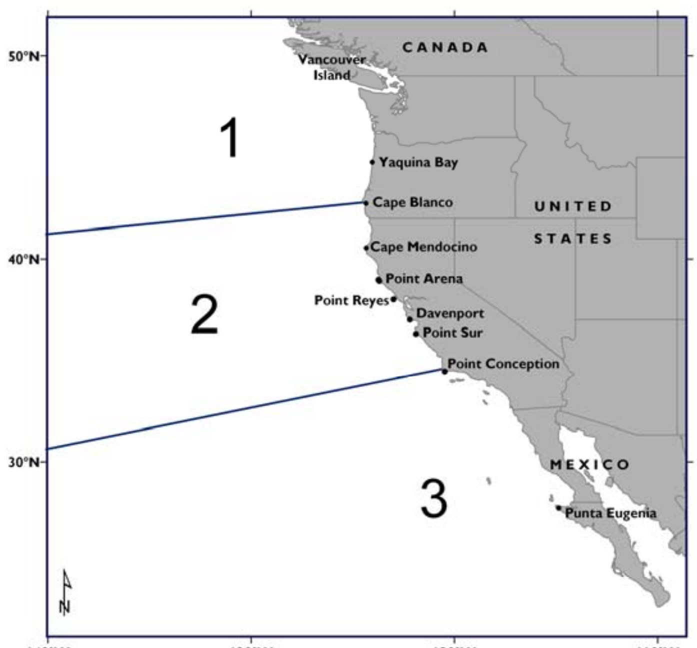
Climatic and Ecological Conditions in the California Current LME for July to September 2009

Summary of climate and ecosystem conditions for Quarter 3, 2009 (July to September) for public distribution, compiled by PaCOOS coordinator Rosa Runcie (email: Rosa.Runcie@noaa.gov). Full content can be found after the Executive Summary.

Previous summaries of climate and ecosystem conditions in the California Current can be found at http://pacoos.org/

CLIMATE CONDITIONS IN BRIEF

- **El Niño Southern Oscillation (ENSO):** A moderate El Niño is expected to strengthen and last through the Northern Hemisphere Winter 2009-2010.
- **Pacific Decadal Oscillation (PDO):** The PDO was negative for 23 months, which is the longest run of negative values since the 1966-1968 period. The higher July values and the marginally positive PDO value in August and September 2009 suggest a reversal of the PDO pattern.
- **Upwelling Index (UI):** Upwelling was weak at the beginning of July. Moderately strong upwelling occurred mid July from Point Sur, California (36°N) to the California Oregon boarder (42°N). Late August there were two strong negative UI pulses at Cape Scott, British Columbia (51°N).
- **Madden Julian Oscillation (MJO):** The MJO index indicated a weak amplitude and showed little to no eastward propagation throughout the July to September period.
- **Water Temperature and Salinity at station NH 05, OR and averages over all 66 CalCOFI stations, CA:**
  Oregon: Bottom temperatures during the third quarter (July-September 2009) at a mid-shelf station off Newport were fresher and warmer than during the past four years.
  California: Temperatures at a depth of 10 m, averaged over the 66 station survey area were slightly below long-term averages, suggesting that the equatorial El Niño had not affected the mixed layer throughout the study area. However, at depths greater than 125 m significantly elevated temperatures were associated with areas where northward flow of water occurs. This flow may be the first effect of the equatorial El Niño on the region.



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

ECOSYSTEM CONDITIONS IN BRIEF

- **California Current Ecosystem Indicators:**
    1. **Copepods:**
       Oregon and California: Samples collected spring 2008-2009 at Trinidad Head line, CA, station TH02, and were analyzed to begin comparing zooplankton community structure along the Trinidad and Newport lines. The TH02 samples were different then the Newport, OR station NH 05. First TH02 had a mixed oceanic zooplankton assemblage including both the boreal and warm water oceanic species. Second, TH02 had much lower abundances of the boreal neritic copepod species than are common off central Oregon (McClatchie et al., 2009).
       Baja California: None of the samples showed a change in the biological variables (Chl a, zooplankton biomass or the abundance of copepods or euphausiids) in response to the 2007/08 La Niña conditions off Baja California. Over the last decade a strong covariation was observed between sea surface salinity (SSS) and Chl a and zooplankton biomass with the surface – 200 m salinity gradient (McClatchie et al., 2009).
    2. **Krill**
    3. **Juvenile Rockfish**
    4. **Coastal Pelagics:**
       Humboldt Squid: *Dosidicus gigas*, were a large fraction of the catch in the summer survey off Newport, Oregon. Large numbers were also stranded along the coasts of Oregon and Washington including the Straits of Juan de Fuca (49°N). Fishers claim that these squid are taking hooked salmon.
    5. **Salmon:** Landings of coho salmon off Oregon and Washington are extraordinarily high this year to date. Managers anticipate that this year will result in the highest landings of coho in decades.
    6. **Groundfish**
    7. **Midwater species**
    8. **Cassin's Auklet:** please see Marine Birds section below
- **Highly Migratory Species (tuna, sharks, billfishes):** Off Oregon, the recreational fishery for albacore has been fair to good, as the coastal upwelling zone has weekend. Off southern California, yellowfin tuna are coming within range of one day recreational boats.
- **Invasive Species**
- **Marine Birds and Mammals:**
  Marine Birds (2008 survey): The 2008 status report of seabirds on southeast Farallon Island states that Rhinoceros auklets exhibited anomalously high productivity and several others, such as Cassin's Auklets, showed significant increases over the last few seasons. In contrast, Brandt's and Pelagic Cormorants had very low productivity.
  Marine Mammals (2008 survey): Species diversity in the summer of 2008 was lower than average, with observations recording only four dolphin species and five large whale species. Common dolphin (*Delphinus* sp.) counts were low throughout 2008 in comparison to previous years, and blue whale counts in 2008 were the lowest they have been since the initiation of systematic marine mammal survey effort in 2004. These apparent decreases in animal density may reflect geographic shifts in populations in response to colder than normal temperatures and poor feeding conditions. Counts of Dall's porpoise, a cold-temperate species, were greater than usual for a winter cruise in 2009. Due to low sample sizes it is difficult to detect statistically significant trends at this time (McClatchie et al., 2009).
- **Harmful Algal Blooms:**
  Oregon: Quarter three paralytic shellfish poisoning (PSP) levels rose above the alert level in mussels and clams along the entire Oregon Coast and domoic acid results continue to test below the alert level along the entire Oregon Coast, from the mouth of the Columbia River to the California border.

California: *Pseudo-nitzschia* was detected at several sites in northern and southern California and domoic acid was not detected in any shellfish samples collected in July or August.

- **Dissolved Oxygen Concentration:**
  Oxygen concentrations in deep water at the mid-shelf station, NH 05, on the Newport OR transect only fell below the hypoxia threshold of 1.4 ml L^{-1} on three occasions (8 July, 23 July and 27 Aug) during the biweekly cruises in 2009.
- **Quarterly Publications and Websites related to the California Current published during Quarter 3, 2009 (see Appendix for cumulative list for 2008 and 2009)**

Jahncke, J., Saenz, B. L., Abraham, C.L., Rintoul, C., Bradley, R.W., Sydeman, W. J. (2008). Ecosystem responses to short-term climate variability in the Gulf of the Farallones. *California Progress in Oceanography* 77, 182-193.

McClatchie, S., Charter, R., Watson, W., Lo, N., Hill, K., Gomez-Valdes, J., Lavaniegos, B. E., Gaxiola-Castro, G., Schwing, F. B., Bograd, S. J., Gottschalck, J., L'Heureux, M., Xue, Y., Peterson, W.T., Emmett, R., Collins, C., Koslow, J. A., Goericke, R., Kahru, M., Mitchell, B. G., Manzano-Sarabia, M., Bjorkstedt, E., Ralston, S., Field, J., Rogers-Bennet, L., Munger, L., Campbell, G., Merkens, K., Camacho, D., Havron, A., Douglas, A., Hilderbrand, J. (2009) The state of the California current, spring 2008-2009: Cold conditions drive regional differences in coastal production. *CalCOFI Reports* Volume 50 (in press).

CLIMATE CONDITIONS

El Niño Southern Oscillation (ENSO):
Source: **http://www.cdc.noaa.gov/people/klaus.wolter/MEI/mei.html,**
http://www.cpc.noaa.gov/products/analysis_monitoring/enso_advisory/

Moderate to weak El Niño conditions were present during July 2009, as monthly sea surface temperatures (SST) departures ranged from +0.5°C to +1.5°C across the equatorial Pacific Ocean, with the largest anomalies in the eastern half of the basin. Weak El Niño conditions continued during August 2009, as sea surface temperature (SST) remained above-average across the equatorial Pacific Ocean. Early September values of the Niño-region SST indices were between +0.7°C to +1.0°C (Figure 1). Current conditions, trends, and model forecasts favor the continued development of a weak-to-moderate strength El Niño into the Northern Hemisphere for the fall 2009, with the likelihood of at least a moderate strength El Niño during the winter 2009-10.

