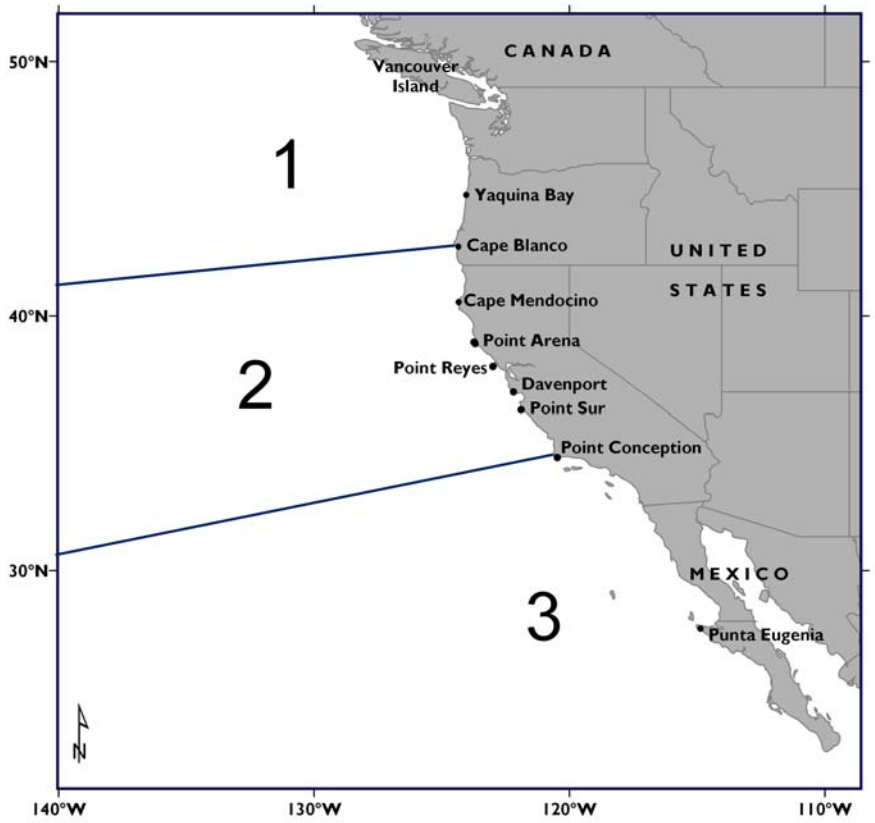
Climatic and Ecological Conditions in the California Current LME for July to September 2008

Summary of climate and ecosystem conditions for quarter 3, 2008 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 Nino Southern Oscillation (ENSO):** ENSO-neutral conditions are expected to continue through the end of 2008.
- **Madden Julian Oscillation (MJO):** In July, the OLR anomalies showed a northeast propagation of enhanced convection, indicative of weak MJO activity. Early August, equatorial westerly 850-hPa vector wind anomalies developed across the eastern Pacific. Late August, westerly 850-hPa vector wind anomalies strengthened across the eastern Pacific. Early September, the MJO showed a eastward propagation with an increase in amplitude.
- **Pacific Decadal Oscillation (PDO):** The PDO Index has been negative for the last 12 months, corresponding to enhanced productivity in the California Current Region. The last time that the PDO was negative for 12 consecutive months was during the 2001 - 2002 period.
- **Upwelling Index (UI):** July and August mean fields showed that intermittently strong upwelling between Yaquina Bay, Oregon (27°N) and Ensenada, Mexico (45°N) led to below average upwelling.



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

ECOSYSTEMS

- **California Current Ecosystem Indicators:**
    1. Copepods: The zooplankton community off Vancouver Island responded to the continuation of cool ocean conditions in early 2008 by showing positive abundance and biomass anomalies of endemic boreal and subarctic taxa, and negative anomalies of taxa from southern Oregon.
    2. Krill
    3. Rockfish juveniles: The SWFSC midwater trawl survey found more pelagic juvenile rockfish in spring 2008 (*Sebastes spp.*) than in 2005-07.
    4. Coastal Pelagics (Sardines and Anchovies): SWFSC surveys found sardines in coastal waters between Point Arena, California (39°N) and Cape Flattery, Washington (48°N). Sardine eggs were sampled off the Columbia River mouth (46°N) and in the Southern California Bight (34°N). Map of sardine and anchovy egg distributions is enclosed.
    5. Salmon: Through July, fish counts at the Bonneville Dam show good returns of chinook and steelhead; sockeye salmon counts have been four times the 10-year average. Escapement success has varied by river, but early observations confirm that salmonid return counts are generally higher in 2008 than in 2007.
    6. Groundfish
    7. Pacific Hake
    8. Sablefish
    9. Midwater species (Pacific mackerel): The PFMC recommends an acceptable biological catch of 51,772 mt and a harvest guideline for the Pacific mackerel directed fishery of 40,000 mt for the fishery season from July 1, 2008 through June 30, 2009. For 2007-2008 PFMC set the harvest guideline at 40,000 mt.
    10. Cassin's Auklet: Biological data demonstrates that in 2006 and 2007 productivity was low, or at best near average for Cassin's auklet.
- **Highly Migratory Species (tuna, sharks, billfishes):** Albacore were found 30 to 60 kilometers offshore Oregon at sharp ocean color (chlorophyll) gradients by fisheries. Albacore were also taken by fishers off southern California. The presence of yellowfin tuna and dorado in southern California landings suggest influx of tropical oceanic conditions.
- **Invasive Species:** The California Ocean Protection Council is in the process of funding projects to address vectors of invasion into California waters.
- **Marine Birds and Mammals:**
  Birds: Biological data demonstrates that in 2006 and 2007 productivity was low, or at best near average for Cassin's auklet while it was above average in 2007 for common murre (Wells et. al., 2008). The indices tuned to the Cassin's auklet and the common murre communities indicate that, while 2006 was well below average productivity, 2007 was about average.
  Mammals: Humpback and Blue Whales were commonly encountered by shore-based excursions operating from California ports in July and August 2008.
- **Harmful Algal Blooms:**
  In Oregon, reports provided week of September 1 to the Oregon Department of Agriculture indicated that levels produce domoic acid and/or *Pseudo-nitzshia* have increased along much of Oregon's central and southern coast. No ecosystem effects have been measured.
  The California coastwide marine biotoxin monitoring program/group reports that domoic acid-producing *Pseudo-nitzschia* numbers increased then decreased in July over a wide geographic region (roughly Monterey Bay to Los Angeles). There appeared to be a mix of toxic and nontoxic species, with the latter more dominant in most areas. Domoic acid has been absent from all samples tested. Also, PSP toxins have been completely absent for most of the year, an extremely rare occurrence.

