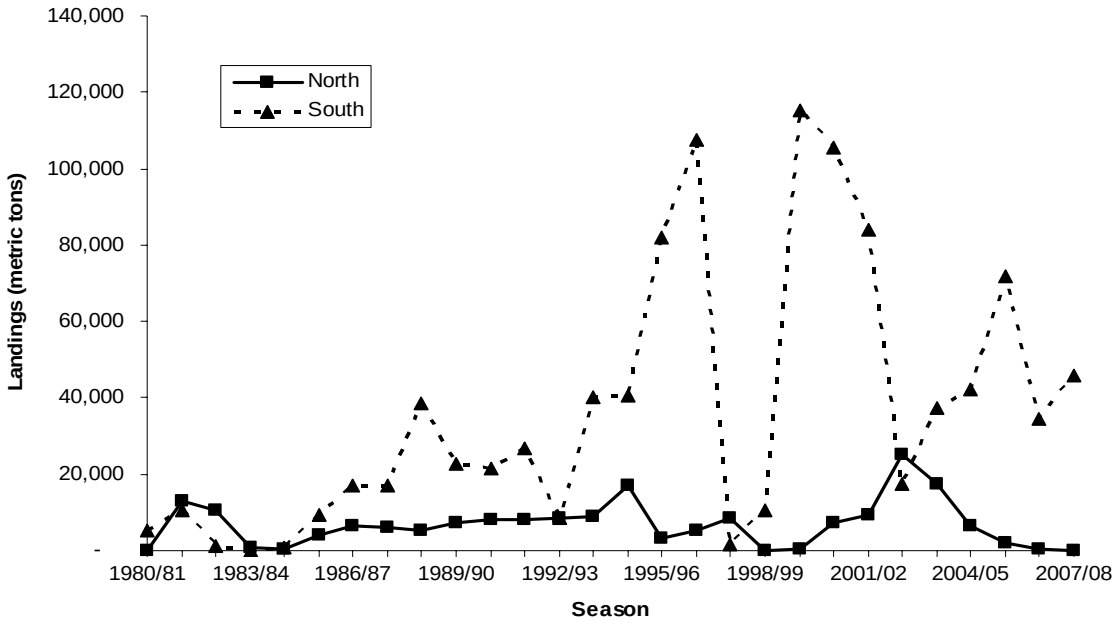


Figure 7. Comparison of market squid landings for northern and southern fisheries by fishing season (1 April - 31 March), from 1980-1981 to 2007-2008 seasons.

Northern Anchovy:
DRAFT ONLY DO NOT CITE- *Source: CDFG, CalCOFI & Dale Sweetnam*
California landings of northern anchovy in 2007 amounted to 10,390 t with an ex-vessel value of nearly $1.2 million. This is 81% of total 2006 landings (12,815 t) but anchovy still ranked as the second most valuable coastal pacific species finfish after Pacific sardine. For 2007, there were no reported landings of northern anchovy in Oregon. Washington reported 153 t valued at $35,883 ex-vessel value for 2007.

Salmon:
Pacific Council News:
Source: Pacific Council News **http://www.pcouncil.org/newsletters/currentnews.pdf**
Council Adopts Most Restrictive Salmon Season Ever:
In April, the Council adopted the most restrictive ocean salmon seasons ever for California and most of Oregon. Commercial and recreational Chinook fisheries south of Cape Falcon, Oregon are closed for 2008 due to the status of Sacramento River fall Chinook.

April:
Source: **http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi**
Spring chinook salmon, both hatchery and wild, are beginning their return to the lower Columbia River and Willamette drainage and other rivers north of 40°N. Thus far, the count of 61,311 spring chinook at Bonneville Dam, 240 km up the Columbia River, is about a third less than the ten-year average cumulative total for April 30. (Fish Passage Center, Portland, OR).
May:
Source: **http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi**
Spring chinook salmon, both hatchery and wild, continued their return to the lower Columbia River and Willamette drainage and other rivers north of 37°N. Thus far, the count of spring chinook at Bonneville Dam is only about 25% of the ten-year average cumulative total for May 31. (Fish Passage Center, Portland, OR).

Groundfish:
DRAFT ONLY DO NOT CITE- ***Source: CDFG, CalCOFI & Dale Sweetnam***
California's commercial groundfish harvest for 2007 was over 10,000 t, a 13% decrease over 2006 landings. Pacific whiting, Dover sole, and sablefish continued to be the top species landed. Ex-vessel value of groundfish landings for 2007 was $15.9 million, 8% higher than in 2006. The first stock assessment for blue rockfish was completed in 2007.

