CLIMATE NARRATIVE, June 2020 and as noted

Climate_Narratives may be found, https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html

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UNITED STATES WEST COAST AND NORTH PACIFIC

During late June 2020, US west coast (20-200 km offshore) satellite derived sea surface temperatures (SST_{Jn}) were 9°-12°C from 38°N to 44°N, 14°-17°C south of 38°N to Point Conception (34.5°N) and 14°-20°C off southern California and northern Mexico. Extensive Positive SST anomaly seen along the west coast of the US at the end of May was replaced by negative to neutral SST_{Jn} anomaly, particularly between 34°-43°N. Negative SST_{Jn} anomaly (≥ -2.5°C) was seen in plumes extending west from Cape Blanco and Cape Mendocino and southwest near Point Arena. Offshore, positive SST_{Jn} anomaly (≤ 2 °C) occurred north of 36°N and west of 128°W. A band of positive anomaly (≤2.5°C), more than 700 km wide, extended zonally across the Pacific Ocean at 30°N bending poleward into the Gulf of Alaska near 140°W and bending equatorward at 180°(E/W) and extending through Indonesia into the Indian Ocean. Positive SST anomaly (≤ 2.5°C) occurred in the Gulf of Alaska, across the North Pacific north of 50°N, and into the Bering Sea. https://www.ospo.noaa.gov/Products/ocean/sst/anomaly/
https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html (current)
https://coastwatch.pfeg.noaa.gov https://climatereanalyzer.org/wx/DailySummary/#sstanom (current)
https://www.ospo.noaa.gov/Products/ocean/sst/contour/index.html
https://www.fisheries.noaa.gov/feature-story/central-gulf-alaska-marine-heatwave-watch?utm_medium=email&utm_source=govdelivery

June **Sea Level Height Anomaly** (SLA) analyses of the Pacific Ocean (30°S-40°N), showed negative SLA persisting along the eastern boundary from the equator poleward of 40°N. At 5°-15°N, negative SLA (≥ -15 cm) occurred across the Pacific Ocean from North America to Indonesia. Negative SLH (>10 cm) occurred in the central north Pacific from 20-35°N, flanked on the east by positive SLH (≤10 cm) 30°-40°N, 130°-170°W and on the west by positive anomaly (≥15 cm) apparently associated with the Kuroshio Ocean Current and Kuroshio extension east across the North Pacific. Negative SLH occurred along the east coast of Japan.

During June, surface **chlorophyll-a** (chl-a) of 0.5- 4.0 mg/m^3 was seen more than 200 km offshore between southern California and Vancouver Island (34°-50°N). This coastal zone of high chl-a appeared widest between 36°N and 42°N. These along-coast bands appeared spatially less developed north of 43°N. Areas of chl-a concentrations from 5 to more than10 mg/m^3 occurred locally inshore. Concentrations 0.5-3.0 mg/m^3, were observed around the Gulf of Alaska and into a productive Bering Sea. Oceanic chl-a concentrations 500-1000 km off Washington were about 0.3-0.6 mg/m^3. High chl-a coastal regions were 25-75 km wide occurred off northern Mexico and Southern California. Offshore water (≤ 0.2 mg/m^3) occurred 50-150 km offshore the Southern California Bight and northern Mexico. Derived surface layer chl-a concentrations and distributions may vary depending on satellite sensors and compositing techniques. Here, we refer primarily to 8-day composite NOAA VIIRS imagery.
https://coastwatch.pfeg.noaa.gov/coastwatch/CWBrowserWW180.jsp#
https://coastwatch.pfeg.noaa.gov/erddap/griddap/erdVHNchla8day.graph?chla[(2020-08-30T00:00:00Z)][(0.0)][(83.65125):(-0.10875)][(-193.76625):(-110.00625)]&.draw=surface&.vars=longitude%7Clatitude%7Cchla&.colorBar=%7C%7C%7C%7C%7C&.bgColor=0xffccccff

Monthly sea temperature list from shore stations and **near-shore buoys,**

The following list gives shore and nearshore water temperature measurementsw in decreasing latitude. Each line begins with a shore station or buoy abbreviation followed by latitude. Temperature values are in brackets with the average of available monthly values first (followed by the range) in parens and change from previous monthly mean. Averages for the (first, second and third) thirds of the month (terciles), are within the second parens, followed by the multiyear monthly average, where available. Subscripts H and L indicate the tercile the Highest and Lowest monthly temperatures occurr.

