

Physical and Ecological Conditions in the California Current LME for April to June, 2010

Summary of climate and ecosystem conditions for Quarter 2, 2010 for public distribution, compiled by PaCOOS coordinator Rosa Runcie (email: Rosa.Runcie@noaa.gov). Data and management decisions are summarized when they are made available and don't necessarily coincide with the publication of the quarterly.

Full content can be found after the Executive Summary. Previous quarterly summaries of climate and ecosystem conditions in the California Current can be found at <http://pacoos.org>

PHYSICAL CONDITIONS

- **El Niño Southern Oscillation (ENSO):** Conditions continue to be favorable for a transition from El Niño to La Niña conditions during the second half of 2010.
- **Pacific Decadal Oscillation (PDO):** Positive PDO values occurred from March to May in concert with weakening of the El Niño in the tropical Pacific.
- **SST at NOAA Buoy 46050, Newport, Oregon:** Sea surface temperatures off Newport (44°40'N) at the NOAA Buoy 46050 have shown warm anomalies in the + 0.5 to 1.0°C range from August 2009 through April 2010. Anomalies have been near zero in May and June 2010.
- **Upwelling Index (UI):** In May, coastal upwelling was greater than in April. Positive wind stress curl accentuated upwelling off central California (37°-39°N), the southern California Bight (32°-36°N), and north of Cape San Lazaro (26°-27°N).

- **Madden Julian Oscillation (MJO):**

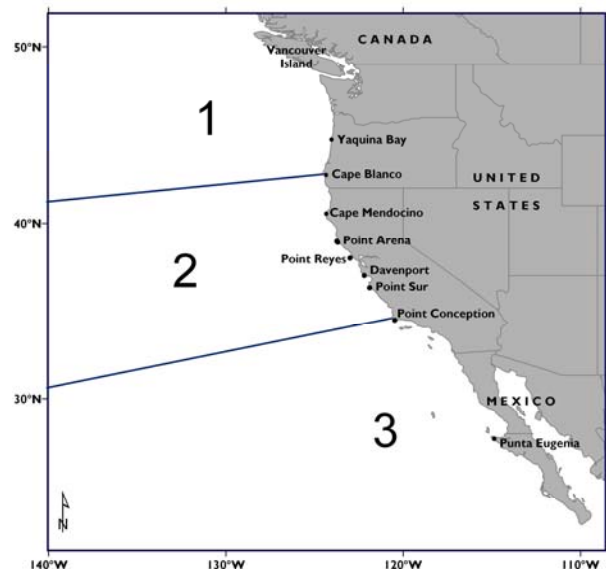
Weak MJO activity was evident in late March - early April 2010 and early May 2010. Mid-May the MJO index indicated a decrease in eastward propagation. Late May, the MJO index showed a weak amplitude.

- **Newport, Oregon and Trinidad Head, California Water Temperature and Salinity Survey Line Observations:**

Deep shelf (62 m) temperature and salinity at Newport Hydrographic Line, OR during April to June 2010 was warmer and fresher than the previous three years. Trinidad Head Survey Line conditions were warmer and fresher during late 2009 and early 2010.

- **Monterey, California Survey Line:**

Five fresh and warm water pulses at 100 m's occurred in mid-October, mid-December 2009, late January 2010, late February 2010 mid-April 2010 which may represent passage coastally-trapped waves excited by equatorial Kelvin Waves. Alternatively they may be associated with coastal storms. If the former, then they represented the in-water indicator of El Niño in central California.



ECOSYSTEM CONDITIONS

- **California Current Ecosystem Indicators:**

1. **Copepods:** Samples collected off Newport, OR by the NWFSC and OSU in 2010 have had on average about 5 more copepod species each month than the monthly average climatology. The biomass of northern copepod species in June was quite high suggesting that the residual effects of the moderate El Niño event of 2009/2010 may be coming to a close.

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2. **Krill:** Krill abundance has been low during 2010 along the Newport, Oregon Line. Apart from a brief spawning event by *Thysanoessa spinifera* in late February during a late-winter phytoplankton bloom, there has been no spawning by either *T. spinifera* or *Euphausia pacifica*. This pattern is common in “warm years.”
3. **Juvenile Rockfish:** The SWFSC’s annual midwater trawl survey for juvenile rockfish and other pelagic nekton along the Central California coast in May-June showed increasing abundance for the species and assemblages that favor cool and productive conditions, including juvenile rockfish, juvenile Pacific hake, market squid and krill.
4. **Coastal Pelagics:**
 - Pacific Sardine:** On June 12, 2010, the Monterey and Southern California sardine fishery closed after reaching the 22,463 mt limit recommended for the first allocation period (Jan 1 – June 30). Eighty-eight percent of these landings were from offshore southern California.
 - Pacific Mackerel:** The Pacific Fishery Management Council is scheduled to review the current Pacific mackerel stock assessment and adopt a harvest guideline for the 2010/2011 Pacific mackerel fishing season, which runs from July 1, 2010 through June 30, 2011.
 - Salmon in the Pacific Northwest:** Counts of spring Chinook at the fish ladder on the first dam on the Columbia River (Bonneville) showed that the third highest number of spring Chinook returned this year.
5. **Groundfish:** Modifications to commercial and recreational management measures for the 2011-2012 season are being considered for final action by the Pacific Fishery Management Council.
6. **Pacific Hake:**
7. **Midwater species:**
9. **Sablefish:**
10. **Cassin’s Auklet:**
- **Highly Migratory Species (tuna, sharks, billfishes):** The Highly Migratory Species Management Team (HMSMT) postponed bigeye and yellowfin tuna recommendations until after the updated stock assessments are released. HMSMT also recommends that the U.S. delegation to the IATTC develop a proposal for a Total Allowable Catch (TAC) in the purse seine fishery.
- **Marine Birds and Mammals:**
 - Marine Birds:** Seabirds were surveyed using standard techniques during legs 1 and 2 of the NOAA-NMFS Juvenile Rockfish/ Ecosystem Survey conducted in May/June 2010. Mike Force of Farallon Institute conducted observations. A total of 778 square-km of ocean habitat was surveyed, resulting in counts for 41 species of seabird. An unusually high number of Black-footed Albatross, Black Storm-Petrel, Cook's Petrel sightings indicated more "warm-water species" in the ecosystem. Correspondingly, sightings of Cassin's Auklet, Common Murre, and Sooty Shearwater, species preferring colder waters, were substantially reduced. We interpret these changes in the avifauna to be reflective of the 2009-2010 moderate El Niño event which began to dissipate in April-May 2010.
 - Marine Mammals:** Female gray whales and their calves are generally observed along the California coast in April, but coastal observers have seen fewer whales than expected. It is not known if the low counts are due to decline in the abundances of Gray whales or a change in their behavior that makes sightings more difficult.
- **Harmful Algal Blooms:**
 - Washington:** April-June domoic acid levels in shellfish along Washington’s outer coast remained well below the closure level of 20 ppm.
 - Oregon:** In May and early June, domoic acid concentrations in razor clams were above the alert level on the south Oregon Coast.
 - California:** In April, phytoplankton observations and toxin monitoring showed that *Pseudo-nitzschia* was detected along the entire southern California coast, with no indication of domoic acid toxin buildup in shellfish. In May, low levels of *Alexandrium* produced PSP-toxins occurred inside Humboldt Bay and at Trinidad Head. *Pseudo-nitzschia*-produced domoic acid was detected at double health alert levels (40 ppm) in mussels from structures offshore of Santa Barbara.

PHYSICAL CONDITIONS IN QUARTER 2, 2010

El Niño Southern Oscillation (ENSO):

Source: http://www.cdc.noaa.gov/people/kl_austr_wolter/MEI/mei.html,
http://www.cpc.noaa.gov/products/analysis_monitoring/enso_advisory/

El Niño weakened during April 2010 as positive sea surface temperature (SST) anomalies decreased across the equatorial Pacific Ocean. The SST anomalies exceeding 1.0°C diminished in 2010 indicating a weakening El Niño. During May El Niño dissipated as positive SST anomalies decreased rapidly across the equatorial Pacific Ocean and negative SST anomalies emerged across the eastern half of the Pacific. All of the El Niño indices decreased between 0.5°C to 1.0°C during the month of May. The majority of statistical and dynamical models predict a transition to ENSO-neutral conditions during April-June 2010, followed by ENSO-neutral conditions through the end of the year. These forecasts and various oceanic and atmospheric indicators, indicate a growing possibility of La Niña developing during the second half of 2010.