Pacific Council News:
Source: Pacific Council News **http://www.pcouncil.org/newsletters/currentnews.pdf**
Council Plans for New and Updated Groundfish Stock Assessments:
In March the Council recommended that full and updated stock assessments be done next year. The stock assessments will contribute to the 2011-12 harvest specifications and management measures decision-making process.

Full Assessments	**Updated Assessments**
Bocaccio Widow Rockfish Yelloweye Rockfish Petrale Sole Spiny Dogfish Cabezon Bronzespotted Rockfish* Greenspotted Rockfish*	Canary Rockfish Cowcod Lingcod Pacific Ocean Perch Darkblotched Rockfish
*May be only a data report.	

Jack Mackerel:
DRAFT ONLY DO NOT CITE- ***Source: CDFG, CalCOFI & Dale Sweetnam***
In 2007, jack mackerel landings represented less than 1% of the total catch of coastal pelagic species in California with 632 t landed. This is nearly half of the total 2006 catch (1,169 t) and generated $144, 167 in ex-vessel value. Landings in Oregon continue to be low with 14 t landed in 2007 for an ex-vessel value of $1,493. Washington reported no landings of jack mackerel during 2007.

Invasive Species:
Marine Birds:
Source: WJ Sydeman, Farallon Institute for Advanced Ecosystem Research, **wsydeman@comcast.net**
Seabird Observations on CalCOFI, 2007-2008
Two standardized seabird observations surveys were conducted in 2007 (January and July) and, to date, 2 surveys in 2008 (January and April). In the past year, the most important results include the following climate change related observations: (1) continuing low abundance, in comparison with the later 1980s and

early 1990s, of trans-hemispheric migrants in the California Current including Sooty (and some Short-tailed) Shearwaters, and (2) a recent and continuing increase in the at-sea abundance of Cassin's Auklet, an obligate krill-feeding planktivore, which started in July of 2005 and persisted in July 2006 and July 2007 (McClatchie et al. in press State of the California Current, 2007-2008). In 2005 and 2006, the increase of auklets in the CalCOFI study region was interpreted as a result of dispersal of this species from the Farallon Islands in central-northern California when the colony was abandoned presumably due to extremely poor localized krill abundance in the Gulf of the Farallones (Sydeman et al. 2006, Peterson et al. 2006, Goericke et al. 2007). In 2007, the Farallon colony was not abandoned in the same way as it was in 2005 and 2006, but breeding success was very poor (> 1 standard deviation below the long-term mean). Thus, WJ Sydeman et al hypothesize that krill availability in the Gulf of the Farallones, while improved in 2007, was still poor, resulting in poor breeding success and dispersal of these highly mobile birds from central-northern California to the CalCOFI study area in summer 2007.

Harmful Algal Blooms:

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

April:

Southern California Summary: *Alexandrium*, the diatom that produces Paralytic Shellfish Poisoning (PSP) was observed at sampling stations between Santa Barbara and San Diego counties during April. The relative abundance of *Alexandrium* was highest at sites in San Diego counties. Low concentrations of PSP toxins continued to be detected in mussels at a number of sites between Santa Barbara and San Diego counties throughout the month. *Pseudo-nitzschia*, the diatom that produces domoic acid, was detected at numerous sites between San Luis Obispo and San Diego counties during April. The highest relative abundance was observed offshore of the Palos Verdes peninsula (LA County). The highest concentration of domoic acid was 12 ppm in a mussel sample from Deer Creek (Ventura County).

Northern California Summary: *Alexandrium* was not observed at any northern California sampling stations in April. PSP toxicity was not detected in any shellfish samples from this region. *Pseudo-nitzschia* was observed at very low numbers at a few sites along the northern California coast in April. Domoic acid was not detected in any shellfish samples analyzed.

The link below provides a summary of biotoxin activity for the month of April, 2008. Ranges of toxin concentrations are provided for the paralytic shellfish poisoning (PSP) toxins and for domoic acid (DA).
http://www.cdph.ca.gov/HealthInfo/environhealth/water/Documents/Shellfish/MonthlyandQuarterlyReports/2008/Biotoxin_Monthly_0408.pdf

Results summarized below are included to highlight species that were found to be abundant (>=50%).