Coastal upwelling and seasonal heating were seen in changes observed at listed buoys and shore stations. Available temperature anomalies for June were less than 1.0°C. Except for the Cape Elizabeth Buoy (CpEz), May to June temperature changes were negative at the Eel River Buoy (EelR) and northward. Largest positive month-to-month changes in this northern area occurred from March to May and the highest temperatures for June occurred in the second tercile. Monthly May to June temperature changes were near zero at Arena Cove (*ArCv*), Santa Monica (*SMca*) and the Torry Pines Buoy (Tory) but otherwise positive at the San Francisco Buoy (SFrn) southward to La Jolla (*LaJo*).

List, June 2020

Neah,48.5°N,124.7°W [11.6(10.0-14.6)-0.6(10.8$_{L}$, 12.4$_{H}$,11.6) 11.7°C]

Cape Flattery 48.4°N

NeBy,48.4°N *[11.5(9.3-14.7)-0.6(10.7$_{L}$,12.1$_{H}$, 11.6)°C]*

CpEz,47.4°N,124.7°W [13.7(10.9-15.9)0.5(12.4$_{L}$,14.3$_{H}$,14.1$_{H}$)13.1°C]

Cape Blanco 42.8°N

PrtO,42.7°N *[9.7 (7.2-14.4)-1.7(9.8,11.1$_{H}$,8.2$_{L}$)°C]*

CCty,41.7°N *[12.9(8.6-16.7)-0.3(13.3,12.2,13.2$_{LH}$)°C]*

EelR,40.7°N,124.5°W [12.5 (10.3-15.4)-0.4(12.0, 13.4$_{H}$,11.9$_{L}$)11.8°C]

Point Arena 39°N

ArCv,38.9°N *[11.2(9.7-14.3)0.2(10.7,11.2$_{L}$,11.8$_{H}$)°C]*

Point Reyes 38°N

SFrn,37.8°N,122.8°W [12.5(10.4-14.7)0.6(12.7$_{LH}$,11.7$_{L}$,13.1$_{H}$)11.6°C]

Mtry,36.6°N *[16.1 (12.5-18.4)1.1(17.0,16.2$_{H}$,15.0$_{L}$)°C]*

Point Sur (36.3°N)

PrtS,35.1°N *[14.5 (11.9-17.7)1.4(14.6$_{H}$,13.3$_{L}$,15.5)°C]*

PtCn,34.5°N,120.8°W [14.3(11.6-16.9)0.8(13.9,13.5$_{L}$,15.7$_{H}$)°C] stable

Point Conception,34.4°N

SBCh,34.3°N,119.9°W [16.3(13.7-17.3)1.8(15.7$_{LH}$,16.0$_{LH}$,17.0$_{H}$)15.5°C]

SMca,34°N *[18.3(13.3-20.8)0.0(17.4$_{L}$,18.6,18.9$_{H}$)°C]*

Tory,32.9°N,177.4°W [18.3(16.1-21.2)0.0(18.2$_{LH}$,18.3$_{H}$,18.6)°C]

LaJo,32.9°N *[19.6 (13.4-21.5)1.3(18.2$_{LH}$,20.4$_{H}$,20.0)°C]*

Point Loma, 32.7°N

Shore temperature measurements, taken at fixed depth below the lowest tide at NOAA **tide stations**, are indicated by: *NeBy* (9443090), *PrtO* (9431647), *CCty* (9419750), *ArCv* (9416841), *Mtry* (9413450), *PrtS* (9412110), *Smca* (9410840), *LaJo* (9410230) in. (Numbers) lead to detailed location and station descriptions, https://tidesandcurrents.noaa.gov/stations.html?type=Physical%20Oceanography

. Near shore buoy measurement details are obtained from number designations: Neah (46087), CpEz (46041),TlMk (46089), EelR (46022), SFrn (46026), PtCn (46218), SBCh (46053),Tory (46225) . https://www.ndbc.noaa.gov/station_page.php?station=46087

EQUITORIAL AND SOUTH PACIFIC (late June and as noted)

During June combined model results give El Niño neutral conditions 50% chance of continuing across the Equatorial Pacific (EP) through fall and into winter. Eastern EP subsurface temperature anomalies increased as negative SST_{Jn} anomaly increased in areal extent. The eastern EP upper 300 m heat content anomaly increased, tending toward neutral. In patterns similar to those of May, the South Pacific Ocean had predominately negative to neutral SST_{Jn} anomaly east of 135°W and neutral to positive SST_{Jn} to the west. Negative SST_{Jn} anomaly (≥-2°C) occurred off the coast of Peru and Ecuador and across the EP to 140°W. Negative SST_{Jn} anomaly occurred along the south coast of Australia and extended in an intermittent band westward across the Indian Ocean to the coast of South Africa. http://www.ospo.noaa.gov/Products/ocean/sst/anomaly/
https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf
https://www.ospo.noaa.gov/Products/index.html