- **Low Dissolved Oxygen:** Dissolved oxygen has been monitored during spring-summer 2008. Reports will be included in the next PaCOOS quarterly issue.
- **Publications: California Current Related (cumulative)**

Bograd, S.J., C. G. Castro, E. Di Lorenzo, D. M. Palacios, H. Bailey, W. Gilly, and F. P. Chavez. 2008. Oxygen declines and the shoaling of the hypoxic boundary in the California Current. Geophysical Research Letters 35 (12) L12607.
http://www.agu.org/journals/gl/gl0812/2008GL034185/2008GL034185.pdf

Brodeur, R., C. Suchman, D. Reese, T. Miller, and E. Daly. 2008. Spatial overlap and trophic interactions between pelagic fish and large jellyfish in the northern California Current. Marine Biology 154(4): 649-659.
http://www.springerlink.com/content/a6m3472t1h835342/fulltext.pdf

Carr, S. D., X. J. Capet, J. C. McWilliams, J. T. Pennington, F. P. Chavez. 2008. The influence of diel vertical migration on zooplankton transport and recruitment in an upwelling region: estimates from a coupled behavioral-physical model. Fisheries Oceanography 17: 1-15.

Di Lorenzo, E., N. Schneider, K. M. Cobb, P. J. S. Franks, K. Chhak, A. J. Miller, J. C. McWilliams, S. J. Bograd, H. Arango, E. Curchitser, T. M. Powell and P. Riviere. 2008. North Pacific Gyre Oscillation links ocean climate and ecosystem change. Geophysical Research Letters 35 (8) L08607.
http://www.agu.org/journals/gl/gl0808/2007GL032838/2007GL032838.pdf

Hay, D. E., K. A. Rose, J. Schweigert, and B. A. Megrey. 2008. Geographic variation in North Pacific herring populations: Pan-Pacific comparisons and implications for climate change impacts. Progress in Oceanography 77: 233-240.

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

McKinnell, S. 2008. Fraser River sockeye salmon productivity and climate: A reanalysis that avoids an undesirable property of Ricker's curve. Progress in Oceanography 77: 146-154.

Perry, R. I., J. F. Schweigert. 2008. Primary productivity and the carrying capacity for herring in NE Pacific marine ecosystems. Progress in Oceanography 77: 241-251.

Reiss, S., D. M. Checkley, an S. J. Bograd. 2008. Remotely sensed spawning habitat of Pacific sardine (*Sardinops sagax*) and Northern anchovy (*Engraulis mordax*) within the California Current. Fisheries Oceanography 17: 126-136.

Suchman, C.L., E.A. Daly, J.E. Keister, W.T. Peterson, and 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

Takasuka, A., Y. Oozeki, H. Kubota, and S. E. Lluch-Cota. 2008. Contrasting spawning temperature optima: Why are anchovy and sardine regime shifts synchronous across the North Pacific. Progress in Oceanography 77: 225-232.
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V7B-4S5FJ92-2&_user=4429&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_version=1&_urlVersion=0&_userid=4429&md5=3d5920d71acc8e64ccee3e889f8818d8

Wells, B. K., C. B. Grimes, J. G. Sneva, S. McPherson, and J. B. Waldvogel. 2008. Relationships between oceanic conditions and growth of Chinook salmon (*Oncorhynchus tshawyscha*) from California, Washington, and Alaska, USA. Fisheries Oceanography 17: 101-125.

Wells, B.K., J. Field, J. Thayer, C. Grimes, S. Bograd, W. Sydeman, F. Schwing, and R. Hewitt. 2008. Untangling the relationships among climate, prey, and top predators in an ocean ecosystem. Marine Ecology Progress Series. 364:15-29
http://www.int-res.com/articles/meps2008/364/m364p015.pdf

Yatsu, A., K. Y. Aydin, J. R. King, G. A. McFarlane, S. Chiba, K. Tadokoro, M. Kaeriyama, and Y. Watanabe. 2008. Elucidating dynamic responses of North Pacific fish populations to climatic forcing: Influence of life-history strategy. Progress in Oceanography 77: 252-268.

Yoo, S., H. P. Batchelder, W. T. Peterson, and W. J. Sydeman. 2008. Seasonal, interannual and event scale variation in North Pacific ecosystems. Progress in Oceanography 77: 155-181.