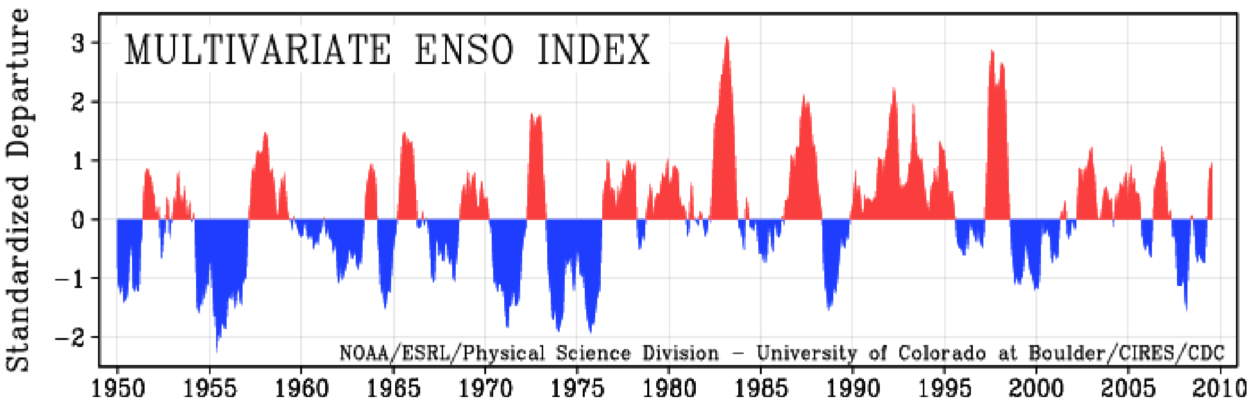


Figure 1. NOAA Physical Sciences Division attempts to monitor ENSO by basing the Multivariate ENSO Index (MEI) on the six main observed variables over the Pacific. These six variables are: sea-level pressure, zonal and meridional components of the surface wind, sea surface temperature, surface air temperature, 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.cpc.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.doc ***(July 2009 report)***

Subsurface oceanic heat content anomalies (average temperatures in the upper 300m of the ocean; Figure 2) continued to reflect a deep layer of anomalous warmth between the ocean surface and thermocline, particularly in the central Pacific.

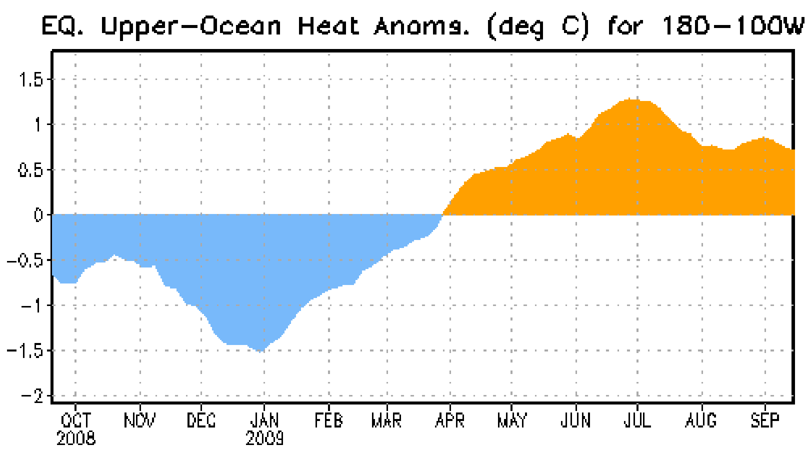


Figure 2. Area-averaged upper-ocean heat content anomalies (°C) in the equatorial Pacific (5°N-5°S, 180°-100°W). Heat content anomalies are computed as departures from the 1982-2004 base period pentad means. Since April 2009, the upper-ocean heat content has been above average across the eastern half of the equatorial Pacific Ocean. The heat content was previously below-average from mid-August 2008 through March 2009, with a minimum reached in late December 2008.

Pacific Decadal Oscillation (PDO) and Sea Surface Temperature at Newport, Oregon:

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

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

Major changes in the northeast Pacific marine ecosystem have been correlated with persistence and phase changes in the PDO; warm periods (+PDO) have generally seen enhanced coastal ocean biological productivity in Alaska and inhibited productivity off the west coast of the contiguous United States, while cool periods (-PDO) have the opposite north-south pattern of ecosystem productivity. For the first five months of 2009, -PDO patterns were associated with negative temperature anomalies and higher primary production in the eastern temperate Pacific, along the west coast of the United States. As the -PDO pattern weakened positive SST anomalies developed along the west coast of the US (Figure 3). After 23 months of negative PDO values, the August and September's values (0.09 and 0.52 respectively) were positive.

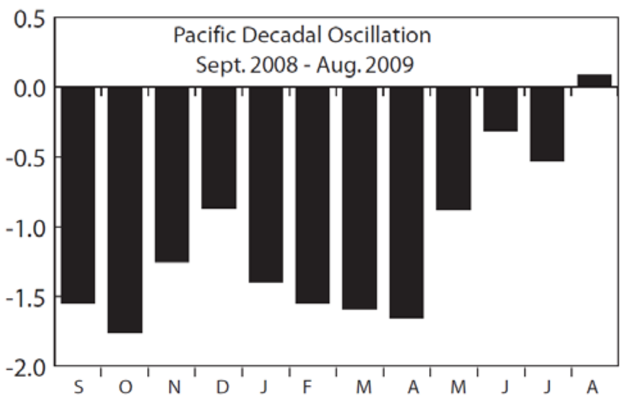


Figure 3. The graph shows monthly values for the Pacific Decadal Oscillation (PDO) Index for September 2008 through August 2009. The PDO is considered a long-lived El Niño like pattern of Pacific climate variability based on sea surface temperature measurements north of 10°N. This index was negative (-PDO) for 23 months, which is the longest run of negative values since the 1966-1968 period. The higher July values and the marginally +PDO-value in August 2009 suggest weakening and perhaps reversal of the -PDO pattern. However, there may be trend reversal to a strong -PDO pattern. This recurrent persistence of -PDO was observed in several years during the 1955 through 1967 period.

Sea surface temperatures measured at the NOAA Buoy 46050, 22 miles west of Newport, were cool through the first two quarters of 2009 but began to be less negative during the third quarter such that a positive temperature was observed in August 2009 (Figure 4). The warming in August 2009 may or may not be related to the El Niño conditions observed at the equator. We will not know until the autumn if the El Niño is influencing ocean conditions in the northern California Current.

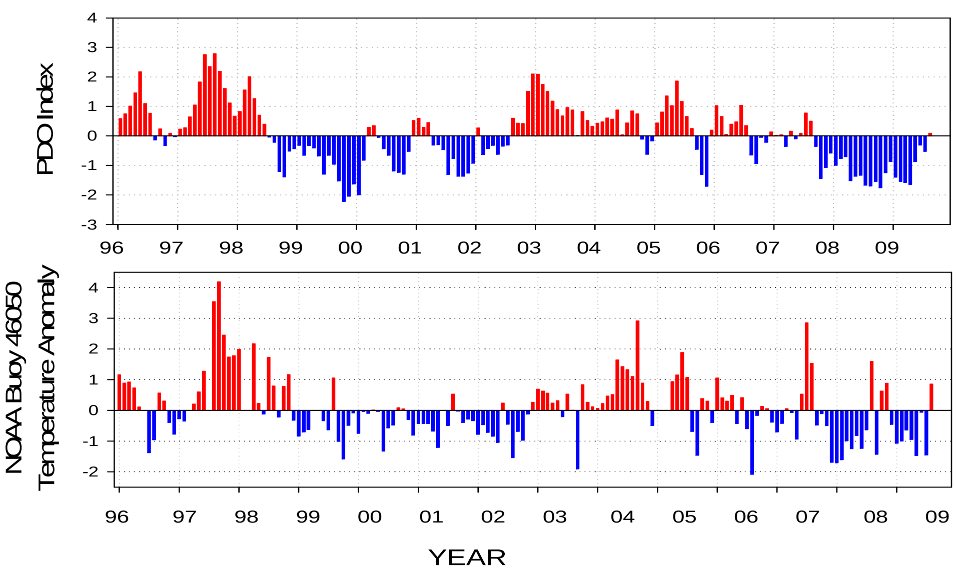


Figure 4. Time series of PDO (upper) and monthly temperature anomalies at the NOAA Buoy 46050 (lower) since 1996.