Late June **Sea level height anomaly** (SLA) analyses for the south Pacific Ocean (0°-30°S) showed negative SLA (≥-10 cm) along the South American coast. Negative to neutral SLH was most common east of 135°W and neutral to positive SLH was more common in the west. Negative SLH (≥ 15 cm) extended from South America westward to 165°W at the equator. Negative SLH was found in an intermittent band across the South Pacific between 10°-20°S. West of 140°W, positive SLH (≤ 10 cm) was observed north and south of this band.
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ocean/weeklyenso_clim_81-10/wksl_anm.gif

The NOAA **Oceanic El Niño Index** (ONI) (3-month running mean of SST anomalies in the Nino 3.4 region) decreased out of El Niño-positive range in the March-April-May (MAM) mean (0.3). The AMJ mean decreased again to 0.0.
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf
https://climatedataguide.ucar.edu/climate-data/multivariate-enso-index (alternate El Niño index)

The **Southern Oscillation Index** (SOI) refers to the alternation of sea level pressure (SLP) anomalies at Darwin in Northern Australia (12.5°S, 130.8°E) and at Tahiti (17.5°S, 149.5°W). Prolonged periods of negative SOI values, corresponding to below-normal SLP at Tahiti and above-normal SLP at Darwin, may indicate abnormally warm ocean waters across the eastern tropical Pacific characteristic of El Niño episodes. NOAA/PSL SOI values for January-June 2020 are 0.30, -0.10, -0.20, 0.30, 0.70, -0.60.
https://psl.noaa.gov/data/correlation/soi.data https://psl.noaa.gov/site_index.html#s https://www.longpaddock.qld.gov.au/soi/

The NOAA/NCEI **Pacific Decadal Oscillation Index** (PDO), calculated from Pacific Basin wide ERSST.v4 was less than -1.30 from January through April, increasing to -0.53 and -0.60 in May and June, respectively.
https://www.ncdc.noaa.gov/teleconnections/pdo/ , http://research.jisao.washington.edu/pdo/PDO.latest.txt

The **Pacific / North American Teleconnection Index** (PNA), computed from atmospheric pressure over the Pacific Ocean and North America in June had neutral to positive daily values, with a monthly "Historical" PNA index of 0.86. The "Historical" PNA indices are standardized by the 1981-2010 climatology and are available, ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/pna_index.tim https://www.cpc.ncep.noaa.gov/data/teledoc/pna.shtml (note computational alternatives).

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June monthly ERD/SWFSC west coast Upwelling Indices (UI) were strongly positive from 24°N to 42°N. The UI values computed for 33°N and 39°N were both 394, where UI anomalies were -16 and 127, respectively. The largest UI anomalies occurred between 36°-42°N. UI was near neutral north of 45°N with small anomaly values. https://upwell.pfeg.noaa.gov/products/PFELData/upwell/monthly/table.2006

At 39°N, daily upwelling conditions indicated by UIs were strongly favorable during 1-4 June and 16-30 June. At 36°N, UI was largest after 15 June, continuing in four episodes until 30 June. UIs are calculated from west coast atmospheric pressure and are usually episodic in one to 10-day periods.
https://oceanwatch.pfeg.noaa.gov/products/PFELData/upwell/daily/p09dayac.all (see computational alternatives)
https://oceanview.pfeg.noaa.gov/products/upwelling/dnld (current)

PRECIPITATION and RUNOFF (late June)

Washington and parts of Oregon had above average monthly rain fall in June. However, most of Oregon and northern California remained in moderate drought conditions, that have persisted through the first half of 2020. Rain deficits > 12 inches were seen in the Umpqua and Rogue River basins of southern Oregon during late June.
https://droughtmonitor.unl.edu.
https://www.cpc.ncep.noaa.gov/products/global_monitoring/precipitation/global_precip_accum.shtml
https://waterdata.usgs.gov/ca/nwis/nwis
https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=4
https://www.cnrfc.noaa.gov/monthly_precip.php

Northwest and Washington River Discharge

Fraser River discharge, measured in late **June** at Hope (130 km upriver from Vancouver, B.C.), was at a seasonal maximum 10,350 m^3/s (365,000 cubic feet /sec or cfs). The late June multi-year median for Hope is 7,500 m^3/s. https://wateroffice.ec.gc.ca
The **Queets** River at Clearwater, WA was flowing at 1,630 [1,560/ -860 cfs -historical median/ and change from previous month as cfs in brackets]. The **Puyallup** at Puyallup was flowing at 3,700 cfs [3,550/ -3,930 cfs]. **Skagit** flow was 24,000 [19,200/ -8,600 cfs] near Mount Vernon. **Stillaguamish** discharge was 834 [1,000/ -1,836 cfs] at Arlington. **Columbia** transport was 312,000 [317,000/ -52,000cfs] at Vancouver,WA.