CLIMATE CONDITIONS

El Nino Southern Oscillation (ENSO):

July ENSO Report:

Source: The Coast Watch **http://coastwatch.pfel.noaa.gov/elnino.html** ***(Advisory 2008-07).***

The cool La Nina gave way to ENSO-neutral conditions in July2008. Positive trends in SST anomalies were found across most of the equatorial Pacific. NOAA analyses suggest that ENSO-neutral conditions in the tropical Pacific will persist into the Fall 2008. For details, see the official NOAA ENSO Advisory bulletin.

August ENSO Report:

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 ***(August 08 report)***

ENSO-neutral conditions continued during July 2008, as sea surface temperatures in the central equatorial Pacific Ocean remained near-average. As is typical with ENSO-neutral conditions, atmospheric and oceanic indicators were mixed, with certain areas in the equatorial Pacific Ocean suggesting a lingering influence of La Niña and others reflecting an increase in above-average temperatures, particularly in the eastern Pacific.

Subsurface oceanic heat content (average temperatures in the upper 300m of the ocean, see Figure1) has increased in response to positive temperature anomalies along the thermocline.

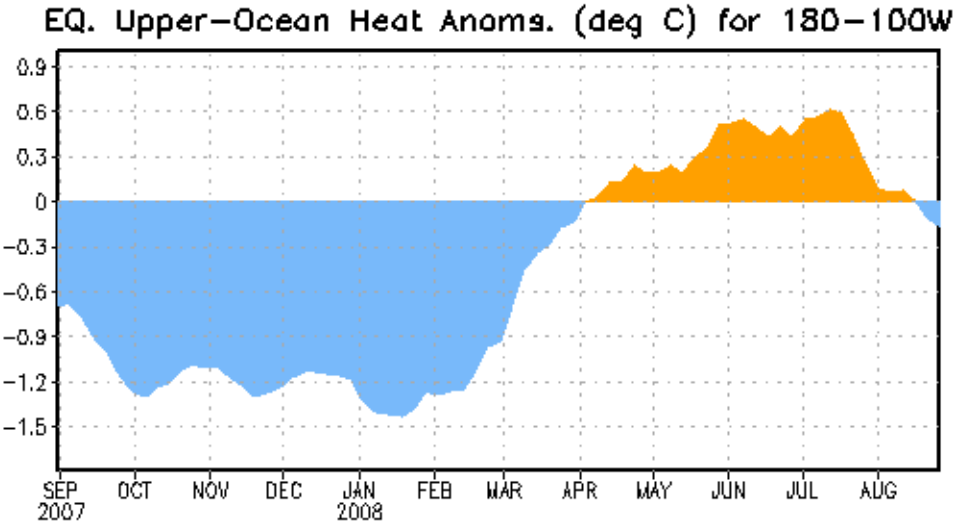


Figure 1. Area-averaged upper-ocean heat content anomalies (°C) in the equatorial Pacific (5°N-5°S, 180º-100ºW). Heat content anomalies are computed as departures from the 1982-2004 base period pentad means.

Source: The Coast Watch **http://coastwatch.pfel.noaa.gov/elnino.html** ***(Advisory 2008-08).***

Regional Oceanic Conditions: The negative SST anomalies off Oregon in July 2008 were replaced by positive anomalies in August 2008 (see Figure 2). Areas of negative SST anomalies occurred offshore north of 47°N and south of 32°N. Offshore areas of positive SST anomaly extended westward across the North Pacific between 20° and 40°N.

September ENSO Report:

http://www.cpc.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.doc ***(11 September 08 report)***

ENSO-neutral conditions continued during August 2008, as recent increases in sea surface temperatures (SSTs) abated across the equatorial Pacific Ocean. Above-average SSTs in the east-central and eastern Pacific diminished, while below-average SSTs in the central Pacific strengthened slightly. The subsurface oceanic heat content (average temperatures in the upper 300m of the ocean) also decreased in response to the emergence of negative temperature anomalies at thermocline depth in the east-central Pacific (Figure 1). ENSO-neutral conditions are expected to continue through the end of 2008.