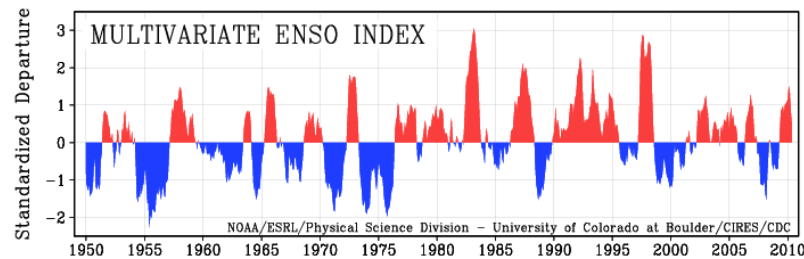


Figure 1. NOAA OAR monitors ENSO using a Multivariate ENSO Index (MEI) on six observed variables over the Pacific: sea-level pressure, zonal and meridional components of the surface wind, sea surface temperature, surface air temperature, and total cloudiness fraction of the sky.

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

Source: *The Coast Watch* <http://coastwatch.pfel.noaa.gov/elnino.html> (Advisory 2010)
http://www.cpc.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.doc (Jan, Feb, March 2010 report)

El Niño weakened during April 2010 as positive surface temperature (SST) anomalies decreased across the equatorial Pacific Ocean. The subsurface heat content anomalies (average temperatures in the upper 300 m of the ocean) have decreased steadily since late February 2010, becoming negative in late April. An upwelling Kelvin wave appears to be crossing the equatorial Pacific bringing temperature anomalies less than -2°C at 100-150 meters depth at 140°W. The upper 300 meter equatorial ocean heat content anomaly became weakly negative in April and continued to decrease in May. Negative subsurface temperature anomalies extended eastward and corresponded spatially to negative sea level height anomalies. Negative temperature anomalies, to 3.0°C, occurred at 50-150 m depth at 130°W. In summary, ENSO-neutral conditions are present across the equatorial Pacific. Sea surface temperatures continue to decrease across much of the Pacific Ocean, and conditions are favorable for a transition to La Niña conditions during June-August 2010.

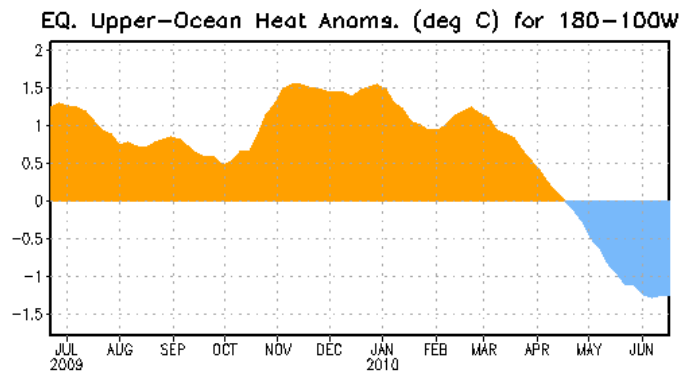


Figure 2. Area-averaged upper-ocean heat content anomalies (°C) in the equatorial Pacific (5°N-5°S, 180°-100°W). Heat content anomalies are computed as departures from the 1982-2004 base period pentad means.

Pacific Decadal Oscillation (PDO):

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

<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>

The PDO is a longer duration temporal pattern of Pacific climate variability that is indexed by sea surface temperature measurements north of 10°N (<http://jisao.washington.edu/pdo/PDO.latest>). This index was negative (-PDO) for 23 consecutive months, which is the longest run of negative values since the 1966-1968 period. July 2009 was the last negative value in this run. In August the index went into a transitional period that appeared to end with positive PDO values exceeding 0.80 in January and February of 2010. Positive PDO values also occurred in March and April in concert with weakening of the El Niño in the tropical Pacific, although the mechanism of connection is not clear. Model estimations by the NCEP Climate Prediction Center (<http://www.cpc.ncep.noaa.gov/products/GODAS>) indicate weakening, and perhaps reversal, of the positive PDO state as the equatorial Pacific cools to ENSO – neutral conditions. The eastern Pacific SST south of 40°N has a pattern (<http://www.osdpd.noaa.gov/ml/ocean/sst/anomaly.html>) that is similar to the canonical PDO-negative state. These conditions have been generally favorable to salmonid returns to Washington and Oregon Rivers.

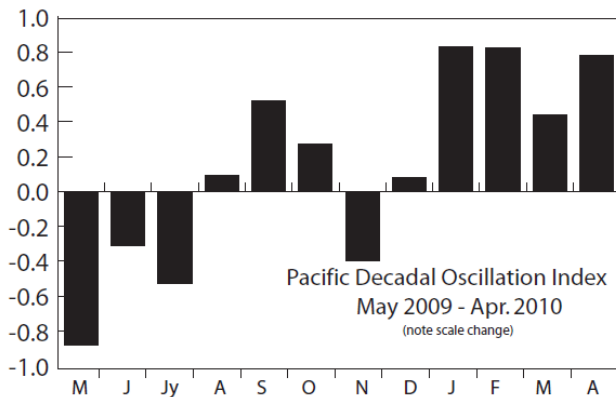


Figure 3. The graph shows monthly values for the PDO Index for May 2009 through April 2010. May's and June's 2010 value are 0.62 and -0.22 respectively.

SST at NOAA Buoy 46050, Newport, Oregon:

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/>

Sea surface temperatures off Newport (44°40'N) at the NOAA Buoy 46050 have shown warm anomalies in the + 0.5 to 1.0°C range from August 2009 through April 2010. Anomalies have been near zero in May and June 2010. These are consistent with the patterns expected from PDO and MEI.

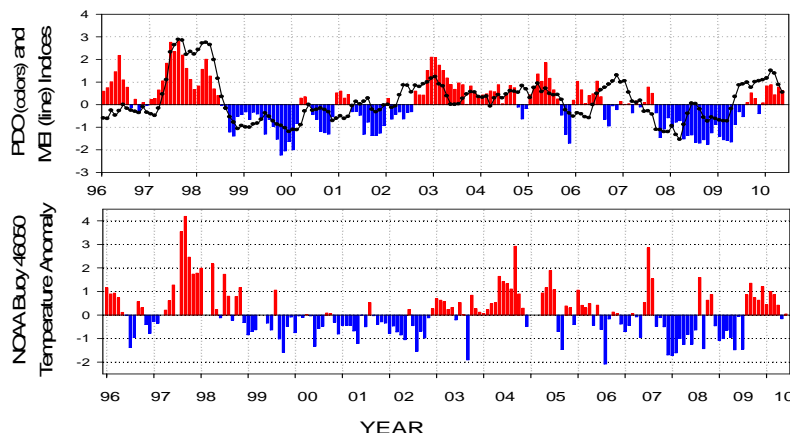


Figure 4. Upper Panel. Time series of the Pacific Decadal Oscillation (PDO) and Multivariate ENSO Index (MEI) from 1996 through June 2010. **Lower Panel.** Time series of monthly averaged sea surface temperature anomalies measured at the NOAA Buoy 46050 located 17 miles off Newport Oregon.

Upwelling Index:

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

Upwelling Index (UI)

Coastal downwelling in April was less than in March. Average upwelling between 42°N and 60°N was weak, highly variable through the month, but near climatological norms. UI at 33°N and 36°N was moderate and near monthly averages. Upwelling was weaker than average along the west coast of Baja California (24°-30°N).

Mean coastal winds increased south of 40°N, becoming more strongly southeast and decreased north of 40°N, becoming less cyclonic. Southeastward winds (7-14 m s⁻¹) persisted along the coast of California and Baja California, increasing in strength to 100-200 kilometers offshore. The resulting positive wind stress curl accentuated upwelling off central California (37°-39°N), the southern California Bight (32°-36°N), and north of Cape San Lazaro (26°-27°N).