Upwelling Index:

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

Throughout July and August coastal upwelling-favorable winds characterized the U.S. West Coast. The NMFS/SWFSC/ERD monthly coastal upwelling index (UI) for July were below average from Baja California (30°N) to the California Oregon boarder (42°N) and at or below the long-term average from Baja California (30°N) to North of Depoe Bay, Oregon (45°N) for August (Figure 4). UI estimates show that upwelling was weak at the beginning of July, after which there were several days of moderately strong upwelling from Point Sur, California (36°N) to the California Oregon boarder (42°N). After August 23 there were two strong negative UI pulses at Cape Scott, British Columbia (51°N). September UI values were generally low and near long-term means. UI had significant positive values between 27°N and 39°N, but September values were consistently lower than the corresponding August UI values.

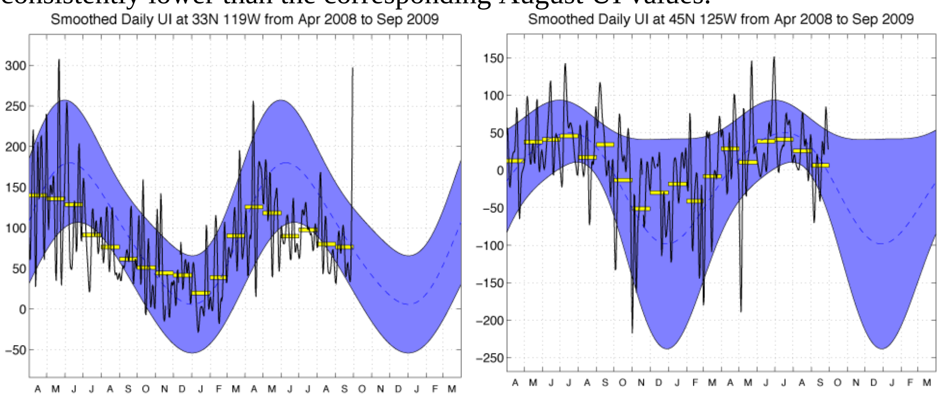


Figure 5. Left panel is recent 18 month record of upwelling for 33°N 119°W. Right panel is same for 45°N 125°W. Positive values are upwelling; negative values are downwelling. Dashed line is the climatological mean. Yellow bars are the means for each month during the period shown.

Regional Oceanic Conditions:

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

July 2009 monthly mean sea surface temperature (SST) fields show that areas of negative anomaly were found north of 42°N and southwest of Point Conception (34°N), but the largest part of the Pacific east of 160°W and between 0° and 60°N had neutral to positive SST anomalies (Figure 5).

August 2009 monthly mean SST fields for the eastern north Pacific show extensive areas of average to above average SST. Negative anomalies were found along the coast, within 150 km of shore, between the following latitudes: 28° to 32°N, 33° to 35°N, 38° to 39°N, 44° to 46°N and 49° to 50°N (Figure 5).

September 2009 monthly mean SST fields for the eastern north Pacific show extensive areas of average to above average SST. Positive SST anomalies exceeding 2.0°C occurred about 200 km west of Oregon and northern California, where SST was 17°-19°C (Figure 5). Coastal SST anomalies less than -1.5°C extended 100 to 300 km seaward between 34°N and 39°N. Negative anomalies were widespread along the Alaskan coast, extending westward to 160°E.

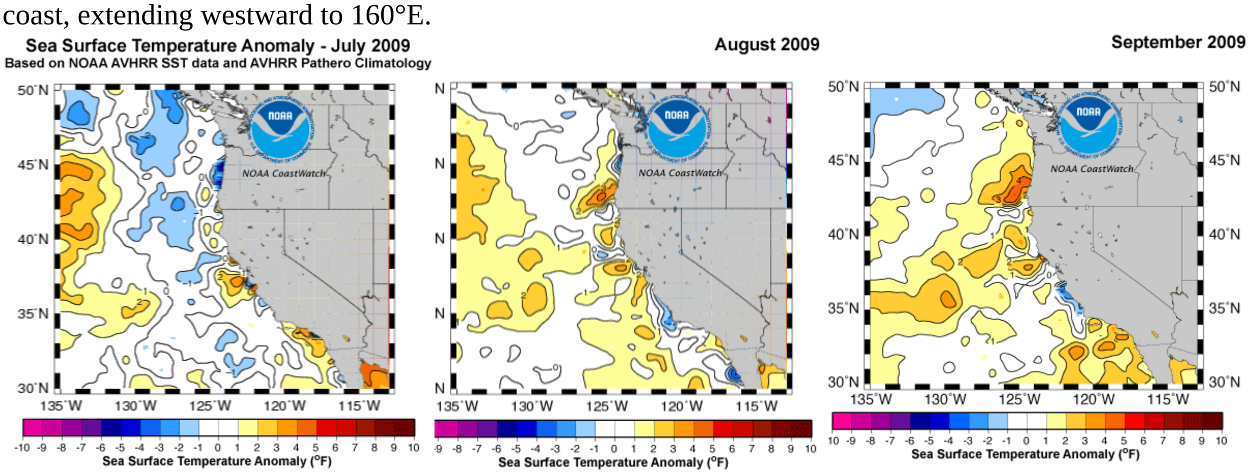


Figure 6. Regional oceanic conditions in the California Current Region.

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)***
The MJO was not active in July. In early August, the MJO index indicated weak amplitude with little propagation. 200-hPa positive velocity potential anomalies developed over the eastern Pacific and South America. Mid August, the MJO index increased in amplitude and showed little eastward propagation, 200-hPa velocity potential anomalies increased, and 850-hPa westerly vector wind anomalies were strong across the east-central Pacific. Late August, the index indicated a decrease in amplitude with no eastward propagation. In early September, the MJO index increased in amplitude and showed little eastward propagation. 200-hPa anomalies increased with strong upper-level convergence evident across the Americas, and 850-hPa westerly vector wind anomalies ended across most areas in the east-central Pacific. Mid September, 200-hPa vector wind anomalies showed a strong Pacific Jet in the Northern hemisphere. The following week, these anomalies continued across much of the Pacific and weakened. Late September, the MJO index maintained its amplitude and showed no eastward movement.

Deep Water Temperature and Salinity at Newport Hydrographic Line, OR:
Source: Bill Peterson, NOAA, NMFS
Bottom temperatures during the third quarter at a mid-shelf station off Newport were fresher and warmer than during the past four years. Conditions observed in 2009 resembled those in 2004 (Figure 7).

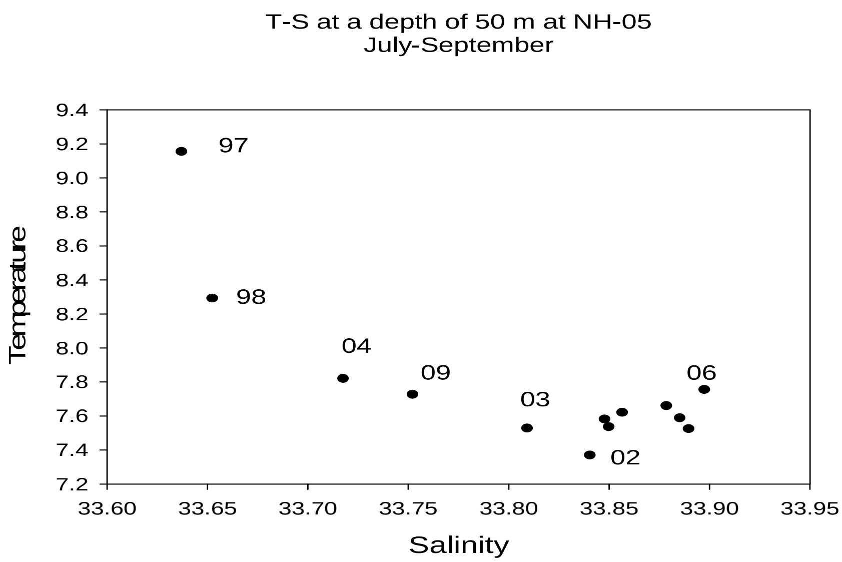


Figure 7. Temperature-salinity relationships at a depth of 50 m at an inner-mid-shelf station off Newport (station NH 05, five miles from shore), averaged for cruises in July-September (n ~ 9 cruises in each year). The unidentified data points are for the years 1999-2001 and 2005-2008.