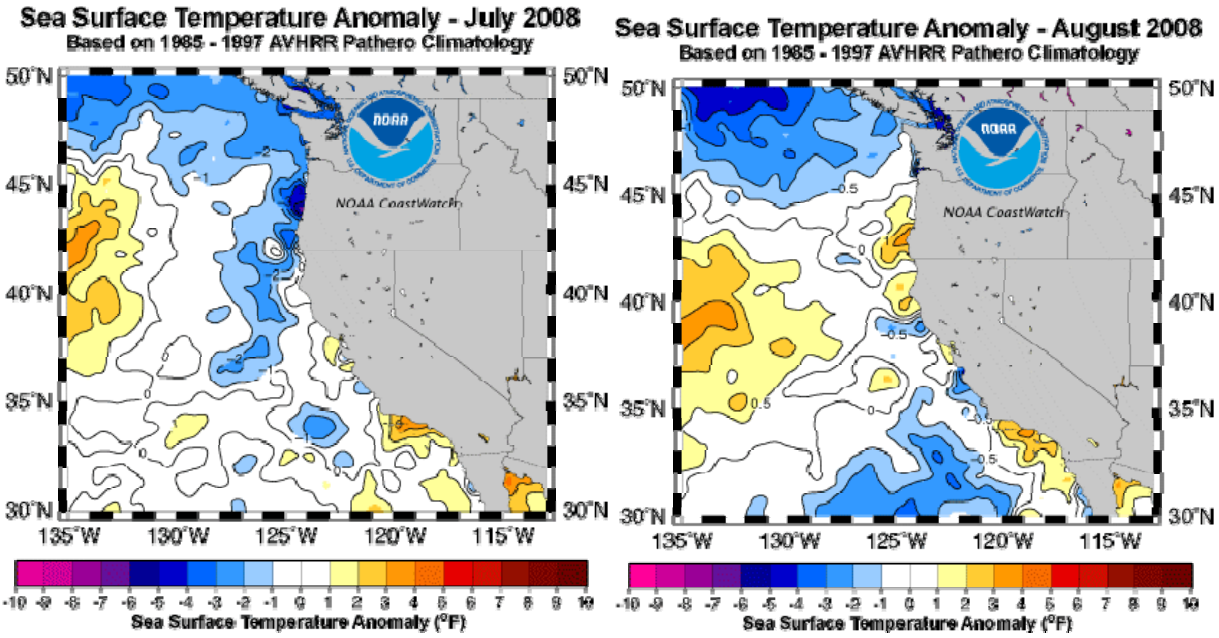


Figure 2. Equatorial Pacific Conditions: ENSO-neutral conditions in July gave way to cool La Nina processes in August 2008. Negative heat content anomalies strengthened in the central equatorial Pacific, while positive anomalies weakened in the eastern equatorial Pacific, official NOAA ENSO Advisory bulletin.

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)***

July and August:

During late-June and early July, convection was very active across the eastern Pacific, Central America, Mexico and western Africa. Outgoing longwave radiation (OLR) maps for June 25th to July 4th indicate wetter-than normal conditions (negative OLR anomalies). Early July, easterly 200-hPa zonal wind anomalies (ms-1) (anomalous east-to-west flow) were observed across the eastern Pacific Ocean.

Although the MJO index did increase in amplitude during the first week of July, no eastward propagation was evident indicating little MJO activity thru August. July 3 to July 7, 2008, westerly 850-hPa vector wind anomalies persisted across the eastern Pacific. The MJO index increased in amplitude during mid-July and an eastward propagation was evident. In late July, the OLR anomalies showed a northeast propagation of enhanced convection, indicative of weak MJO activity.

September:

Early September, the MJO showed a eastward propagation with an increase in amplitude.

Pacific Decadal Oscillation (PDO):

Source: Jerrold Norton, NOAA (Jerrold.G.Norton@noaa.gov)
Environmental Research Division, NOAA, NMFS

Major changes in northeast Pacific marine ecosystems have been correlated with phase changes in the PDO; warm eras have seen enhanced coastal ocean biological productivity in Alaska and inhibited productivity off the west coast of the contiguous United States (positive index values), while cold PDO eras (negative index) have seen the opposite north-south pattern of marine ecosystem productivity. The standardized values for the PDO index are derived as the leading Principal Component (PC - the statistical abstract of the sea-surface temperature anomaly) of monthly SST anomalies in the North Pacific Ocean, poleward of 20N. The monthly mean global average SST anomalies are removed to separate this pattern of variability from any "global warming" signal that may be present in the data.

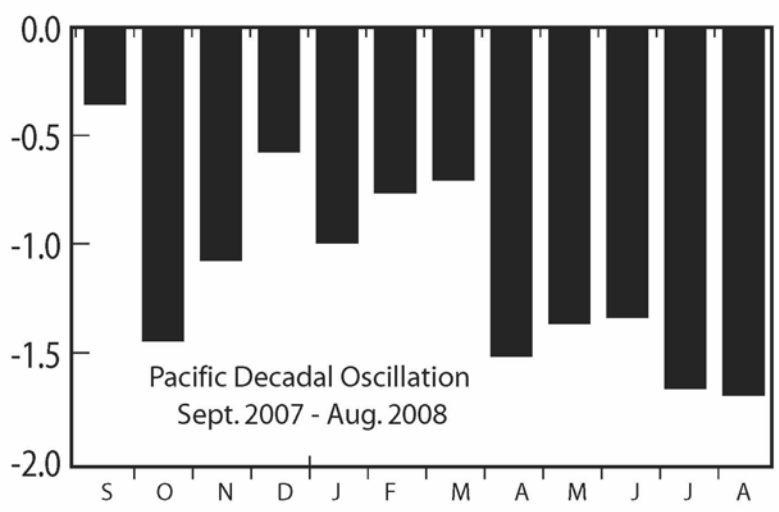


Figure 3. This graph presents monthly values for the PDO Index. The "Pacific Decadal Oscillation" (PDO) is a long-lived El Niño-like pattern of Pacific climate variability (http://jisao.washington.edu/pdo/). The PDO Index has been negative for the last 12 months, corresponding to enhanced productivity in the California Current Region. The last time that the PDO was negative for 12 consecutive months was during the 2001 - 2002 period.

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 (Figure 4). 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.