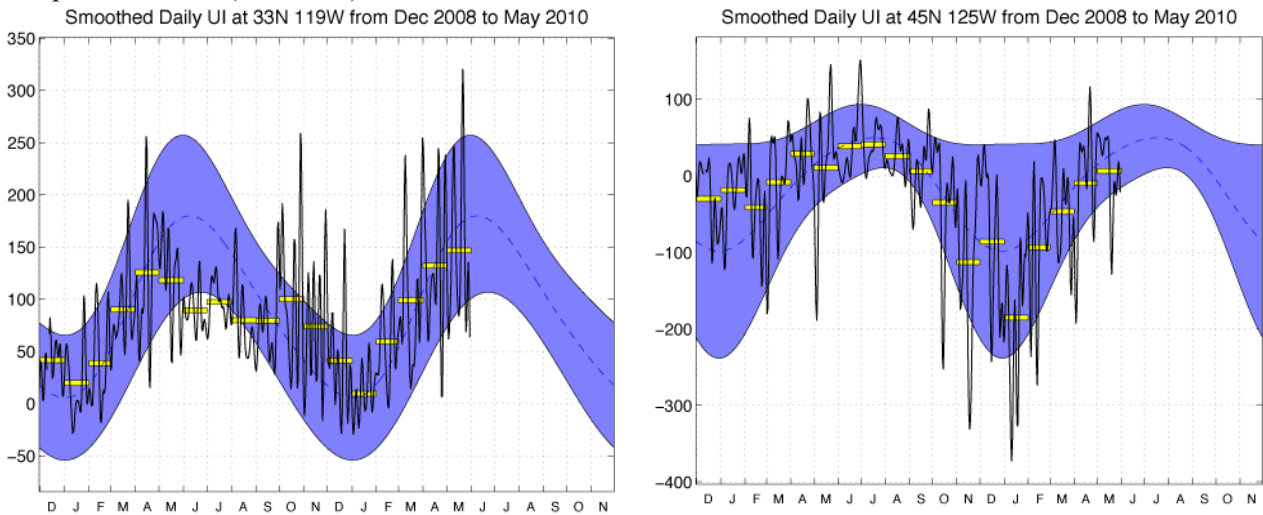


Figure 5. Left panel is recent 18 month record of upwelling for 33°N 119°W. Right panel is same for 45°N 125°W. Positive values are upwelling; negative values are downwelling. Dashed line is the climatological mean. Yellow bars are the means for each month during the period shown.

Regional Oceanic Conditions:

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

The monthly mean sea surface temperature (SST) field for April shows SST anomaly patterns that are within 0.5°C of average within a 200-600 kilometer wide coastal strip from 30°N to 50°N. West of this strip negative SST anomalies intensified during April, dropping to -2°C west of 130°W between 35°N and 45°N.

In May monthly SST showed widespread negative anomalies, to -2°C, over the area east of 150°W and between 35°N and 50°N. Pockets of weak (<± 1°C) SST anomalies persisted off the California coast. This pattern is similar to spring 2009 SST patterns, before El Niño effects were observed in the California current. Seasonal warming continued, with the 11°C isotherm advancing northward from 42°N to 48°N.

In June monthly SST showed increases of 1-2°C over the northeastern temperate Pacific. However, negative SST anomalies, to -2°C, persisted over the area between 35°N and 50°N and east of 135°W in patterns similar to those of May. Negative SST anomaly increased west of 130°W. Offshore, negative SST anomalies extended into the Gulf of Alaska and the eastern Bearing Sea. Positive SST anomalies occurred in the Southern California Bight and southwest of 31°N, 133°W.

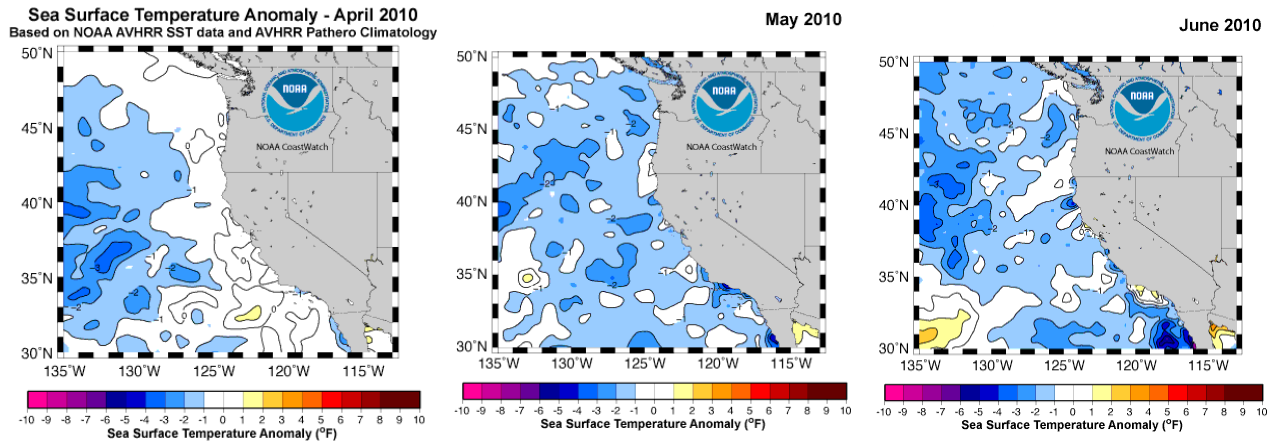


Figure 6. Regional oceanic conditions in the California Current Region.

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)

During late March - early April 2010 and early May 2010, weak MJO activity was evident. In early April, the MJO index indicated eastward propagation of a weak MJO signal. Mid-April 200-hPa westerly wind anomalies (5°S-5°N) developed in the eastern Pacific, and heat content anomalies decreased in the east-central Pacific in association with the upwelling phase of a Kelvin wave. Late April early May, 200-hPa westerly anomalies increased and fast eastward propagation was evident. Mid-May the MJO index indicated a decrease in eastward propagation. Late May, the MJO index showed a weak amplitude.

Water Temperature and Salinity at Newport Hydrographic Line, OR:

Source: Bill Peterson, NOAA, NMFS

In contrast to observations made one year ago (when temperatures were among the coldest recorded in the 12 year time series), warm and fresh water persisted through the winter and spring of 2010. The average T-S properties in 2010 resembled those observed in the spring of other weak El Niño events (2006) and the spring of 1997 which preceded the large 1998 event. The anomalously warm spring of 2005 is in the same cluster of points.

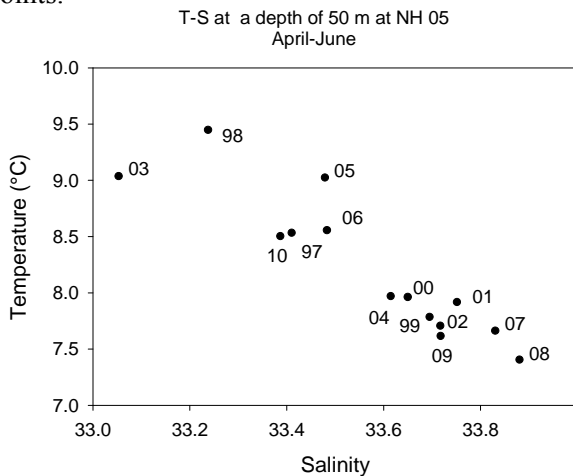


Figure 7. Temperature and salinity measured at a depth of 50 m at a baseline station off Newport, Oregon located 9 km from shore along the Newport Hydrographic line for the months of April to June. Water depth at this station is 62 m. Averages for each year are identified.