Summer 2009 Observations by the SIO CalCOFI group
Source: Ralf Goericke, SIO
The summer CalCOFI survey was conducted in July 2009. Data collected during this cruise are still at a preliminary stage of data processing. Temperatures at a depth of 10 m (Fig. 8c), averaged over the 66 station survey area were slightly below long-term averages, suggesting that the equatorial El Niño had not affected the mixed layer throughout the study area. However, at depths greater than 125 m significantly elevated temperatures were associated with areas where northward flow of water occurs (Fig. 9). This flow may be the first effect of the equatorial El Niño on the region. Dynamic height anomalies showed the California Current meandering through the study area forming loops or eddies in various places (Fig. 8a), exiting the study area broadly along Line 93. The tongue of cold water extending SW from Pt. Conception reflects recent or active upwelling in this area, since nutrient concentrations in this area were high. The area of unusually high concentrations of phytoplankton biomass (Fig. 8d, Chl a) south of Pt Conception may well be the result of upwelling in the recent past. Overall phytoplankton biomass during this cruise was higher than long-term averages, primarily due to the presence of high concentrations of Chl south of Pt. Conception.

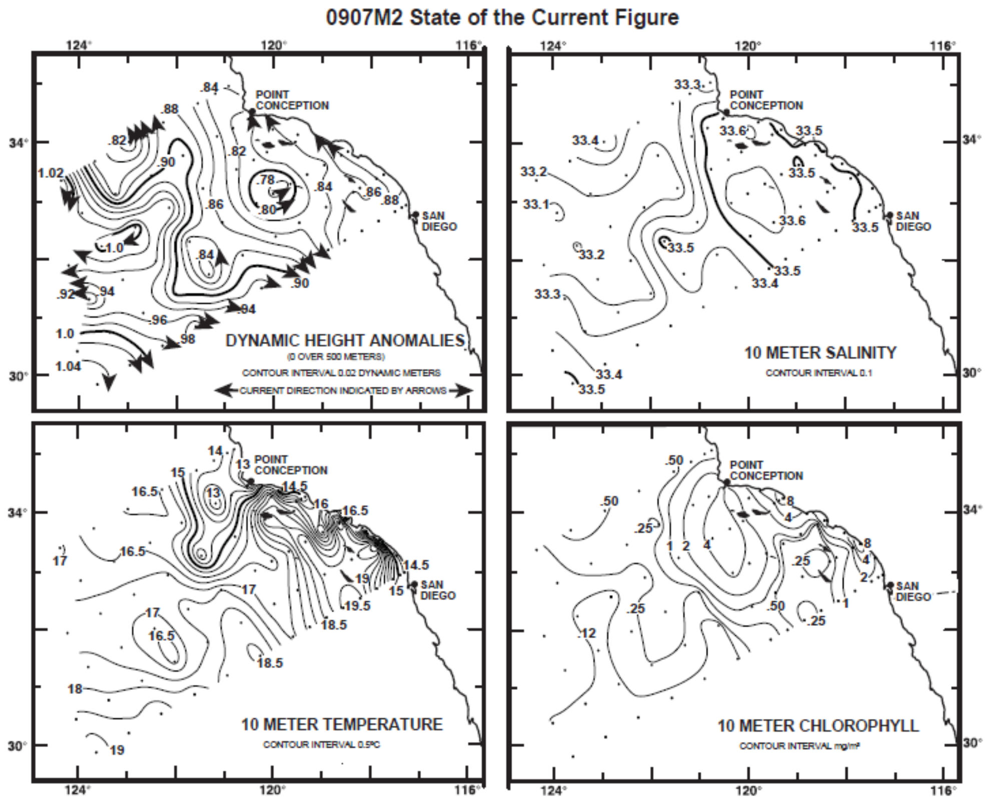


Figure 8. Spatial patterns for CalCOFI cruise 200907 including upper-ocean geostrophic flow estimated from the 0/500 dbar dynamic height field, 10 m salinity, 10 m temperature, and 10 m chlorophyll a.

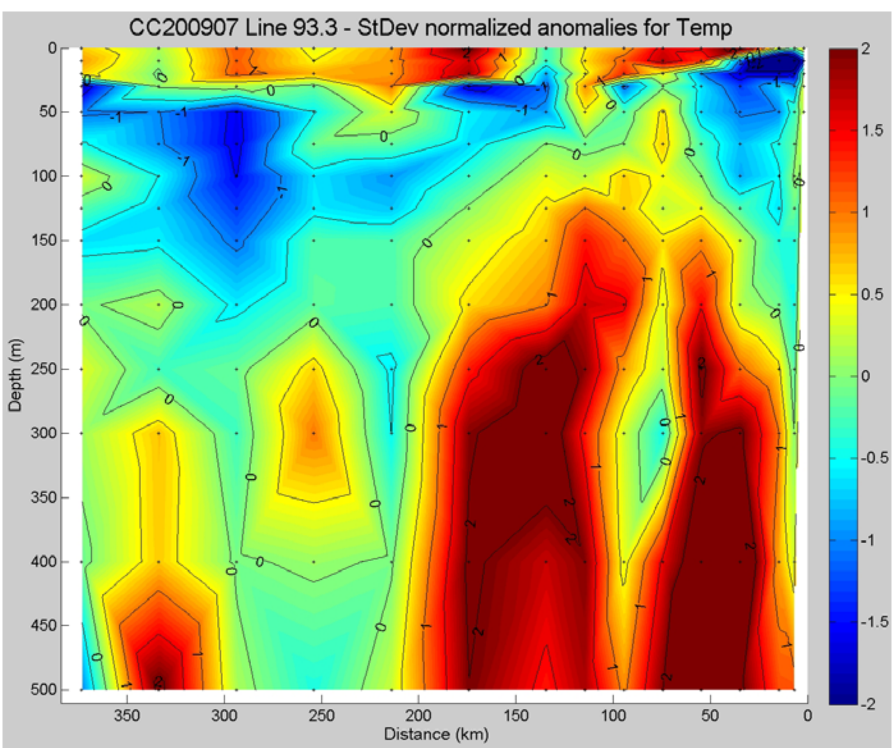


Figure 9. Temperature anomalies normalized by the standard deviation (dimensionless, since it is the deviation from the 1984 to 2008 average divided by the long-term average) along CalCOFI Line 93. Whereas the surface water is a patchwork of warmer and colder areas (likely due to the diurnal heating warming signal), at depth a strong warm anomaly is present, associated with the undercurrent and other water masses.

ECOSYSTEMS

California Current Ecosystem Indicators:
Copepods:
Source: Bill Peterson, NOAA, NMFS
Monthly copepod species richness was average during the third quarter (Figure 10).

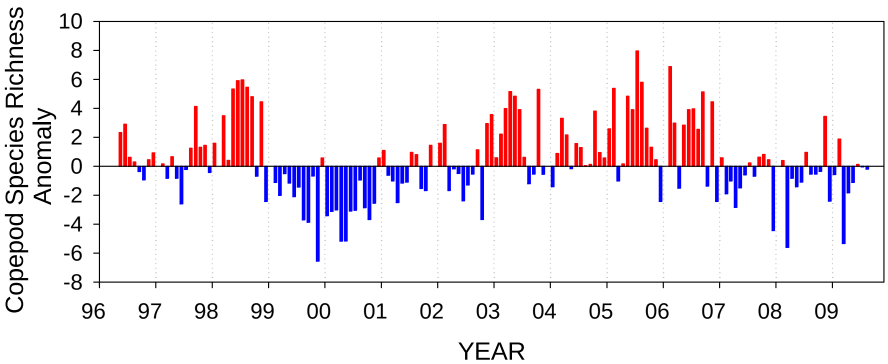


Figure 10. Time series of the copepod species richness, taken from Newport Hydrographic (NH) line, Oregon.

Comparison of Newport, Oregon line with Trinidad Head, California line 2008-2009:
Source: The state of the California current, Spring 2008-2009: Cold conditions drive regional differences in coastal production.
Source: (McClatchie et al. 2009) Sam *McClatchie (NOAA, NMFS), Eric Bjorkstedt (NOAA, NMFS, Humboldt State University)*
Since the Fall of 2008 the Newport Line zooplankton protocol has been used on the Trinidad Head California surveys. The samples collected at one of those stations, (station TH02, water depth of ~ 70 m) were analyzed to begin comparing zooplankton community structure along the Trinidad and Newport lines. TH02 was selected for the initial analysis because it was in the same water depth as most frequently sampled station on the Newport line, NH 05, in 62 m of water. Shelf waters in 2008 were colder than in 2007. Initial results show that despite the two stations being in inner-to-midshelf waters, TH02 appears quite different from station NH 05 in two ways. First TH02 has a more oceanic zooplankton assemblage including the boreal oceanic species *Neocalanus plumchrus*, *N. cristatus*, *Microcalanus pusillus*, as well as the warm water oceanic copepod *Calanus pacificus*. Second, TH02 had much lower abundances of the boreal neritic copepod species that are common off central Oregon: *Calanus marshallae*, *Tortanus discaudatus* and *Centropages abdominanlis*.