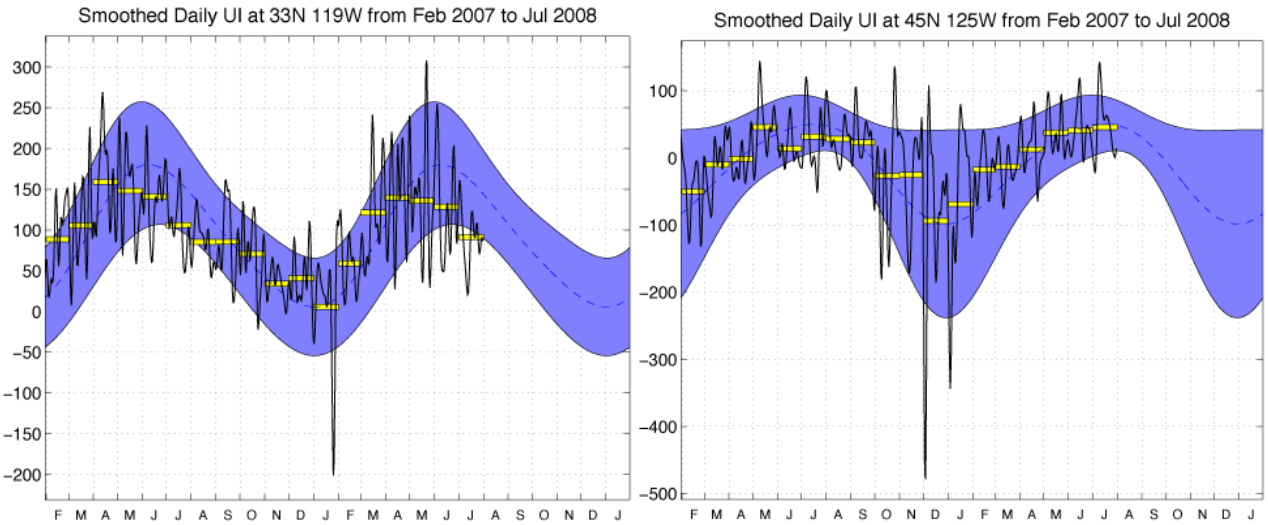


Figure 4. Left panel is recent 18 month record of upwelling for 33°N. Right panel is same for 45°N. Position values are upwelling; negative values are downwelling.

July Upwelling Report:
http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi NMFS/SWFSC/ERD monthly coastal upwelling index
The North Pacific high atmospheric pressure system (NPH) dominated atmospheric forcing between Cape Flattery (48°N) and Point Baja (30°N). In the monthly mean wind stress field the NPH was centered near 35°N, 144°W. Moderate to strong southeastward, upwelling favorable, wind stress occurred along the coast between Cape Blanco (43°N) and Point Baja (30°N) in spatial patterns also seen in preceding months. Coastal areas of strongly positive wind stress curl occurred between Point Sur (36°N) and Point Arena and north of Cape Mendocino (41°N). Upwelling indices, computed from July mean fields, showed that intermittently strong upwelling between 27°N and 45°N led to below average upwelling. The largest indices were computed for 39°N.

August Upwelling Report:
http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi NMFS/SWFSC/ERD monthly coastal upwelling index
The North Pacific high atmospheric pressure system (NPH) weakened during August, but dominated coastal atmospheric forcing between Cape Blanco (43°N) and Cape San Lazaro (25°N). The monthly mean wind stress field showed that east of 145°W NPH circulation was weakest near 144°, 35°N. Moderate to strong southeastward, upwelling favorable, wind stress occurred along the coast between Cape Blanco and San Miguel Island (34°N); spatial patterns were weaker but similar to those seen in preceding months. Coastal areas of intensified wind stress curl occurred off Vancouver Island (48°N) and central California (37°N). Upwelling indices, computed from August pressure fields, showed that intermittent upwelling between 27°N and 39°N led to below average upwelling for the month, particularly between 30° and 36°N. The largest indices, 20% larger than average, were computed for 39°N.

ECOSYSTEMS

California Current Ecosystem Indicators:
Copepods:
Source: Dave Mackas (Fisheries and Ocean Canada)
Zooplankton Anomaly Time Series – Southern Vancouver Island Continental Margin

The zooplankton community off Vancouver Island responded to the continuation of cool ocean conditions in early 2008 by showing positive abundance and biomass anomalies of most of the endemic boreal and subarctic taxa (e.g. 'boreal shelf ' copepods *Acartia longiremis* and *Calanus marshallae*; 'subarctic oceanic' copepods *Neocalanus cristatus* and *N. plumchrus*; 'northern chaetognaths' *Sagitta elegans* and *Eukrohnia hamata*), and negative anomalies of taxa with distributions centered further south (e.g. 'southern copepods' *Paracalanus parvus, Clausocalanus* spp., *Mesocalanus tenuicornis*, *Ctenocalanus vanus*) (Figure 5).

Compared to the southern copepods, the northern copepod species tend to have larger individual body size and considerably higher energy content due to stored lipids. Years with negative PDO anomalies dominated by northern zooplankton are correlated with high survival of juvenile salmon.