Humboldt	Humboldt Bay: diatom *Thalassiosira*
Marin	Tomales Bay, Mouth: diatom *Chaetoceros*
San Francisco	San Francisco Marina: diatom *Chaetoceros*
Santa Cruz	Seacliff Pier: diatom *Chaetoceros*
Monterrey	Comercial Pier: diatom *Chaetoceros*
San Luis Obispo	Morro Bay: datom *Detonula*
	Diablo Cove: diatom *Lauderia*
Santa Barbara	Ellwood Pier: dino *Ceratium*
	Santa Barbara Channel 2: diatom *Centrics*
	Santa Barbara Channel 5: diatom *Centrics*
	Pitas Offshore: diatom *Centrics*
Ventura	Ventura Pier: dinos *Noctiluca*
	Port Hueneme Pier: diatom *Thalassiosira*
Los Angeles	Los Angeles Harbor : *Pseudo-nitzschia*
Orange	Dana Point: *Pseudo-nitzschia*
	Newport Offshore: dino *Ceratium*
San Diego	Oceanside Pier: datom *Chaetoceros*

May:
The following is a brief update on phytoplankton observations and toxin monitoring for the month of May. Although relatively quiet, *Pseudo-nitzschia* began increasing in the Santa Barbara region the last two weeks of May. Low levels of domoic acid were detected in shellfish from this region. Low levels of the PSP toxins persisted in the Santa Barbara region as well. The annual quarantine on sport-harvesting of mussels began on May 1. This quarantine applies to the entire California coastline, including all bays and estuaries.
Results summarized below are included to highlight species that were found to be abundant (>=50%).
http://www.cdph.ca.gov/healthinfo/environhealth/water/Pages/Shellfish.aspx

Del Norte	Crescent City: diatom *Thalassiosira*
Humboldt	Trinidad Pier: diatom *Thalassiosira*
Contra Costa	Presido Pier: diatom *Thalassiosira*
	SF Offshore 19 mi: diatom *Chaetoceros*
San Mateo	Devil's Slide W: diatom *Chaetoceros*
	Princeton Harbor: diatom *Thalassiosira*
Santa Cruz	Santa Cruz Pier: diatom *Chaetoceros*
San Luis Obispo	Cyucos Pier: diatom *Chaetoceros*
	Morro Bay outer: datom *Deetonula*
	Cal Poly Pier: diatom *Bacteriastrum*
Santa Barbara	Pitas offshore: dino *Ceratium*

California HABMAP:
Source: Dave Caron, NOAA, NMFS , University of Southern CA
Three sites are sampled for HAB along a transect leading out of the LA-Long Beach Harbor to Catalina Island. The quarterly sampling in May revealed only modest concentrations of domoic acid in the water across the region from Palos Verdes south to Newport Beach (all values were less than 0.4 micrograms/liter). Also, samples from late April and early May have shown a virtual absence of Pseudo-nitzschia in the water. The onshore-offshore transect samples revealed some very high values (up to more than 19 micrograms/liter) at nearshore stations. This is not quite as high as maximal values observed in 2007 (which went to approximately 25 micrograms/liter), and a bit higher than 2006 (which maxed out at approximately 15 micrograms/liter).

Paralytic shellfish poisoning (PSP) levels have risen above the alert level in mussels on the North, Central and South Oregon Coast.
Source: Oregon Department of Agriculture Food Safety Division
http://egov.oregon.gov/ODA/FSD/shellfish_status.shtml
Recent mussel samples taken from the area indicate levels of PSP toxins have risen above the alert level. The area is closed for recreational harvesting of mussels and coastal scallops as of June 12, 2008. Results summarized from the week of June 8, 2008 for PSP indicated alert levels for PSP at Bastendorf Beach to Cape Arago, Oregon. Mussels sampled contained 89.0 mcgm PSP. "Alert" level for PSP is 80 micrograms per 100 grams.

Domoic acid results continue to be in safe range in Oregon.
Mussels, clams and oysters sampled the week of June, 1 2008 contained very low levels of domoic acid.