Zooplankton abundance, plankton biomass, and hydrological properties off Baja California (2008-2009):
Source: The state of the California current, Spring 2008-2009: Cold conditions drive regional differences in coastal production. **(McClatchie et al. 2009)** ***Sam McClatchie (NOAA, NMFS), Jose Gomez-Valdes, Bertha E. Lavaniengos, Gilberto Gaxiola-Castro, Marlenne Manzano-Sarabia (CICESE)***
Off Baja California the effects of basin-wide La Niña conditions on SST were evident only during early 2008; SSTs were close to long-term averages during the rest of 2008. None of the biological variables (Chl a, zooplankton biomass or the abundance of copepods or euphausiids – Figure 11) responded to the 2007/08 La Niña conditions. However, a strong covariation was observed between sea surface salinity (SSS) and Chl a (Figure 11) over the last decade. The exceptions are October 1997, January 1998 and the entire year of 2007. The relationship between Chl a and zooplankton biomass has changed over the last two years. During 1999-2006 the two measures were negatively correlated ($r^2 = 0.349$). In contrast anomalies for both measures have been positive during 2008.

Over the last decade zooplankton biomass covaried strongly with the upper 200 m salinity gradient, a proxy for stratification (Figure 12). The time series consists of two distinct periods, a period of weak stratification (and low zooplankton biomass) during July 1998 to Jan 2003 and a period of strong stratification (and high zooplankton biomass) during April 2003 to July 2008. Exceptions to these patterns were observed during the El Niños of 1997/98 and 2007 due to intrusion of equatorial water of a high salinity close to values of the undercurrent salinity. The abundances of the main suspension feeding crustaceans (copepods and euphausiids) were above long-term averages over the last four years (2004-2008; (Figure 11)); these time series do not show a distinct response to basin-wide forcing, i.e. ENSO or salinity signals. The covariation between copepod abundance and salinity gradient was not as strong as that observed for total zooplankton biomass but still significant (F=5.0, p=0.031 when weak and strong stratification periods were compared). Euphausiids did not show significant differences between stratification periods. Rather they showed high and erratic variability, excepting for a spell of negative anomalies since the transition to La Niña until July 2000.

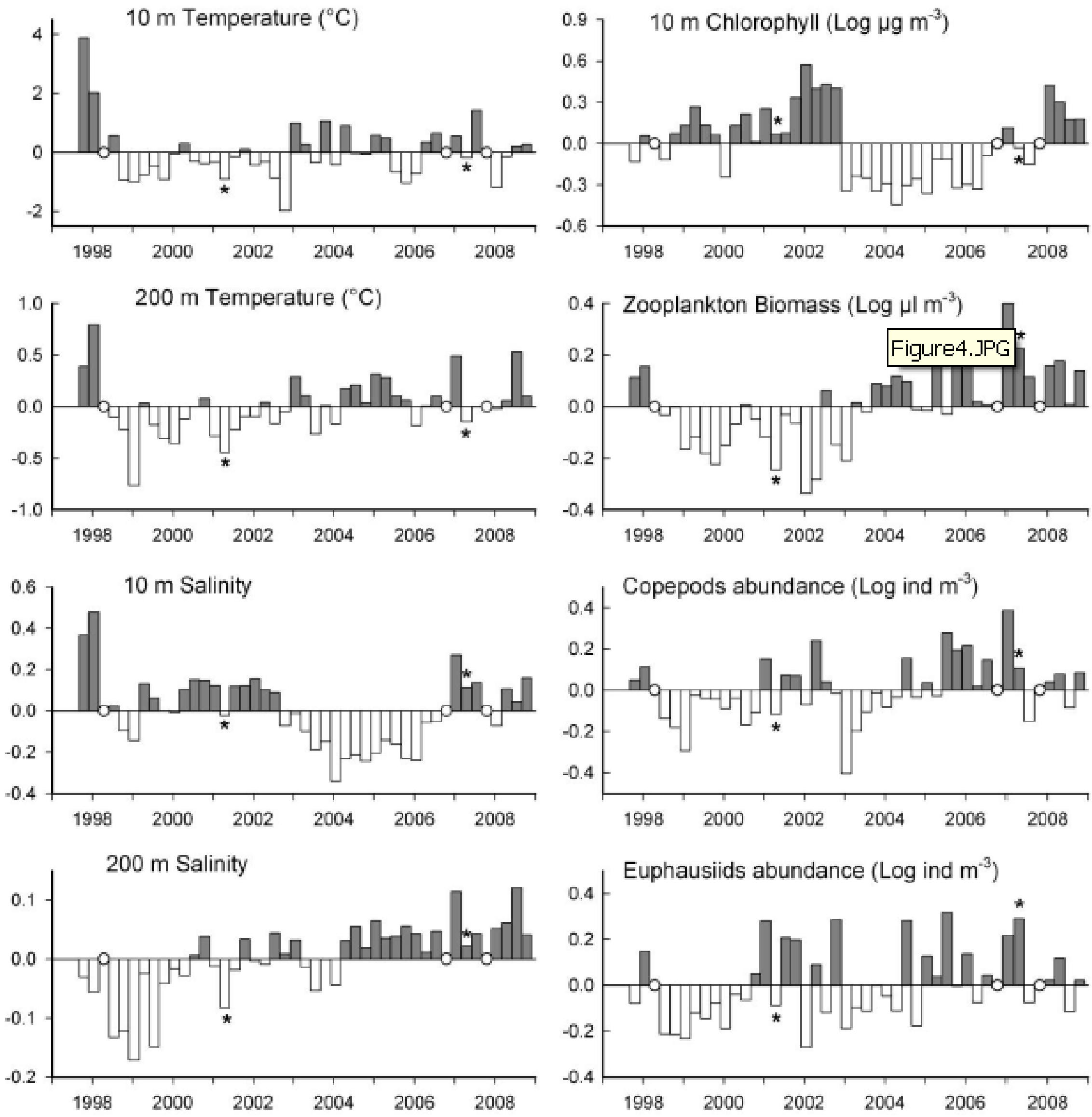


Figure 11. Time series anomalies of hydrological properties at two depths (temperature and salinity), plankton biomass (Chl and zooplankton displacement volume), and nighttime zooplankton abundance (copepods and euphasiids) estimated for the entire area off Baja California. Anomalies were calculated removing the seasonal means of the period 1997-2008. Open circles indicate missing cruises; the asterisk indicate data available only from north Baja California. Biological variables were previously transformed to logarithms.

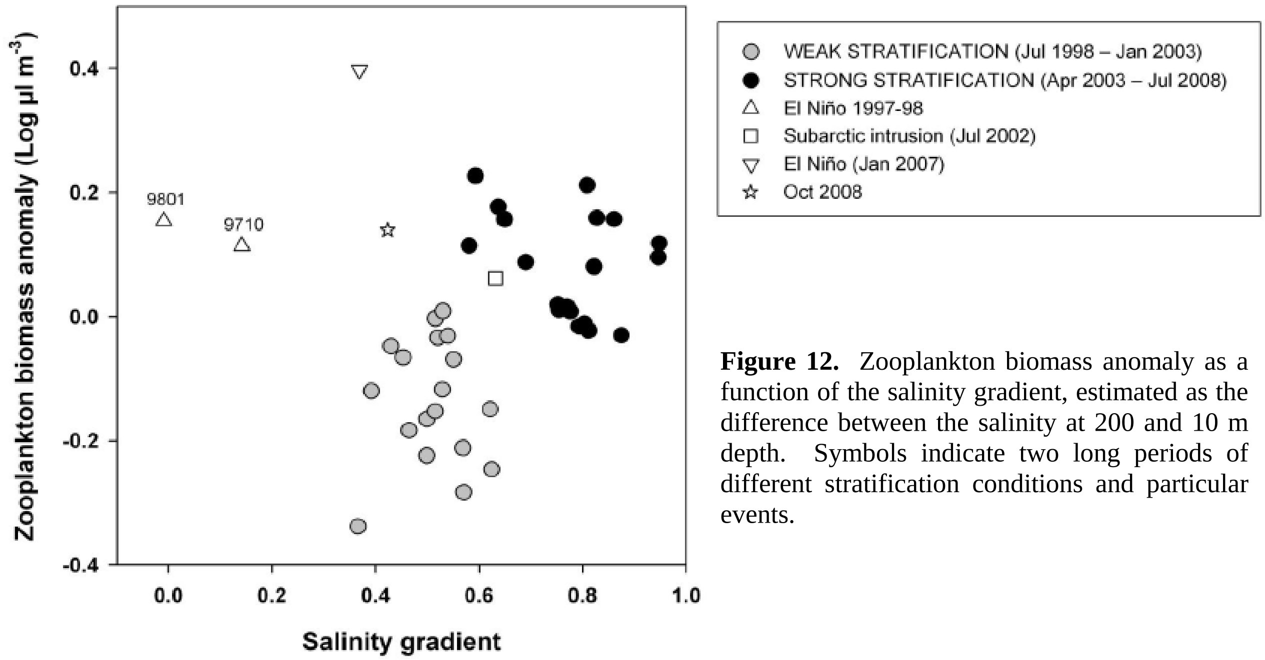


Figure 12. Zooplankton biomass anomaly as a function of the salinity gradient, estimated as the difference between the salinity at 200 and 10 m depth. Symbols indicate two long periods of different stratification conditions and particular events.