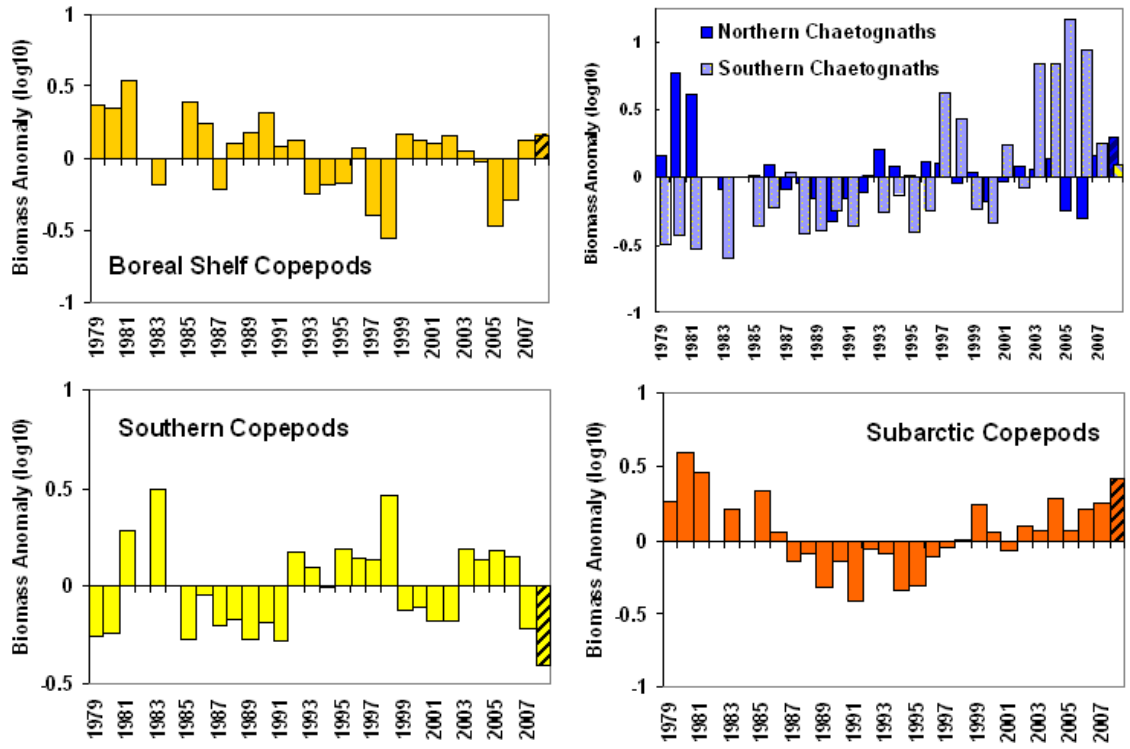


Figure 5. Anomaly time series for southern Vancouver Island zooplankton, averaged within species groups sharing similar zoogeographic distributions. 1979-2007 are annual averages of seasonal anomaly estimates from multiple surveys. 2008 is late spring only.

Rockfish Juveniles:
Source: **http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi**
The SWFSC midwater trawl survey found more pelagic juvenile rockfish in spring 2008 (*Sebastes spp.*) than in 2005-07.

Coastal Pelagics:
Sardines:
July:
Source: **http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi**
Sardine landings into California, Oregon and Washington ports through 20 July were 10,402, 5,615 and 1,190 metric tons, respectively. This total is about 50% of the July -- September sardine allocation set by the Pacific Fisheries Management Council. SWFSC surveys found sardines in coastal waters between 39° and 48°N.

August:
Source: **http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi**
Sardine landings into California, Oregon and Washington ports from 1 July until 8 August, when the second coast wide allocation of the Harvest Guideline was filled, totaled more than 32,000 metric tons. Ongoing SWFSC surveys sampled sardines in coastal waters between 36° and 48°N. Sardine eggs were sampled off the Columbia River mouth (46°N) and in the Southern California Bight (34°N).

Source: Richard Charter (NOAA)
Below is a map (Figure 6) of sardine and anchovy egg distributions from Continuous Underway Fish Egg Sampler (CUFES) and the location and catches from surface trawls overlaid on a 30 day composite of sea surface temperatures (satellite SST from West Coast Coastwatch) for July/August 2008 California Current Ecosystem survey.