Trinidad Head, California Survey Line Observations for 2009 and 2010

Source: Eric Bjorkstedt, NOAA, NMFS and Jeffrey Abell (HSU, Oceanography)

Observations along the Trinidad Head survey line show warmer, fresher water along the coast during late 2009 and early 2010, consistent with the timing of El Niño effects in the California Current. This pattern is also apparent at other stations along the Trinidad Head Line and reflects substantial onshore transport associated with numerous strong storm systems. Evidence of renewed upwelling was apparent by the Spring 2010, but the June 2010 cruise was canceled due to severe northerly winds that presumably will cause intense upwelling in the early summer 2010.

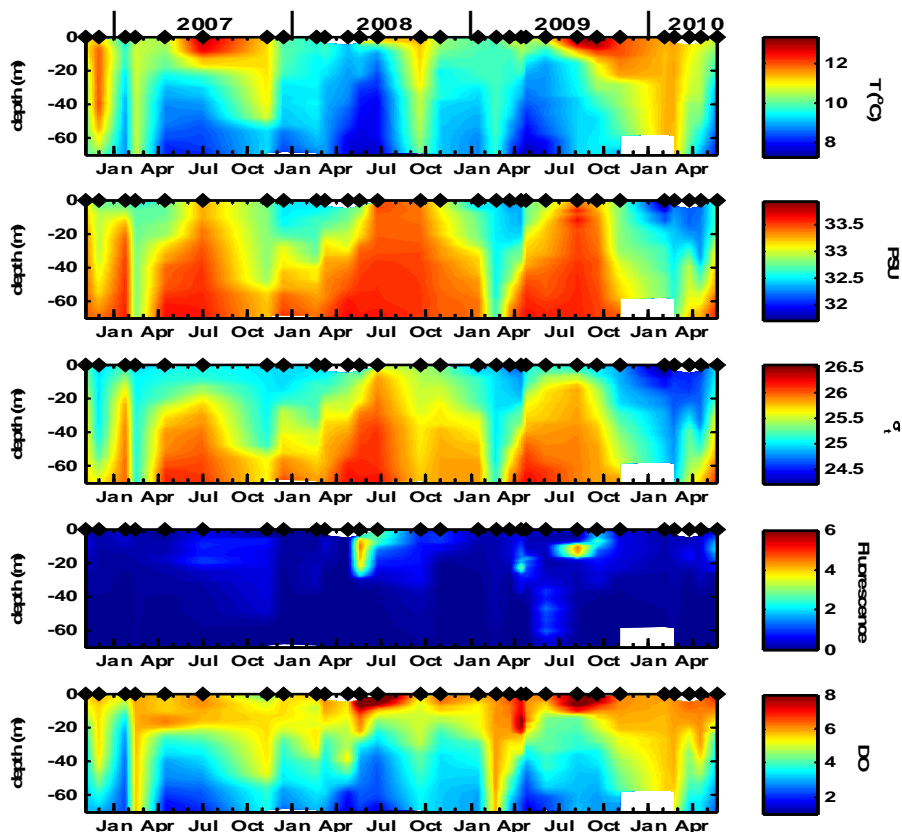


Figure 8. Time series of vertical structure at station TH02 (41° 3.50' N, 124° 16.00' W) along the Trinidad Head Line from late 2006 through early 2010. Panels from top to bottom display temperature (°C), salinity (PSU), density (σ_t), fluorescence (volts), and dissolved oxygen (ml/L). Black diamonds indicates sampling dates.

Monterey Bay, California Survey Line for 2009 and 2010:

Source: F.P. Chavez, J.T. Pennington, (MBARI), C.A. Collins (NPS)

Presented here are 2009 and early 2010 temperature and salinity at the surface and at 100 m for Monterey Bay based on MBARI monthly cruises and mooring data (Figures 9 and 10). The cruises occupy the historic CalCOFI Line 67 which was occupied three times in 2009 and twice so far in 2010. Three of these occupations were regular CalCOFI cruises and the data will be included in a future Quarterly report.

The 2009 spring transition to upwelling conditions having lower (higher) surface temperatures (salinities) occurred in the later half of March, but seems to have been anticipated at 100 m. April and inconsistently May were somewhat cooler and saltier than normal, whereas summer was close to climatology. Summer 2009 chlorophyll and primary production values were also close to climatology, lower than during the most recent 4-5 years (data not shown).

Five prominent episodes of fresh and warm water at 100 m occurred in mid-October, mid-December 2009, late January 2010, late February 2010 mid-April 2010, but were hardly discernable at the surface. These pulses may represent coastally-trapped waves excited by equatorial Kelvin Waves (Figure 11) passing by the Monterey Bay region. They may also be associated with coastal storms but their timing is relatively consistent with equatorial waves observed by the TAO (Tropical Atmosphere Ocean) array. If so they represent the in-water indicator of El Niño in central California. The water column remained anomalously warm and fresh at the surface until late April/early May 2010, when the spring transition occurred. The transition in 2010 was more than a month later than the transition in spring 2009. The recovery to La Nina conditions began earlier at depth where conditions returned to normal by early March 2010.

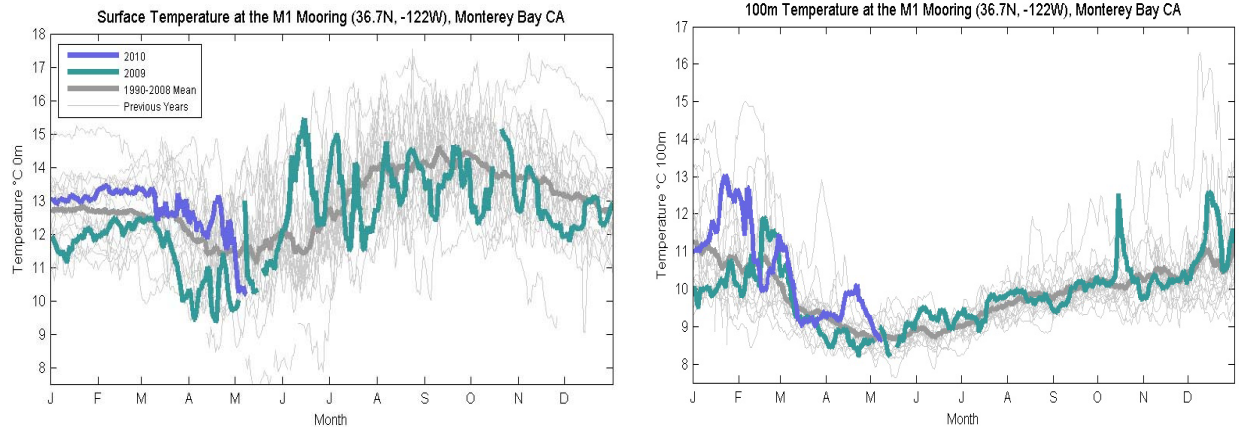


Figure 9. Daily 2009 (green) and 2010 (blue) temperatures at the surface (top) and 100m (bottom) measured by the M1 mooring in Monterey Bay compared to climatological values (grey).

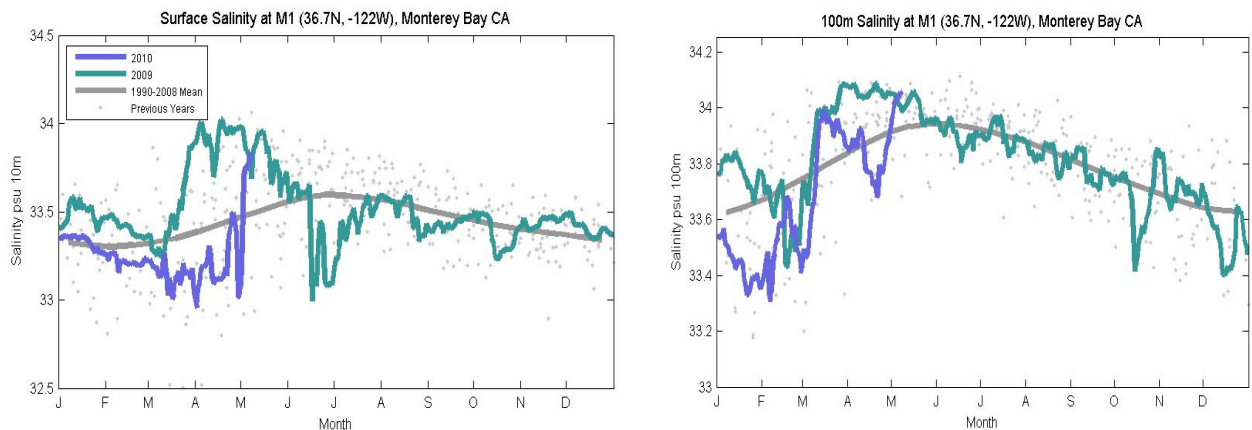


Figure 10. Daily 2009 (green) and 2010 (blue) salinities at the surface (top) and 100m (bottom) measured by the M1 mooring in Monterey Bay compared to climatological values (grey) from shipboard measurements.