Low Dissolved Oxygen:

Source: Lisa Levin Scripps Institute of Oceanography, Steve Bograd NOAA, NMFS, Jim Wilkinsen Scripps Institute of Oceanography

Oxygen data generated during the last CalCOFI cruise (24 March- 9 April) revealed reduced oxygenation of inshore waters, particularly along the southern lines. Along line 93 (off San Diego) for example, the hypoxic zone (< 1.4 ml/ l) shoaled from > 350 m water depth at the offshore stations (300 km offshore) to 150 m at the most inshore station (Fig 8). Thus hypoxic water appeared on the inner shelf during this period, and was present along much of the inshore CalCOFI survey area at 200 m (Fig. 9). This is the shallowest level that hypoxia has been observed since July 1997, and is consistent with a long-term trend towards declining oxygen levels in the region.

No single explanation is evident, but contributing factors may include an intense upwelling event or increased northward advection of low-oxygen tropical water. We note that the hypoxic waters will undoubtedly be associated with reduced pH.

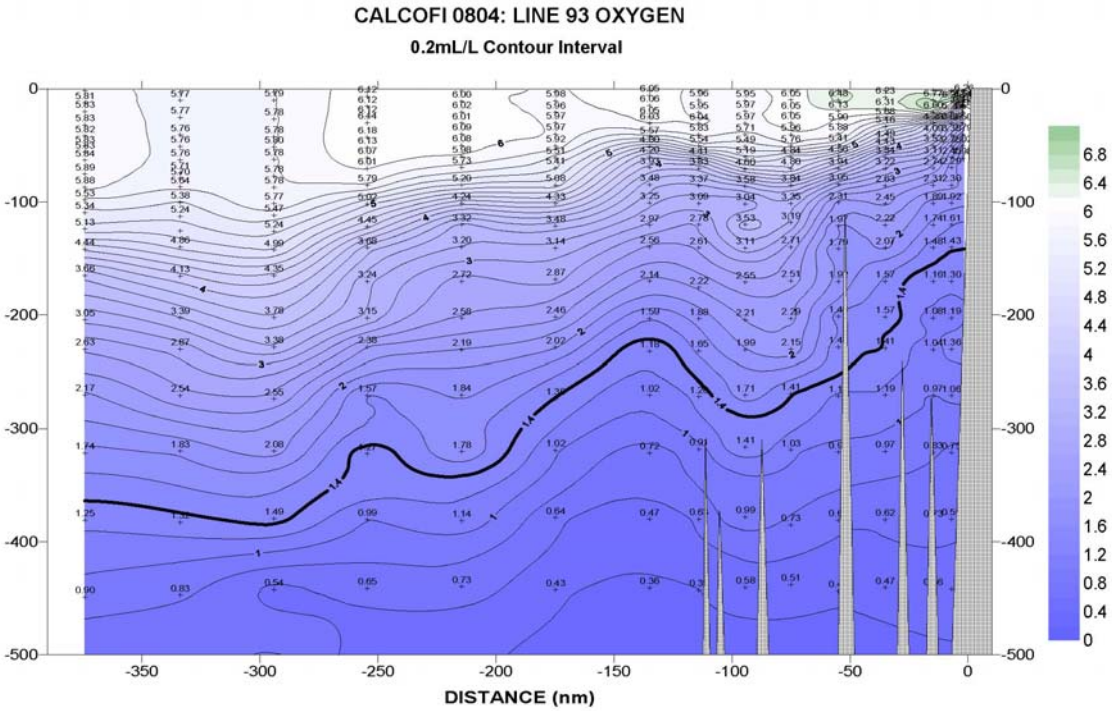


Figure 8. Oxygen values (ml/l) generated during the last CalCOFI cruise (24 March- 9 April) revealed low dissolved oxygen levels, particularly along the southern lines.