Coastal Pelagics:

Humboldt Squid:

Humboldt squid numbers in coastal waters off Oregon and Washington were very high during summer 2009:

Source: Bill Peterson, NOAA

The summer survey for juvenile salmon conducted by scientists at NOAA's Northwest Fisheries Science Center in shelf waters off Washington and northern Oregon resulted in unusually high catches of Humboldt squid and of ocean sunfish (Mola mola), suggesting the advent of the El Niño event. It is still too soon to make this call but the presence of large numbers of ocean sunfish certainly indicates shoreward transport of offshore subtropical waters into shelf waters of the northern California Current.

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

Dosidicus gigas, or Humboldt squid, have been stranded along the coasts of Oregon and Washington including the Straits of Juan de Fuca (49°N). Fishers claim that these squid are taking hooked salmon.

Salmon:

Source: El Niño Watch, Advisory http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi, Fish Passage Center, Portland, OR http://www.fpc.org/

July: Salmonid counts at the Bonneville Dam, 270 kilometers from the mouth of the Columbia River, show adult Chinook at 96% of last year and 83% of the 10-year averages and sockeye salmon at 83% and 226% of last year and 10-year averages, respectively. Steelhead trout passage has been 94% of 2008 and 121% of 10-year averages. On the Rogue and Umpgua Rivers in Oregon, Chinook salmon have been more abundant in 2009 than in the previous three years.

August: Chinook salmon counts on the Columbia River indicate an early start to the fall run, which sometimes leads to a larger than average return of spawning adults. The spring-summer run of Chinook into the Trinity River, a major tributary to the Klamath, was below average. However, the passage of steelhead in both rivers and the Columbia has been above average.

September: Salmonid counts on the Columbia River have been generally good. Summer Chinook, Fall Chinook, Coho, Sockeye and Steelhead have returned at 106%, 77%, 165%, 226% and 170%, respectively, of the ten-year averages. Unfortunately, Fall Chinook usually constitute the largest run. However, this is the second consecutive excellent year for sockeye salmon. The Klamath and Trinity River systems are receiving good returns of Fall Chinook, but low and warm river flows may lead to high mortality before spawning occurs.

Source: Bill Peterson, NOAA, NMFS

Landings of coho salmon off Oregon and Washington are extraordinarily high this year to date. Managers anticipate that this year will result in the highest landings of coho in decades. These returns can be attributed to superior ocean conditions observed during 2007, the year that the returning coho went to sea. Managers are also expecting high numbers of Chinook salmon in 2010, again, as a result of juveniles entering the ocean during the spring of 2008. Chinook salmon usually spend two to three years at sea before returning to their natal streams to spawn.

Highly Migratory Species:

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

August: Off Oregon, the recreational fishery for albacore has been fair to good, as the coastal upwelling zone has weakened. Off southern California, yellowfin tuna are coming within range of one day recreational boats. Dorado and yellowtail jacks are often encountered on the way to yellowtail fishing grounds, which are in the warmer waters pushing toward the Southern California Bight.

September: The influx of warm oceanic water from the southwest brought yellowfin tuna and other tropical game fish to within range of day trips from Southern California ports.

Marine Birds and Mammals:

Marine Birds:

Source: Status of seabirds on southeast Farallon Island during the 2008 breeding season
P.M. Warzybok, R.W. Bradley
Source: Jaime Jahncke (PRBO Conservation Science)

PRBO Conservation Science biologists, in partnership with USFWS and the Farallon National Wildlife Refuge, have monitored the population size and reproductive success of seabirds on Southeast Farallon Island (SEFI) continuously since 1971. Seabirds monitored include: Ashy Storm-petrel, Double-crested Cormorant, Brandt's Cormorant, Pelagic Cormorant, Western Gull, California Gull, Black Oystercatcher, Common Murre, Pigeon Guillemot, Tufted Puffin, Rhinoceros Auklet, and Cassin's Auklet.

The reproductive performance of seabirds on SEFI during 2008 was generally better than the pervious few seasons. All species except Western Gulls and Brandt's Cormorants experienced equivalent or higher reproductive success relative to 2007 and productivity for Cassin's Auklets, Rhinoceros Auklets, Pigeon Guillemots, and Pelagic Cormorants was significantly higher than any year since 2004 (Figure 13).

The 2008 population size was estimated for all species except Ashy Strom-petrels and Rhinoceros Auklets (Figure 14). Breeding populations were higher than the 2007 estimates for Pelagic Cormorants, Pigeon Guillemots, and Western Gulls while down for all other species.

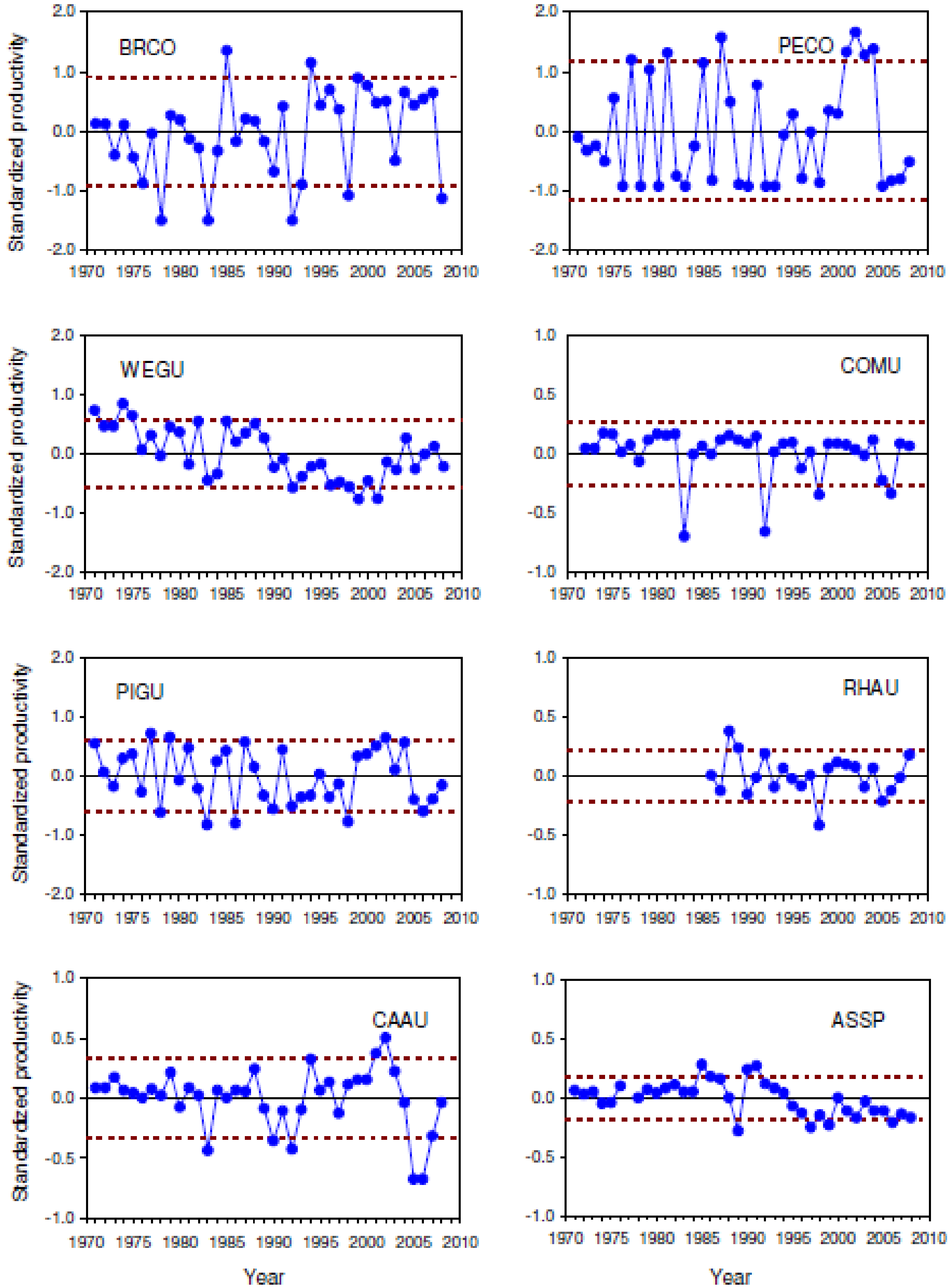


Figure 13. Standardized productivity anomalies (annual productivity – long term mean) for 8 species of seabirds on SEFI, 1971-2008. The dashed lines represent the 80% confidence interval for the long term mean.