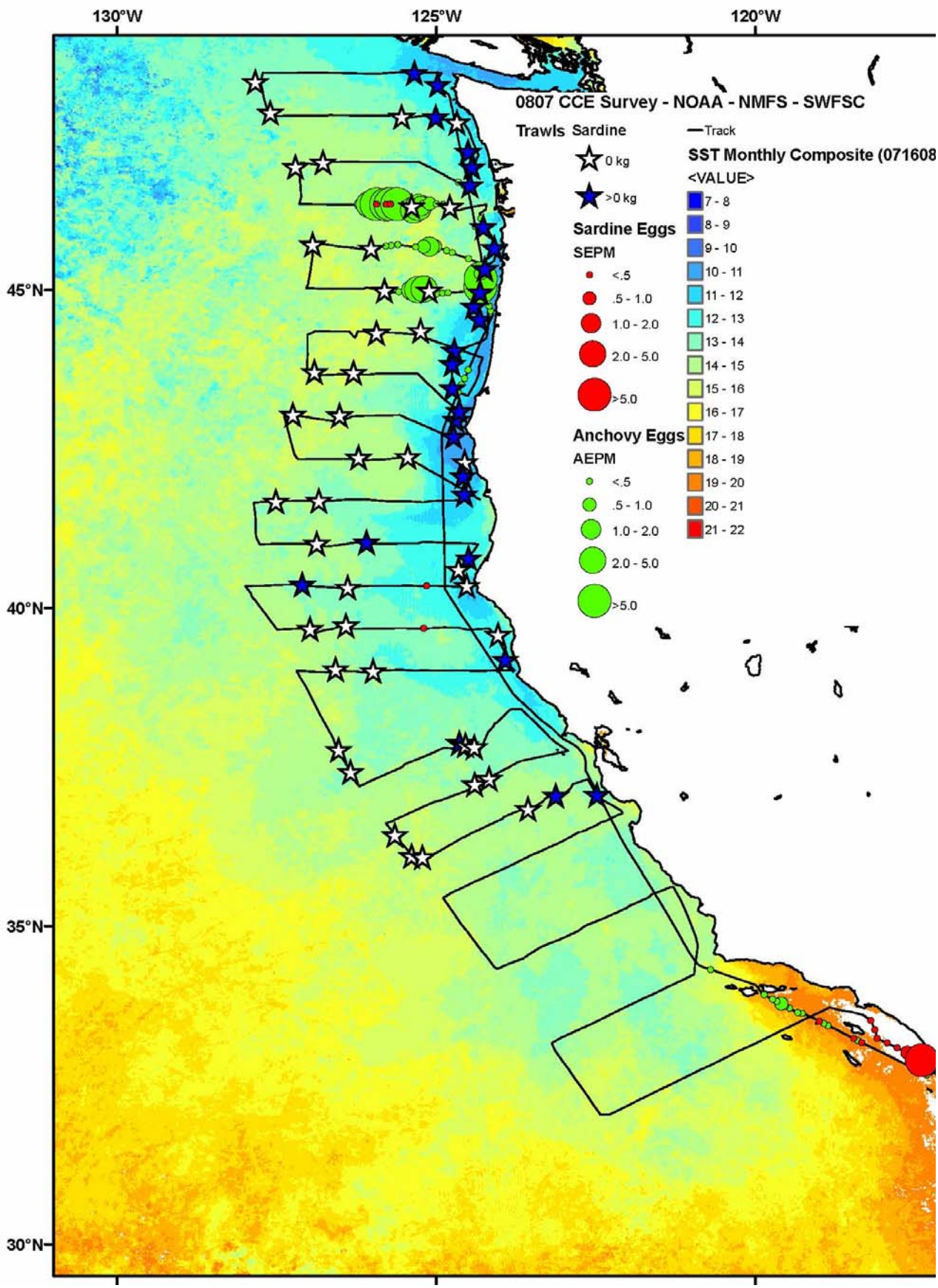


Figure 6. Sardine and anchovy egg distribution along the California Current.

Salmon:

Pacific Council News:

Source: Pacific Council News **http://www.pcouncil.org/newsletters/currentnews.pdf**

Council Adopts Criteria to End Klamath Fall Chinook Overfishing Concern:
Natural adult spawning Klamath River fall Chinook (KRFC) exceeded their escapement floor by a wide margin in the fall of 2007. Council action at its June meeting could help ensure that future escapement goals are met.

July:

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

Summer run salmonids continued their return to the lower Columbia River and other rivers north of central California (37°N); escapement success has varied by river. Through July, fish counts at the Bonneville Dam show good returns of chinook and steelhead; sockeye salmon counts have been four times the 10-year average (Fish Passage Center, Portland, OR).

August:

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

Summer run salmonids continued their return to the Columbia River system and other rivers north of central California (37°N). Escapement success has varied by river, but early observations confirm that salmonid return counts are generally higher in 2008 than in 2007. Escapement counts at Bonneville Dam show current totals that are near or above 10-year averages for runs of summer chinook, fall chinook, coho and sockeye salmon and steelhead. (Fish Passage Center, Portland, OR). Sea-run cutthroat trout are more common in some Oregon Rivers than they have been over the past 10 years.

Pacific Mackerel:

Source: Pacific Council News **http://www.pcouncil.org/newsletters/currentnews.pdf**

The PFMC recommends an acceptable biological catch of 51,772 mt and a harvest guideline for the Pacific mackerel directed fishery of 40,000 mt for the fishery season from July 1, 2008 through June 30, 2009. The harvest guideline value is the same as the prior 2007-2008 season at 40,000 mt.

Highly Migratory Species (tunas, shark, billfishes):

July:

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

The Oregon sport albacore tuna-fishing season began in July. Albacore were found 30 to 60 km offshore at sharp ocean color (chlorophyll) gradients in areas where SST was between 14°C and 17°C.

August:

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

Albacore were found 30 to 60 kilometers offshore Oregon at sharp ocean color (chlorophyll) gradients. Albacore were also taken by fishers off southern California. The presence of yellowfin tuna and dorado in southern California landings suggest influx of tropical oceanic conditions. Basking sharks were seen in Monterey Bay during August.

Invasive Species:

Source: Jeff Crooks (Tijuana River National Research Reserve)

In January of 2008, the Governor of California approved the "California Aquatic Nuisance Species Management Plan." One element of that plan is to more fully develop Aquatic Invasive Species Risk Assessments. In May 2008, the California Ocean Protection Council approved funding for addressing the following vectors: 1) commercial fishing, 2) recreational boating, 3) aquaculture, 4) live bait, 5) live seafood, and 6) aquariums and aquascaping.

There was recently a Request for Proposals to address these vectors, and the Ocean Protection Council / Ocean Science Trust is now in the process selecting teams and initiating work. The hope is to have the risk assessments completed within one year. Work on the risks associated with these vectors will supplement the

efforts already put into two other vectors, namely ballast and fouling associated with commercial ships. It is also likely that additional vectors will be addressed in the future.

Marine Birds and Mammals:

Marine Birds:

What was the ocean condition in Central California Coastal ocean?

A summary of Wells et al (2008) results extended to 2006 –2007

Wells et al (2008) demonstrated that environmental variables from along the central California coastal system could be used in a multivariate approach to fit the productivity of two biological communities in the system. Ultimately, the values served as good indicators of ecosystem productivity and even correlated well with the Central Valley Index (CVI), a measure of salmon adult abundance (Correlation = 0.71). In summary it develops a multivariate environmental score based on wind direction and strength, upwelling, timing of upwelling, local retention (curl), sea level height, and sea surface temperature tuned to the community production. Two communities within the central California system were used to tune the multivariate environmental index: 1) krill, shortbelly rockfish, common Murre, 2) krill, shortbelly rockfish, Cassin's auklet. The multivariate environmental scores that resulted from these two fits can be used as indices of ecosystem productivity and it is these indices that correlate to CVI values.

Biological data demonstrates that in 2006 and 2007 productivity was low, or at best near average for zooplankton, rockfish, and Cassin's auklet while it was above average in 2007 for common murre (Figure 7). The indices tuned to the Cassin's auklet and the common murre communities indicate that, while 2006 was well below average productivity, 2007 was about average.