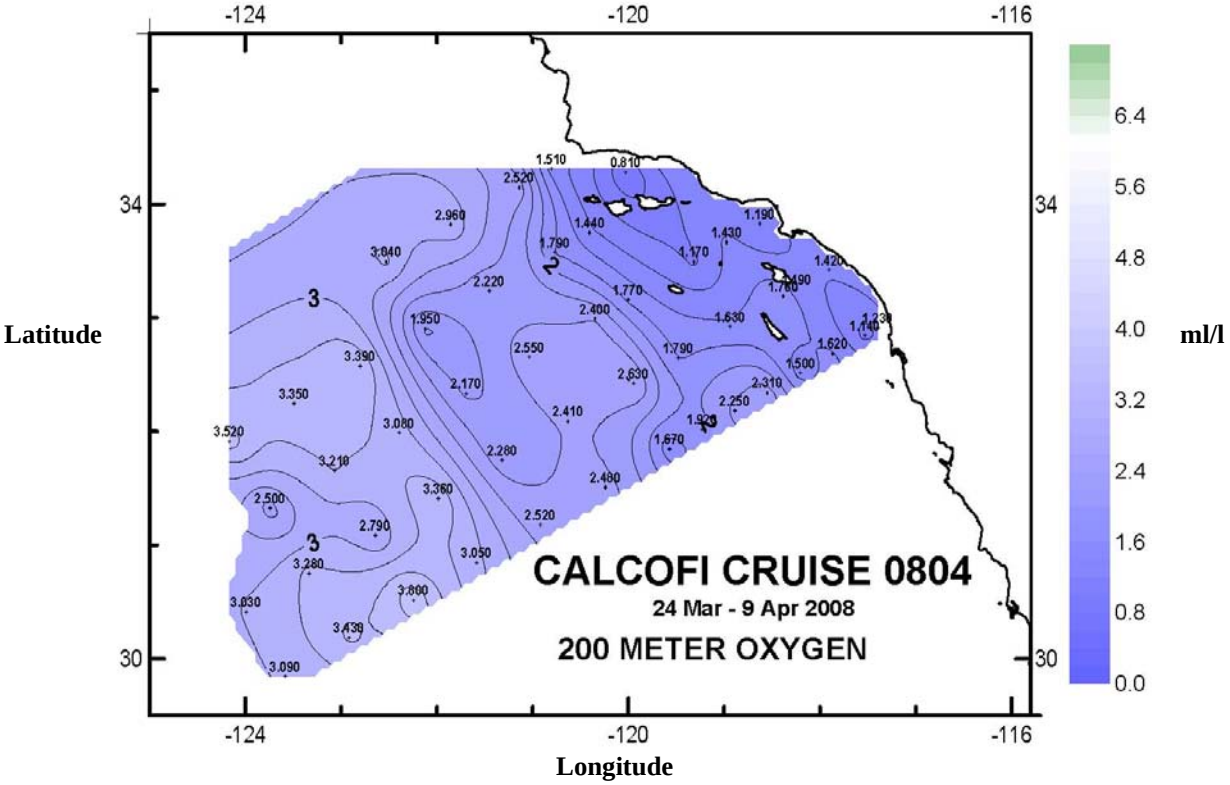
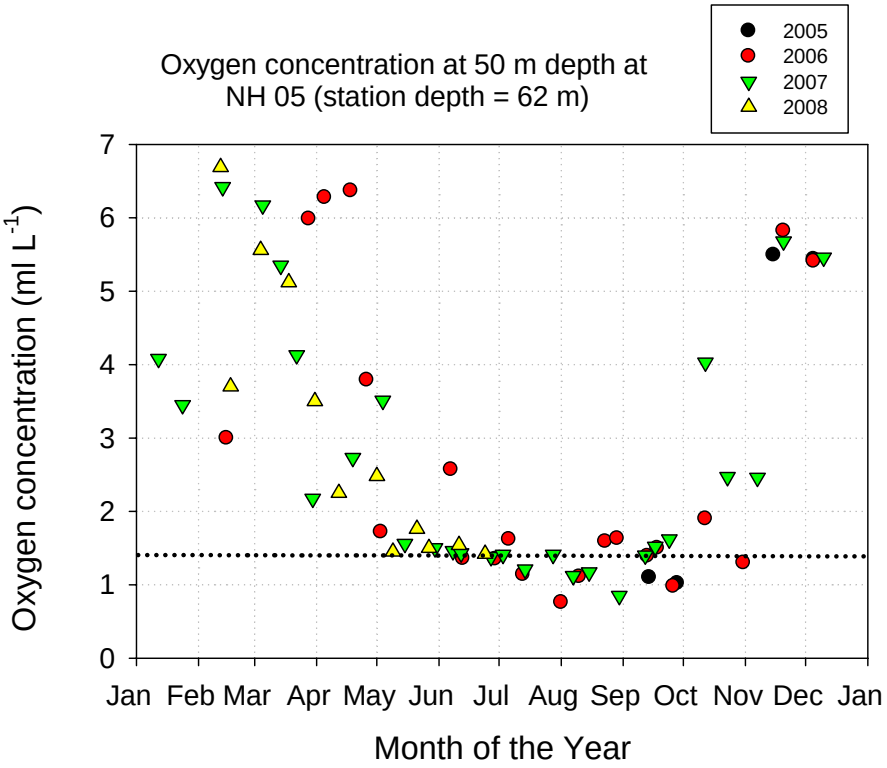


Figure 9. Map of oxygen concentrations at 200 m across the CALCOFI grid.