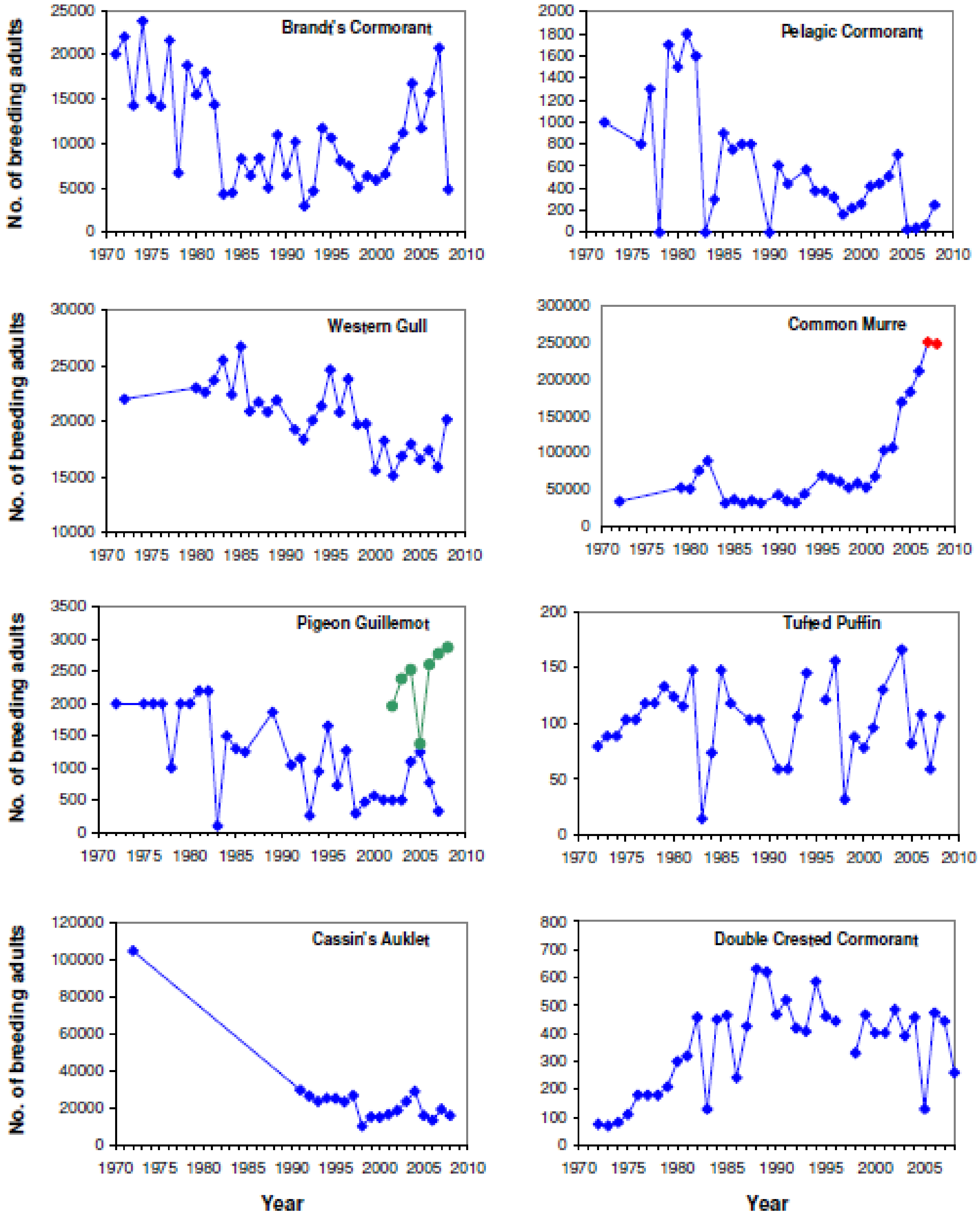


Figure 14. Population trends for 8 species of seabirds on Southeast Farallon Island, 1972-2008. Populations were determined by counting either individuals or nests on all visible areas on SEFI and West End. Please note the different scales on the Y-axis and the different methodology used for Common Murre population estimates beginning in 2007 (denoted by red points) and Pigeon Guillemot morning census numbers (denoted by green points).

Marine Mammals:

Ecosystem Survey of common dolphin, *Delphinus*, Species Report

Source: http://swfsc.noaa.gov/textblock.aspx?Division=PRD&ParentMenuId=612&id=15442

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

Field studies conducted in Quarter three by NOAA-Fisheries, SWFSC in the Southern California Bight collected data on 59 schools of common dolphins (*Delphinus* spp.). There are thought to be more than 200,000 common dolphins in this area. Risso's dolphins , fin, humpback and blue whales were also encountered during the study.

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

Impaired and dead yearling California sea lions have stranded in high numbers during Spring and Summer of 2009. The mortality of this year's pups at the San Miguel and San Nicolas Island rookeries was also high. Pup production was down by about 20%. Central California rescue centers were reporting fewer impaired pups during July.

The state of the California current, Spring 2008-2009: Cold conditions drive regional differences in coastal production.

Source: **(McClatchie et al. 2009)** ***Sam McClatchie, Richard Charter, William Wastson, Nancy Lo, Kevin Hill (NOAA, NMFS), Lisa Munger, Greg Cambell, Karlina Merkens, Dominique Camacho, Andrea Havron, Annie Douglas, JohnHildebrand (SIO)***

Cetacean visual survey data from the Spring 2008 suggest a decrease in overall species diversity and changes in abundance for some species within the CalCOFI study area. Species diversity in summer 2008 was lower than usual for the summer season, with observations recording only four dolphin species (including both forms of common dolphins) and five large whale species (including on opportunistic sperm whale sighting). Common dolphin (*Delphinus* sp.) counts were low throughout the year in comparison to previous years, and blue whale counts in 2008 were the lowest they have been since the initiation of systematic marine mammal survey effort in 2004. These apparent decreases in animal density may reflect geographic shifts in populations in response to colder than normal temperatures (common dolphins prefer warmer temperatures), poor feeding conditions (it has been suggested that blue whales are reoccupying former feeding grounds to the north or elsewhere, and/or other habitat variables). Counts of Dall's porpoise (*Phocoenoides dalli*), a cold-temperate species, were greater than usual for a winter cruise in 2009. Due to low sample sizes it is difficult to detect statistically significant trends at this time.

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 a toxin called paralytic shellfish poisoning (PSP), and *Pseudo-nitzschia* is the diatom that produces domoic acid.

Oregon HAB Summary

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

Paralytic shellfish poisoning (PSP) and domoic acid:

Status of HABs in OR as of October 5, 2009: PSP levels rose above the alert level in mussels and clams along the entire Oregon Coast and domoic acid results continue to test below the alert level along the entire Oregon Coast, from the mouth of the Columbia River to the California border. Most of the north and central coast has been closed to mussel harvesting and clamming will remain prohibited until PSP levels fall within a safe range.

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

Source: Zach Forster, Oregon Department of Fish and Wildlife

Oregon's Harmful Algal Bloom (OHAB) 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 15) for evidence of the phytoplankton species *Pseudo-nitzschia* and *Alexandrium*.

In late July and early to mid August 2009 *Pseudo-nitzschia* cell counts increased in the central and south coasts. Counts at Agate Beach were significantly higher than the rest of the test sites with a *Pseudo-nitzschia* count of 558,000 cell/liter. Late August, north and central coast test sites had some positive domoic acid tissue with the highest counts coming from Clatsop and Agate Beach Razors at 14 ppm and 8.8 ppm, respectively. *Pseudo-Nietzsche* cell counts at these same sites have consistently been decreasing since the beginning of August when cell counts reached a high of 900,000 cells/L. *Alexandrium* was present in all net tows coast wide along with multiple species of *Dinophysis* during September. *Pseudo-nitzschia* counts were low, the highest count was from the central coast (Agate Beach at 43,000 cells/L), domoic acid was not detected.