Five Day Zonal Wind, SST, and 20°C Isotherm Depth Anomalies 2°S to 2°N Average

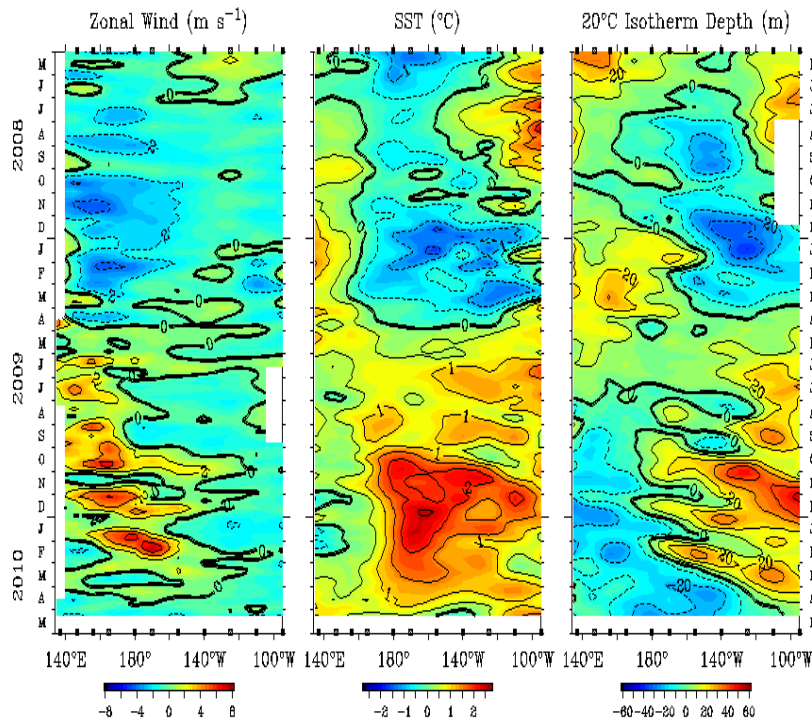


Figure 11. Five day zonal wind, SST, and 20 °C depth anomalies for the equatorial Pacific from 2008 to 2010. Five equatorial Kelvin waves are evident in the 20 °C plot with arrivals in the eastern terminus of approximately August, October and December 2009, and February and March 2010. These would be expected to arrive off Monterey approximately 2 months later.

TAO Project Office/PMEL/NOAA

May 11 2010

ECOSYSTEMS IN QUARTER 1, 2010

California Current Ecosystem Indicators:

Copepod Biodiversity (Species Richness):

Source: *Bill Peterson, NOAA, NMFS*

Species richness is the number of copepod species found in a plankton net sample. Samples collected in 2010 have had on average about 5 more species each month than the monthly climatologies. Such anomalies are common and expected during the past warm phases of the PDO as seen from 2003 through 2006 and during the 1998 El Niño event. Increased species richness during the warm years is due to a combination of onshore transport of waters from the offshore of Oregon and northward transport of coastal waters from California via the Davidson Current.

Although species richness has remained high through May and June 2010, the biomass of northern copepod species in June was quite high (not illustrated) suggesting that the moderate El Niño event of 2009/2010 may be coming to a close.

A new ecosystem indicator not presented before relates to the occurrence and abundance of *Neocalanus plumchrus*. This species awakens from diapause in January and enters diapause in late spring. This is a large lipid rich species so variations in its abundance in spring may be important to juvenile fishes such as sablefish which are abundant in spring. The date when 50% of the population has passed through the fifth copepodite stage is an indication of developmental timing. During warm years this date is early, and cold years, late. During 2010, the transition date was on day 71, the second earliest of our 13 year time series. The earliest date was in 1998 (day 60) and the latest date in 2002 (day 126). The implication of these observations is that during warm years, *N. plumchrus* are available as a prey item for sablefish and other winter-spawners.

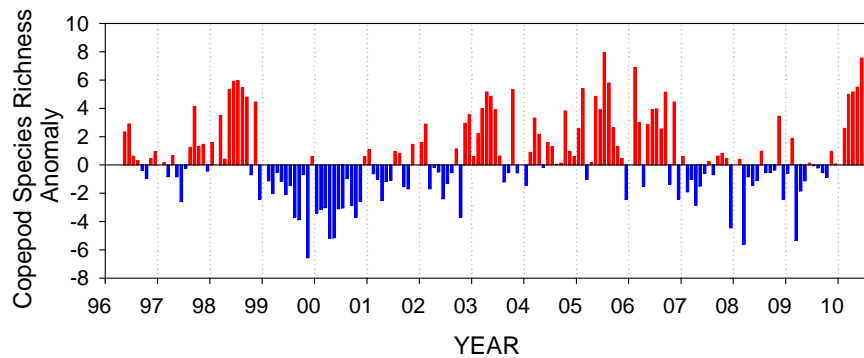


Figure 12. Time series of the anomaly of monthly averaged species richness of copepods collected at a baseline station NH 05, located 9 km off Newport, Oregon along the Newport Hydrographic line.

Krill:

Source: Bill Peterson, NOAA, NMFS

Krill abundance has been low during 2010 along the Newport, Oregon Line. Apart from a brief spawning event by *Thysanoessa spinifera* in late February during a late-winter phytoplankton bloom, there has been no spawning by either *T. spinifera* or *Euphausia pacifica*. This pattern is common to warm years.

Juvenile Rockfish:

Ecosystem indicators for the Central California Coast, May-June 2010:

Source: John Field, Steve Ralston and Keith Sakuma (Fisheries Ecology Division, SWFSC/NMFS/NOAA)

The Fisheries Ecology Division of the SWFSC has conducted an annual midwater trawl survey for juvenile rockfish and other pelagic nekton along the Central California coast in late spring (May-June) since 1983. The survey targets pelagic juvenile rockfish for fisheries oceanography studies and for developing indices of year class strength for stock assessments, although many other commercially and ecologically important species are captured and enumerated as well. The results here summarize trends in the core area since 1990, as not all species were consistently identified in earlier years. Most cruises have taken place on the NOAA ship David Starr Jordan, but in 2009 the cruise took place on the NOAA Ship Miller Freeman and the 2010 cruise took place on the F/V Frosti (a chartered commercial fishing vessel). A total of 136 midwater trawls and 235 CTD casts, as well as zooplankton samples, seabird and mammal observations, and continuous underway data collections were conducted in 2010. The data presented here are preliminary. Although this survey has sampled a greater spatial area from 2004 onward (roughly Cape Mendocino to the U.S./Mexico border), the results presented here focus on the core survey area (corresponding to the region just south of Monterey Bay to just north of Point Reyes, CA) as the greater length of the time series leads to more informative insights. Results from the expanded survey area will be developed for future reports.

The standardized anomalies from the log of mean catch rates are shown by year for six key species and assemblages that are sampled in this survey (Figure 13). Most are considered to be well sampled, although the survey was not designed to accurately sample krill, and those numbers should be considered preliminary. Interpretation of acoustic data from this survey to better assess krill trends in abundance is ongoing. Trends in 2009 and 2010 were of increasing abundance for the species and assemblages that tend to do better with cool and productive conditions, including juvenile rockfish, juvenile Pacific hake, market squid and krill. However, while the trend in relative abundance for rockfish and squid has been increasing since record low values in the 2005-2006 period, this increase has been only to levels close to the long term mean. Krill appear to be the exception, with very high catches in recent years. By contrast, the coastal pelagic forage species (adult life history stages of northern anchovy and Pacific sardine) typically observed in greater numbers during warmer, less productive periods were at low levels in 2009 and 2010, either as a result of lower abundance, a more offshore or southerly distribution, or both. Humboldt squid, encountered regularly since 2004, were not encountered in either trawl or jigging operations this year. As with the 2009 data, results from this year continue to represent a return to cool, high productivity conditions similar to the 1999 to 2003 period for many groups, while others are at moderate levels that approximate long term mean conditions.