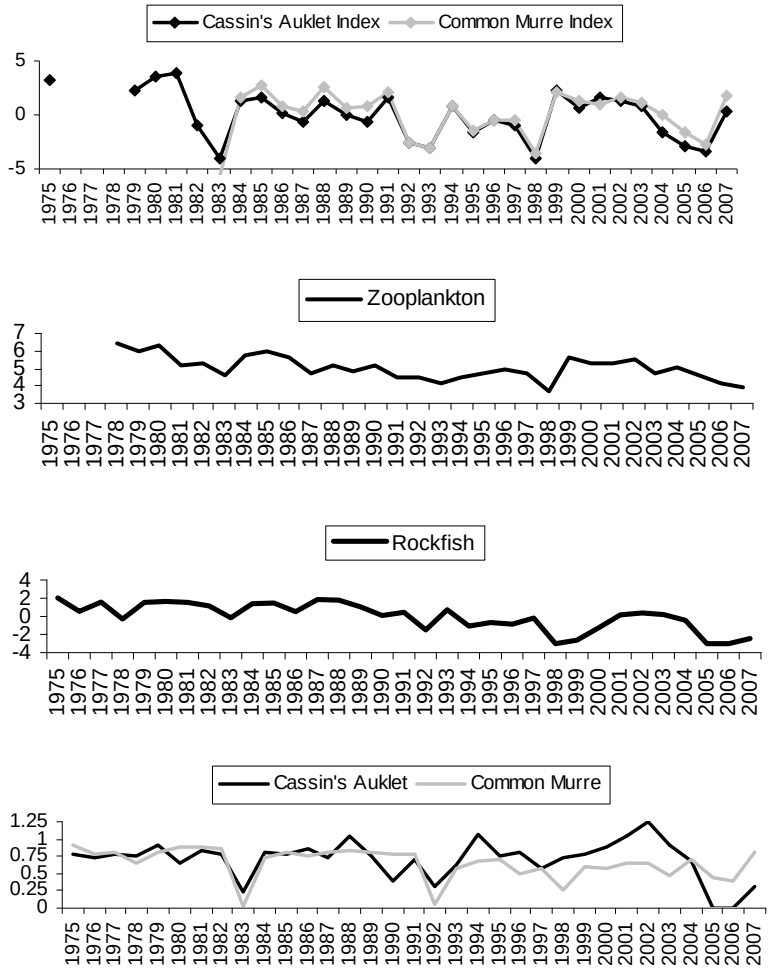


Figure 7. Biological time series from 1975 - 2007. The top panel shows index values from Wells et al. (2008) updated through 2007 developed for Cassin's auklet and common murre. Zooplankton is geometric mean abundance in Central California, Rockfish is the residual from a stock recruit curve on Shortbelly rockfish in Central California, the seabirds (Cassin's auklet and Common murre) productivities are represented by their fledgling success.

Marine Mammals:

July and August:

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

In July and August, humpback and Blue Whales were commonly encountered by shore-based excursions operating from California ports south of San Francisco. Monitoring was conducted aboard NOAA research vessels.

In August, SWFSC - Protected Resources Division cruises off northern California and Oregon photographed blue whales, fin whales, sei whales, and sperm whales during the first days of August. After the twentieth, larger numbers of delphinids were encountered and photographed. Two biopsy samples were obtained from killer whales. Jigging for Humboldt squid was successful within the habitat surveyed.

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/shelfish/razorclm/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 to test 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. 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. During the summer of 2008, shellfish toxin levels have resulted in several spatio-temporal closures of shellfish harvests. Clatsop County beaches north of Tillamook Head remained closed to razor clam harvesting from July 15 to September 30, for ODFW conservation closure. It is not possible for a quarterly analysis such as this to reflect the most recent situation regarding regions and times of shellfish closures. The shellfish safety toll-free hotline (1-800-448-2474) provides the most current information regarding shellfish safety closures for Oregon.

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**

Domoic acid continues to test in the safe range. Mussels and clams sampled between September 2 and September 4, 2008 contained very low levels of domoic acid. 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.

Harmful algae bloom monitoring: Elevated levels reported in Oregon.

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

Reports provided week of September 1 to ODA indicated that levels of *Pseudo-nitzshia* have increased along much of Oregon's central and southern coast.

California HAB Summary

July:

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

California Department of Public Health shore-based net phytoplankton samples were dominated by non-toxic diatom species. Toxic, domoic acid (DA) producing species were detected at low to moderate levels at several sites, although shellfish DA concentrations have been well below health alert levels.

Source: Gregg W. Langlois, Senior Environmental Scientist, CA Department of Public Health
http://www.cdph.ca.gov/healthinfo/environhealth/water/Pages/Shellfish.aspx

Phytoplankton observations and toxin monitoring along the California coastline for the month of July:
Pseudo-nitzschia numbers increased then decreased in July over a wide geographic region (roughly Monterey Bay to Los Angeles). From the observations and reports provided from researchers at various locations there appeared to be a mix of toxic and nontoxic species, with the latter more dominant in most areas. Domoic acid has been absent from all samples tested.
Alexandrium distribution had increased, but numbers remained very low during mid July. PSP toxins have been completely absent for most of the year, an extremely rare occurrence. Exceptions include recent low positive results in shellfish from Humboldt Bay and Avila (San Luis Obispo County).
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.

August:

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

Phytoplankton observations and toxin monitoring along the California coastline the month of August:
Alexandrium and *Pseudo-nitzschia* began increasing at sites around Drakes Bay the week of August 18, with alert levels of the PSP toxins in shellfish earlier in the week, declining below the alert level by the end of the week.

Low Dissolved Oxygen:

Dissolved oxygen has been monitored during spring-summer 2008. Reports will be included in the next PaCOOS quarterly issue.