Oregon River Discharge

The **Columbia** at the Dalles, OR was flowing at 327,000 [343,000/ -25,000 cfs], The **Wilson** at Tillamook, was flowing at 325 [208/ -27 cfs]**.** At Elkton, **Umpqua** transport was 1,900 [2,030/ -1,410cfs]. **Rogue R.** flow was 1,740 [2,080/ -2,930 cfs] at Grants Pass and 2,560 [2,700/ -1,100cfs] at Agness.

California River Discharge

The **Klamath** near Klamath, CA was transporting 3,890 [5,890/ -5,160 cfs]. **Smith** R. discharge was 698 [645/ -1,102 cfs] near Crescent City. The **Eel** at Scotia had 297 [500/ -1,503 cfs] transport. The **Battle Creek,** Coleman National Fish Hatchery flow was 261 [338/ -108 cfs]. **Butte Creek** at Chico had 141 [179/ -41 cfs] transport.

Sacramento R. transport was 10,200 [11,600/ 1,750 cfs] at Verona and 16,700 [14,700/ 2,200 cfs] at Freeport. **San Joaquin** flow was 845 [1,700/ -865 cfs] at Vernalis. **Pescadero Creek** transport was 2 [6/ -3 cfs] near Pescadero. **San Lorenzo** discharge was 13 [21/ -10 cfs] at Santa Cruz. The **Pajaro** R. at Chittenden was flowing at 11 [9/ -19 cfs]. The **Salinas** near Spreckels was at 46 [2/ 27 cfs]. The **Carmel** at Carmel was flowing at 9 [1 / -25 cfs]. The **Big Sur** River near Big Sur, CA discharged at 31 [26/ -23 cfs], during the final days of June.

Notes (June 2020)

These **Climate_Narratives** collect information from a wide variety of sources, there may have transcription errors. The assembly of information may also lead to i**nconsistencies**, as when sequential monthly descriptions emphasize different information sources. The reader is cautioned to check the references. If the sources given are not sufficient to verify the Narrative or you have found errors, please contact us, Jerrold.G.Norton@noaa.gov . We want to correct any errors detected. Errors can be corrected in a modified text and reposted on the Environmental Research Division web site, https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html If the reader would like to discuss inconsistencies, please contact us. The intent of these monthly Narratives is to assemble descriptions and references that may be combined with user information to assist further study and understanding of ongoing climate characteristics.

Fish Otoliths are continually growing calcium carbonate and protein structures within a fish's inner ear that aid in hearing and balance. Otolith structure is banded at annual and other frequencies, making them useful in estimating fish age and other environmental characteristics. Analysis of trace elements and isotopes within the banded otolith structure can information about the fish's time-dependent environmental exploitation. Thomas Helser and others have pioneered and improved methods of otolith analysis based on Fourier transform-near infrared spectroscopy (FT-NIRS), that is a method of measuring light absorbance signatures (Canadian Journal of Fisheries and Aquatic Sciences, 2019, https://doi.org/10.1139/cjfas-2018-0112). FT-NIRS methods were demonstrated effective in determining the age and species from otolith structure. FT-NIRS analyses can be done at 10 times the rate of traditional methods with comparable precision. This approach indicates fish (depending on species) age within ±1.0 year of age 67% of the time. When comparing approaches, the FT-NIRS had as good or slightly better precision (75% agreement) than the traditional ageing (66% agreement) and showed little or no bias at ages ≤ 12 years for Walleye Pollock (*Gadus chalcogrammus*) otoliths. Age data are critical for understanding population dynamics of commercially fished species and for providing management advice.
https://www.fisheries.noaa.gov/feature-story/innovative-technology-promises-fast-cost-efficient-age-data-fisheries-management
https://www.fisheries.noaa.gov/feature-story/near-infrared-technology-identifies-fish-species-otoliths?utm_medium=email&utm_source=govdelivery