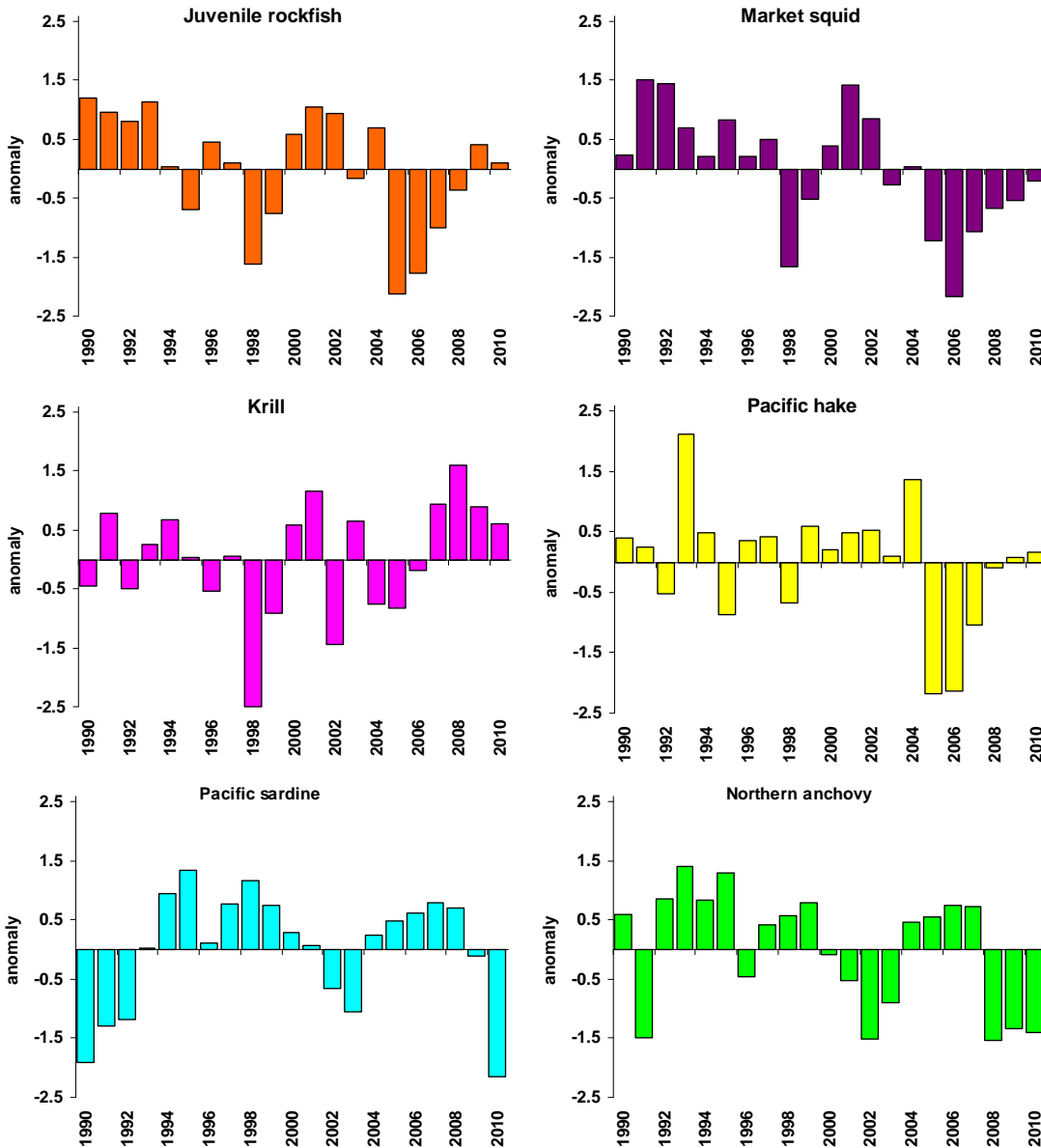


Figure 13. Long-term standardized anomalies of several of the most frequently encountered pelagic forage species from the central California rockfish recruitment survey in the core region (anomalies based on the 1990-2010 period only).

The trends observed in these six ecosystem components are consistent with trends across a number of other taxa within this region. When the covariance among the most frequently encountered species and species groups are evaluated in a Principal Components Analysis (PCA) (Figure 14), there are strong loadings for the groundfish young-of-the-year taxa (rockfish, Pacific hake, rex sole and sanddabs) as well as cephalopods, and euphausiids, with slightly weaker (and inverse) loadings for Pacific sardine, northern anchovy, and several species of mesopelagic fishes. The first and second components explain 39% and 14% of the variance in the data respectively, and plotting trends of the two components against each other, some patterns seem to emerge. In particular, the clupeoid-mesopelagic group was prominent during the 1998 El Niño and during the anomalous 2005-2007 years, while the groundfish group prospered during the early 1990s, the cool-phase between 1999 and 2003, and the most recent period from 2009 through 2010.

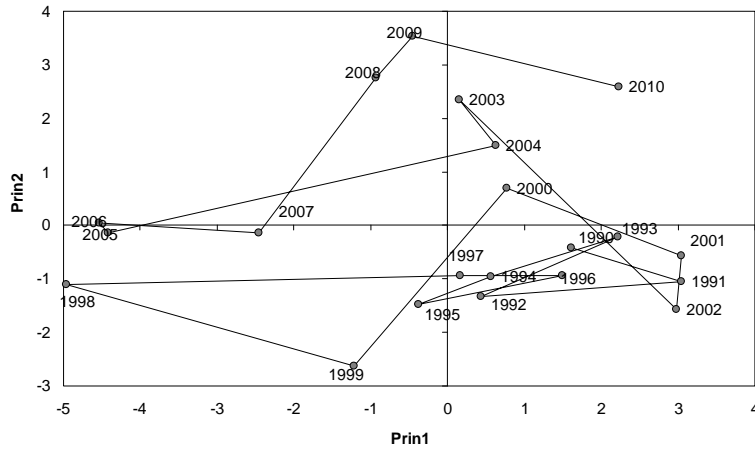


Figure 14. Principal component scores plotted in a phase graph for the most frequently encountered species groups sampled in the central California core area in the 1990-2010 period.

Coastal Pelagics:

Pacific Sardine:

Source: Pacific Fisheries Management Council Newsletter www.pcouncil.org and Dale Sweetnam, California Department of Fish and Game

2010 Pacific Sardine Harvest Specifications and Management Measures:

On November 3, 2009 the Council adopted a coastwide harvest guideline (HG) of 72,039 mt for the 2010 Pacific sardine fishery. The adjusted allocation of 60,039 mt is to be allocated seasonally as follows:

Coastwide Harvest Guideline = 72,039 mt – 5,000 mt = 67,039 mt				
	Period 1	Period 2	Period 3	Total
	Jan 1 – June 30	July 1 – Sept 14	Sept 15 – Dec 31	
Seasonal Allocation	23,463	26,816	16,760	67,039
Incidental Set Aside	1,000	1,000	1,000	3,000
Management Uncertainty Buffer	0	0	4,000	4,000
Adjusted Allocation	22,463	25,816	11,760	60,039

* Note: All data presented are considered preliminary and subject to change.

Eighty-eight percent of the total landings are from southern California (primarily San Pedro and Terminal Island). Statewide the fleet is averaging 222.19 mt/day while fishing an average of 4 days/week (just under 900 mt/wk).

The Pacific sardine fishery was officially closed by NMFS at 12:01 am on Sunday, June 12, 2010. Until the next allocation period opens on July 1, 2010, sardine can only be harvested as part of the live bait fishery or incidental to other fisheries (limited to 30-percent or less by weight of all fish per trip) (Figure 15).