Oxygen at 50 m depth at Newport Hydrographic (NH) line, Oregon (Figure 10):



Source: Bill Peterson, NOAA

Figure 10. Low oxygen values were first observed in early May but values have not yet fallen below 1.4 ml L^{-1}. Hypoxia is expected July 2008. NH = Newport Hydrographic line, Oregon.

Appendix

MEMORANDUM

to Establish the

PACIFIC COAST COLLABORATIVE

PREAMBLE

THE GOVERNMENTS OF ALASKA, BRITISH COLUMBIA, CALIFORNIA, OREGON, AND WASHINGTON,

Recognizing the unique and shared circumstances of the coastal and Pacific jurisdictions of North America;

Partners in taking action to address climate change;

Committed to collaboration and collective action to maximize the impact of our individual and joint actions;

Sharing a common vision of Pacific North America as a model of innovation and sustainable living in the Pacific Century that creates new and growing economic opportunities for our citizens;

Desiring therefore to create a model for sharing best practices, a framework for cooperative action, a forum for leadership, and a common voice on issues affecting the Pacific coast region;

NOW THEREFORE HEREBY AGREE AS FOLLOWS:

Establishment of the Pacific Coast Collaborative

1. The Pacific Coast Collaborative ("the Collaborative") is hereby established by this Memorandum.
2. The signatories as represented by their Governor or Premier, as the case may be, are members of the Pacific Coast Collaborative.

Objectives

3. The Pacific Coast Collaborative is being established in recognition of, and to address, the unique and shared circumstances of the Pacific coastal areas and jurisdictions in North America by providing:
   - a framework for cooperative action;
   - a forum for leadership and the sharing of information on best practices; and
   - a common voice on issues facing coastal and Pacific jurisdictions.

Mandate

4. The Collaborative shall provide for an annual meeting to initiate, undertake and review joint actions and the coordination of individual actions by its member governments on:
   - Clean Energy;
   - Regional transportation;
   - Innovation, research and development;
   - Enhancing a sustainable regional economy, especially with respect to environmental good and services;
   - Emergency management; and
   - Other areas as determined that would benefit from cooperative action.
5. To this end, future agreements reached by all signatories to this Memorandum pursuant to Article 4 will be set out in an Appendix 1 and incorporated into this Memorandum.
6. Future agreements pursuant to Article 4 that apply to some signatories to this Memorandum will be set out in an Appendix 2, and they will apply only to those signatories that have signed them.

Organization

7. The Collaborative is under the responsibility of the signatories, the Governors of Alaska, California, Oregon and Washington, the Premier of British Columbia, and the Governors of other Pacific North American jurisdictions who may wish to join.
8. The Collaborative shall meet at least once a calendar year. The Chair and the meeting location will rotate annually through each jurisdiction. Each member of the Collaborative is responsible for their representatives' travel expenses to attend such meetings.
9. Any member of the Collaborative may propose initiatives and agreements to be added to Appendix 1 or Appendix 2 of this Memorandum, or amendments to this Memorandum.
10. Decisions or resolution of any disagreements with respect to this Memorandum shall be by consensus.
11. Decisions or resolution of any disagreements with respect to any of the initiatives or agreements set out in Appendix 1 or Appendix 2 of this Memorandum shall be as provided for in those agreements.

Final Provisions

12. Nothing in this Memorandum alters the legislative or other authorities of the state or provincial legislatures or of the state or provincial governments or the rights of any of them with respect to the exercise of their authorities under the Constitution of the United States or the Constitution of Canada as the case may be.
13. The parties agree that participation as a member of the Collaborative established in this Memorandum is voluntary and no party to this Memorandum may bring legal action to enforce any provision herein or amendment thereto.
14. This Collaborative comes into effect on July 1, 2008.

SIGNED AT JACKSON HOLE, WYOMING, ON THE OCCASION OF THE 2008 ANNUAL MEETING OF THE WESTERN GOVERNORS ASSOCIATION, THIS 30TH DAY OF JUNE 2008.

SARAH PALIN
Governor of Alaska

GORDON CAMPBELL
Premier of British Columbia

ARNOLD SCHWARZENEGGER
Governor of California

THEODORE R. KULONGOSKI
Governor of Oregon

CHRISTINE O. GREGOIRE
Governor of Washington