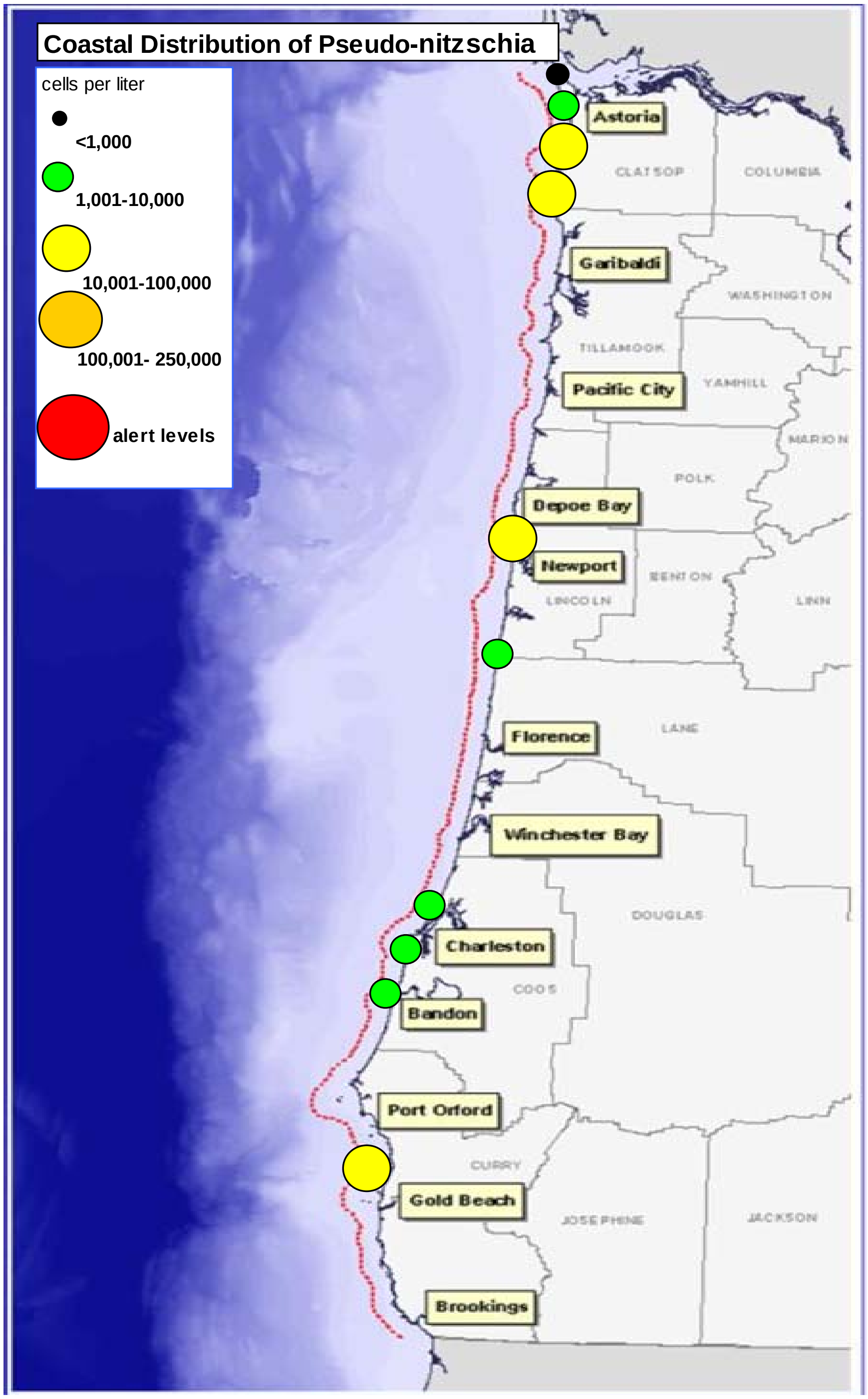


Figure 15. Oregon's Harmful Algal Bloom monitoring project in conjunction with Oregon Department of Agriculture is working to monitor ten sites along the Oregon coast. The coastal distribution of *Pseudo-nitzschia* (cells per liter) for September, 2009 are shown.

California HAB Summary

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

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

Southern California Summary: *Alexandrium* was observed along most of the southern California coast during July and at several locations between San Luis Obispo and Ventura counties during August. PSP toxins were not detected in any shellfish samples collected in July or August. *Pseudo-nitzschia* was detected along the entire southern California coast during July and August. Domoic acid was not detected in any shellfish samples collected in July or August.

Northern California Summary: *Alexandrium* was observed at many sampling sites in July, occurring at most sites between Bodega Bay and Monterey Bay. PSP toxins were detected in shellfish samples from Marin County sites for the first time in 2009. In August, *Alexandrium* was observed at locations between Del Norte and Santa Cruz counties. The third week of August there were alert levels of the PSP toxins at sites in Sonoma and Marin counties, persisting through the end of August. Toxin concentrations exceeded 600 ug/100 g in mussels from Bodega Harbor and Drakes Estero, reaching a maximum of 966 ug/100 g in the mid-Estero on August 20. PSP toxicity increased from below the alert level to well above within one day (46 µg on August 18 and 432 µg on August 19, respectively). These toxins were detected inside Tomales Bay throughout the month, exceeding the alert level by August 23. Elevated levels of the PSP toxins have not been detected inside Tomales Bay since 2002. *Pseudo-nitzschia* was observed at several sites in July and August. There was a continued decrease in *Pseudo-nitzschia* at sites in Monterey Bay compared to previous months. In July, the highest relative abundances of this diatom were observed offshore near the Farallon Islands. Domoic acid was not detected in any shellfish samples collected in July or August.

Dissolved Oxygen Concentration:

Source: Bill Peterson, NOAA

Oxygen concentrations in deep water at the mid-shelf station, NH 05, on the Newport OR transect only fell below the hypoxia threshold of 1.4 ml L^{-1} on three occasions (8 July, 23 July and 27 Aug, Figure 16) during the biweekly cruises in 2009. This result is largely because upwelling was relatively weak during the summer of 2009 with bottom waters being among the freshest and warmest during the past 13 years.

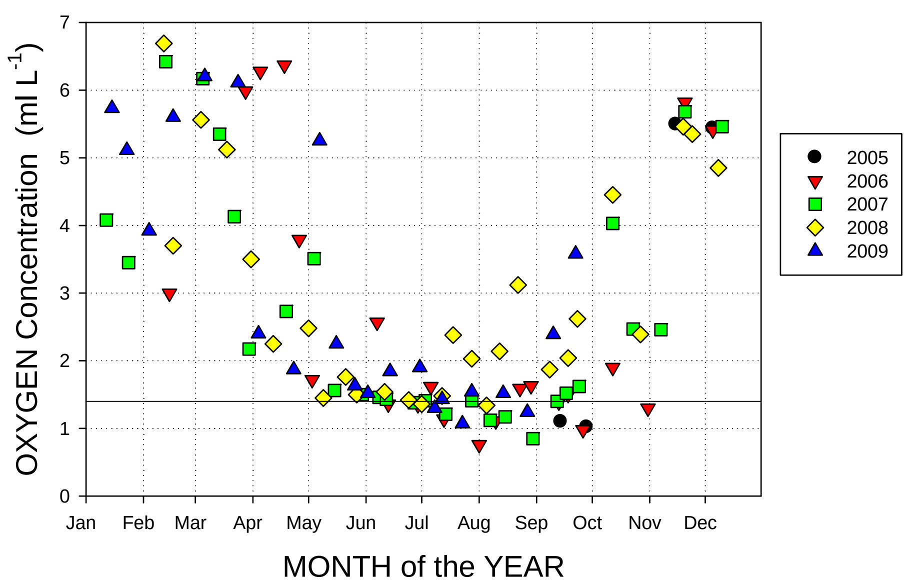


Figure 16. Oxygen concentrations at station NH-05 (five miles off Newport, OR), at a depth of 50 m. Station depth is 60 m.

Appendix:

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

Cooperative Zooplankton Dataspace. Historical access for zooplankton data from southern and central CA.
https://oceaninfo-dev.ucsd.edu/zooplankton/

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

News & Updates from the Southwest Fisheries Science Center homepage:
http://swfsc.noaa.gov/news.aspx?id=15134

NOAA Northwest Fisheries Science Center, ocean environmental time series data; salmon forecasting webpage http://www.nwfsc.noaa.gov, click on “Ocean Index Tools”

Norton, J.G., S.F. Herrick and J.E. Mason. 2009. Fisheries abundance cycles in ecosystem and economic management of California fish and invertebrate resources. In R.J.Beamish and B.J. Rothschild (eds.), The Future of Fisheries Science in North America, 227 -- 244. Springer Science, Neatherlands.

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

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

West Coast Governors’ Agreement on Ocean Health, Action Plan
The Office of the Governors: Washington, Oregon, and California
http://www.westcoastoceans.gov/docs/WCGA_ActionPlan_lowest-resolution.pdf

West Coast Regional Research and Information Needs Report
wsg.washington.edu/research/pdfs/WCRMRIN_2009.pdf