1st Allocation Sardine Landings 2009 & 2010

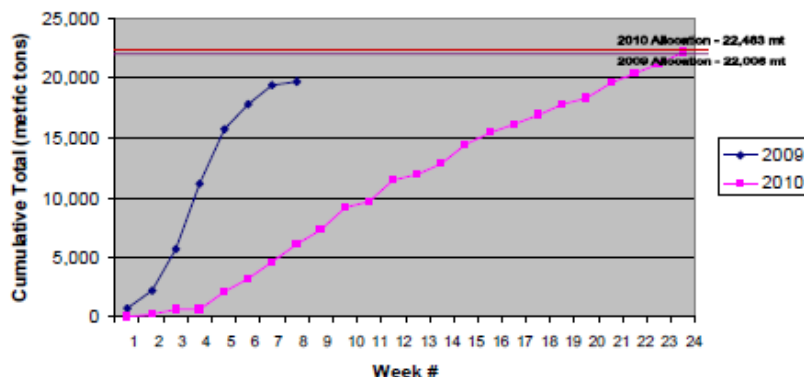


Figure 15. This graph compares the weekly Pacific sardine cumulative landings from 2009 and 2010.

Pacific Mackerel:

Source: Pacific Fisheries Management Council (PFMC) www.pcouncil.org

The Pacific Fishery Management Council (Council) is scheduled to review the current Pacific mackerel stock assessment and adopt a harvest guideline for the 2010/2011 Pacific mackerel fishing season, which runs from July 1, 2010 through June 30, 2011. The Council is also scheduled to review the 2010 Status Assessment and Fishery Evaluation document, which includes a Coastal Pelagic Species Management Team (CPSMT) recommendation on the Coastal Pelagic Species (CPS) Essential Fish Habitat (EFH) five-year review.

In the absence of an updated assessment in 2010, harvest and management recommendations for the 2010-2011 fishing season will be based, in part, on the 2009 full assessment. The CPSMT will consider the 2009 assessment results, the ongoing 2009-10 fishing season, and any new research results when developing its recommendations for 2010-2011. The harvest specifications and management measures in place for 2009-10 could be considered for the 2010-2011 fishing year as well. These included an Acceptable Biological Catch (ABC) of 55,408 metric tons (mt), and a Harvest Guideline (HG) of 10,000 mt with a 2,000 mt set-aside for incidental harvest.

Salmon in the Pacific Northwest:

Source: Bill Peterson, NOAA, NMFS

Counts of spring Chinook at the fish ladder on the first dam on the Columbia River (Bonneville) showed that the third highest number of spring Chinook returning since the time series was initiated in 1938. These fish went to sea during the spring of 2008 and experienced the best ocean conditions in several decades. Similarly, coho salmon that went to sea in 2008 returned in fall of 2009 at the second highest counts ever recorded. For coastal hatchery coho salmon (aka OPIH) that went to sea in spring 2008, the returns in 2009 were 4.7%, the highest value observed since 1990.

Groundfish:

Source: Pacific Fisheries Management Council (PFMC) www.pcouncil.org

Modifications to commercial and recreational management measures for the 2011-2012 season are being considered for final action by the PFMC especially for the 2011-2012 Washington recreational groundfish fisheries. The WDFW discussed recreational bottomfish proposals for 2011 and 2012.

Highly Migratory Species (HMS):

Source: Pacific Fisheries Management Council (PFMC) www.pcouncil.org

The Highly Migratory Species Management Team (HMSMT) recommended postponing any management measures for bigeye and yellowfin tuna until September after the updated stock assessments for these species are available.

The HMSMT discussed the possibility that the U.S. delegation propose adoption of a Total Allowable Catch (TAC) management framework for the eastern Pacific Ocean tuna purse seine fishery at the upcoming IATTC meeting. The HMSMT believes that this may be a more effective method to manage capacity and catch in the purse seine fleet compared to the current vessel capacity limits and time/area closures.

Fishery Management Plan Amendment 2, Annual Catch Limits and Accountability Measures:

The Council took final action by adopting a new alternative, Alternative 5, which has the following elements of change to the HMS fishery management plan (FMP): (1) Defining management unit species as: albacore tuna, bigeye tuna, skipjack tuna, bluefin tuna, yellowfin tuna, striped marlin, swordfish, blue shark, common thresher shark, shortfin mako shark, and dorado (dolphin); (2) Defining ecosystem component species as: bigeye thresher shark, common mola, escolar, lancetfishes, louver, pelagic stingray, pelagic thresher shark, and wahoo; (3) Adding language describing the need for the Council to coordinate with the Western Pacific Fishery Management Council to determine the primary FMP at the stock level for managed species found in both the HMS FMP and the Pelagics FMP; (4) Adding language describing how maximum sustainable yield (MSY) or MSY proxies are to be estimated using methods consistent with data availability category and specification of ABCs and ACLs as described in National Standard 1 Guidelines in the case any managed

species become not subject to the international exception; (5) Adding language describing that estimates of MSY and optimum yield (OY), currently included in the FMP, can be adjusted based on new information through the biennial management process described in the HMS FMP, which provides for NMFS review of Council recommendations; and (6) While not a change to the FMP, the Council confirmed that status determination criteria and OY will be estimated using methods as currently described in the FMP.

Marine Mammals:

Source: SWFSC, Gray Whale Studies

<http://swfsc.noaa.gov/textblock.aspx?Division=PRD&ParentMenuId=211&id=9036>

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

Each winter, the entire Eastern Pacific (or California) population of gray whales migrates from its primary feeding grounds in the Arctic to the lagoons and near-shore areas of Baja California, Mexico to breed, bear and nurse their young, and cavort before returning to the Arctic. Southwest Fisheries Science Center (SWFSC) monitors this migration each year, conducting shore-based surveys from two sites on the California coast. Southbound migration monitoring occurs from the Granite Canyon Marine Laboratory and northbound migration monitoring occurs from Piedras Blancas.

Counts of northbound cows and calves have revealed surprising variability in calf production for this population. Estimates of gray whale calf abundance from 1994-2006 are shown in figure 16. It appears that the number of calves born each year is related to environmental conditions in the Arctic that limit prey populations and/or the availability of prey to reproductive females. It's hypothesized that the timing of the melt of sea ice in the Arctic may control access to primary feeding grounds for newly pregnant females and thus impact the probability that existing pregnancies will be carried to term.

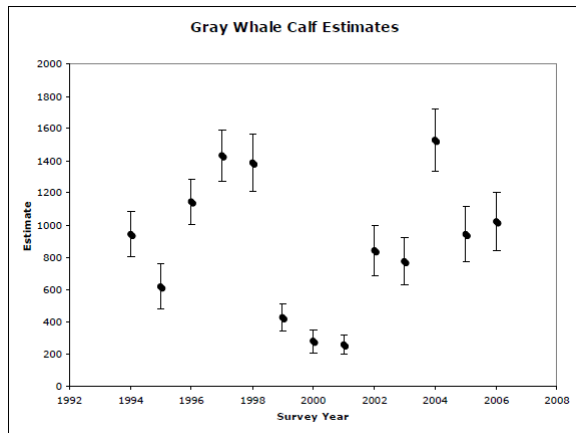


Figure 16. Estimates of northbound gray whale calves based on counts from the Piedras Blancas Light Station. Vertical bars around the points indicate the uncertainty in the estimate.

The April 2010 coastal census did not record as many northbound gray whales as expected. There either appears to be a change in whales' behavior that makes them more difficult to locate or there may be fewer Gray whales than expected.

Harmful Algal Blooms:

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

Washington HAB Summary

Washington Department of Health <http://ww4.doh.wa.gov/gis/mogifs/biotoxin.htm>,
<http://www.wdfw.wa.gov/fish/shelfish/razorclm/season.htm>

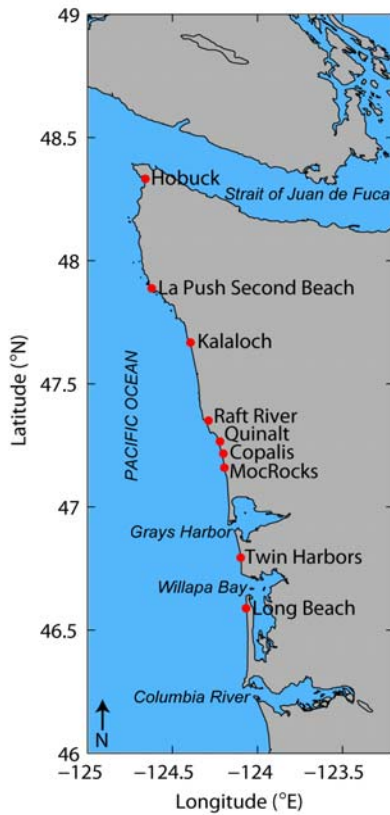


Figure 17: ORHAB monitoring locations on the outer coast of Washington State.

Washington's Olympic Region Harmful Algal Bloom (ORHAB) partnership monitors nine regular sites along Washington's outer coast (Figure 17) for the presence of several harmful phytoplankton species including *Pseudo-nitzschia* spp., *Alexandrium* spp., and *Dinophysis* spp. The smaller *Pseudo-nitzschia* cell type commonly includes *P. delicatissima*, *P. pseudo-delicatissima*, *P. cuspidata*, *P. calliantha* and the larger cell type commonly includes *P. australis*, *P. multiseriata*, *P. pungens*, *P. heimii*, *P. fraudulenta*. When action levels for the 2 cell sizes are exceeded (50,000 cells/L for the larger cell type; 1,000,000 cells/L for the smaller cell type), toxin testing in seawater and shellfish is initiated.

In April, domoic acid levels in shellfish remained well below closure level of 20 ppm along Washington's outer coast. Domoic acid levels in razor clams was 1.0 ppm at Kalaloch Beach (measured April 12th, 2010), Copalis Beach (measured April 11th, 2010), MocRocks Beach on the central Washington coast (measured April 18th, 2010), at Twin Harbors (measured April 11th, 2010), and at Long Beach (measured April 12th, 2010).

In June, the Washington Department of Health enacted emergency closures. In San Juan County, as of June 18th, 2010, the east side of San Juan Island from Low Point north to the north side of Roche Harbor and the north and east side of Lopez Island from Flat Point southeast to Shoal Bight are closed to all species of shellfish. "All species" include clams, oysters, mussels, and other invertebrates such as moon snail.

Oregon HAB Summary

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

Pseudo-nitzschia (P-n) cell counts remained above alert levels along much of the Oregon Coast during the mid May collection. The greatest abundance of cells was found in the region between Gold Beach and Newport. The “hotspot” was near Coos Bay, on May 19 Whiskey Run had 384,000 cells/L while Bastendorff Beach had 361,000 cell/L. Gold Beach cell counts dropped slightly to 270,000 cells/L and cell counts were also a bit lower to the north with Tillicum beach at 120,000 cells/L on May 17.

Along the north coast *P. deli/p-deli* complex dominated and cell densities reached a maximum of 55,000 cells/L at Cannon Beach and 19,000 cells/L along Clatsop Beach.

Samples collected in early June indicated warming water temperatures and decreasing phytoplankton abundance coast-wide; temperatures reached 60°F along Clatsop Beach and 58°F in Gold Beach. Previously high P-n cell counts in the affected clam closure region from Coos Bay to Bandon have decreased to well below alert levels. In this region, the highest P-n cell count was at Gold beach at 24,000 cells/L. *Alexandrium* was also seen in the Gold Beach sample at 1,000 cells/L.

Continuing up the coast *Psuedo-nitzschia* cell counts continued to decrease with most sites well below 10,000 cells/L. *Alexandrium* and *Dinophysis* were observed in whole water samples collected along Clatsop Beach both at 1,000 cells/L.

In May and early June, domoic acid levels in razor calms were above the alert level on the south Oregon Coast. Recreational razor clam harvesting is closed from Coos Bay to Bandon.

Please view the http://oregon.gov/ODA/FSD/shellfish_status.shtml site for the most current status.

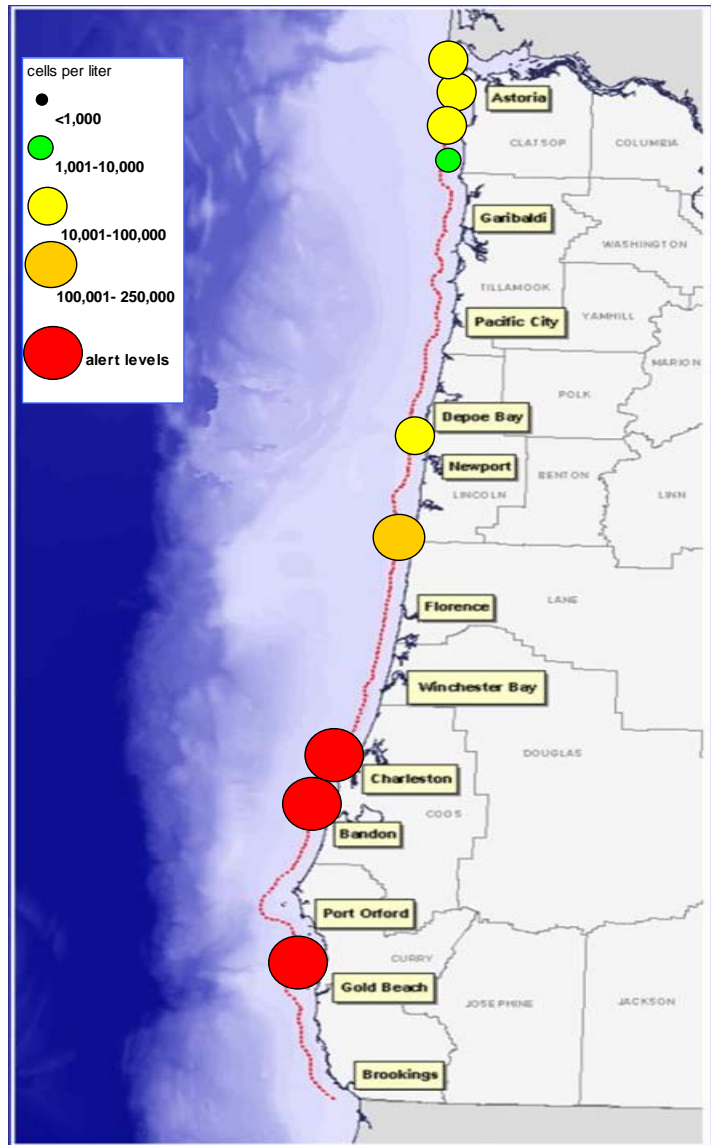


Figure 18. Oregon’s HAB monitoring project in conjunction with Oregon Department of Agriculture monitors ten sites along the Oregon coast. The coastal distribution of *Pseudo-nitzschia* (cells per liter) for the second quarter of 2010.

California HAB Summary

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

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

Phytoplankton observations and toxin monitoring during April detected *Pseudo-nitzschia* along the entire southern California coast and at most sampling locations between Sonoma and Monterey counties, as well as Del Norte and Humboldt counties, but with no indication of domoic acid toxin buildup in shellfish. *Alexandrium* was observed at San Luis Obispo, Ventura, and San Diego counties. Paralytic Shellfish Poisoning (PSP) toxins were not detected in any southern California shellfish samples collected in April. Northern California mussel samples collected from Humboldt Bay and Drakes Estero indicated low concentrations of PSP.

In May, *Alexandrium* dinoflagellates were observed offshore of Marin and San Mateo counties (38°N). Low levels of *Alexandrium* produced PSP-toxins occurred inside Humboldt Bay and at Trinidad Head (41°N). *Pseudo-nitzschia* diatoms (PN) increased to bloom levels in Monterey Bay and at several Santa Barbara sites. Domoic acid was detected in shellfish in both regions, and at double health alert levels (40 ppm) in mussels from structures offshore of Santa Barbara.