

CLIMATE NARRATIVE, July 2019 and as noted

WEST COAST OF UNITED STATES AND NORTH PACIFIC

Weakening of coastal upwelling winds north of Cape Mendocino (40.4°N) combined with anomalously high July sea surface temperature (SST_{Jy}) offshore, resulted in positive SST_{Jy} anomaly ($\leq 2.5^{\circ}\text{C}$) extending from the coast to 160°W . These areas of positive anomaly also extended poleward into the Gulf of Alaska, the Bering and Chukchi Seas. Areas of negative anomaly ($\geq -1.5^{\circ}\text{C}$) occurred off the lower Southern California Bight and northern Mexico (27° - 33°N). However, east of 160°W , areas of negative SST anomaly in the North Pacific (NP) are being replaced by areas of average or above average SST. Negative SST_{Jy} anomaly ($\geq -2^{\circ}\text{C}$) occurred between 160°W - 160°E and 40° - 50°N . <https://www.ospo.noaa.gov/Products/ocean/sst/anomaly/> https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html (current) <https://coastwatch.pfeg.noaa.gov/> (archive) <https://climatereanalyzer.org/wx/DailySummary/#ws10> <https://www.ospo.noaa.gov/Products/ocean/sst/contour/index.html> (current)

During July negative **sea level height anomaly** (SLA) -20 to -5 centimeters (cm) was typical of the Pacific east of 150°W between 0° - 10°N . Negative SLA ($\geq -10\text{ cm}$) was found from this southern area northward along the North American coast beyond 40°N . Negative SLA of the northern coastal area was also continuous southwestward with a trans-Pacific strip of negative SLA that reached to 125°E , off Indonesia (0° - 20°N). Positive SLA (5-15 cm) occurred in the western Pacific north of 25°N and in the central Pacific between 120°E - 150°W and 3° - 20°N .

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ocean/weeklyenso_clim_81-10/wksl_anm.gif (current 30°S-40°N)

During late July, NOAA VIIRS and other satellite derived imagery showed filaments of surface **chlorophyll-a** (chl-a) between 0.3-1.0 mg/m³ extending out from the coast 50-100 kilometers (km) south of 33°N off Southern California and northern Mexico. From Point Conception (34.4°N) to Point Reyes (38.0°N) these structures extended 200-300 km offshore. From Point Arena (38.9°N) to Cape Blanco (42.8°N) the filaments reached 300-500 km offshore. North of Cape Blanco there was a more uniform coastal band of elevated chl-a about 100-200 km wide. Chl-a, at 4-12 mg/m³, occurred within the areas of lower concentration, often near the coast. Irregular coastal band boundaries marked the coastal upwelling system's transport, subsidence and mixing processes. Chl-a concentrations, usually $\leq 4\text{ mg/m}^3$, were observed throughout the Gulf of Alaska and Bering Sea.

[https://coastwatch.pfeg.noaa.gov/erddap/griddap/erdVHNchla8day.graph?chlal\[\(2019-07-30T00:00:00Z\)\]\[\(0.0\)\]\[\(83.65125\):\(-0.10875\)\]\[\(-193.76625\):\(-110.00625\)\]&draw=surface&vars=longitude%7Clatitude%7Cchlal&.colorBar=%7C%7C%7C%7C%7C&.bgColor=0xffffccff](https://coastwatch.pfeg.noaa.gov/erddap/griddap/erdVHNchla8day.graph?chlal[(2019-07-30T00:00:00Z)][(0.0)][(83.65125):(-0.10875)][(-193.76625):(-110.00625)]&draw=surface&vars=longitude%7Clatitude%7Cchlal&.colorBar=%7C%7C%7C%7C%7C&.bgColor=0xffffccff) <https://coastwatch.pfeg.noaa.gov/coastwatch/CWBrowserWW180.jsp#> <https://coastwatch.pfeg.noaa.gov>

SST at Buoys

Offshore **Torrey Pines**, (46225) 32.9°N , 177.4°W at 549 meter depth, the average SST_{Jy} was 21.0°C with a range of 18.1 - 23.6°C . Average SST_{Jy} values were 19.9 , 20.8 , 22.1°C for the first, second and final thirds of July, noted below as [19.9, 20.8, 22.1°C]. **Santa Barbara Channel** Buoy (34.3°N , 119.9°W) multi-year SST average (SST_a) and SST_{Jy} were 17.1 and 16.4 (14.4 - 18.0°C), respectively [16.3, 16.4, 16.4°C]. At the **San Francisco** Buoy (46026) 18 nautical miles (NM) west of San Francisco (37.8°N , 122.8°W), SST_a and SST_{Jy} were 13.0 and 12.8 (10.9 - 15.4°C), respectively, [12.3, 12.3, 13.8°C]. At the **Eel River** Buoy (46022) 17 nm WSW of Eureka, CA

(40.7°N, 124.5°W) July SST_a and SST_{Jy} were 12.3°C and 12.7°C (10.9-15.2°C), respectively [12.9, 12.7, 12.5°C]. At the **Tillamook Buoy** (46089), 85 NM WNW of Tillamook, OR (46°N, 125.8°W), the July aSST and SST_{Jy} were 16.2°C and 17.6°C (15.6-20.7°C), respectively [16.6, 17.7, 18.5°C]. Near **Cape Elizabeth** (46041), 45 NM NW of Aberdeen, WA (47.4°N, 124.7°W) SST_a and SST_{Jy} were 13.7°C and 16.5°C (13.7-19.7°C), respectively [15.4, 17.4, 16.7°C]. **Neah Bay** Buoy (46087), 6 NM north of Cape Flattery (48.5°N, 124.7°W) had SST_a and SST_{Jy} of 11.9°C and 12.8°C (10.8-15.6°C), respectively [12.6, 12.8, 12.9°C]. SST is measured 0.4-1.0 m below the level sea surface, depending on buoy type. https://www.ndbc.noaa.gov/station_page.php?station=46087

Shore station temperature

The **La Jolla** (32.9°N) SIO-Manual **Shore Station** Program found SST anomaly reached the daily average of 19.5° at the end of June, dropped to 17°C in early July, then increased again to 23.3°C with 2-3°C anomaly at the end of July. The multi-year monthly mean for July is 20.2°C. <https://scripps.ucsd.edu/programs/shorestations/> **La Jolla Subtidal Water Temperature** (STWT), measured at fixed depth below the lowest tide at tide monitoring stations, had July mean of 20.0°C with range from 12.8 to 24.5 (12.8-24.5). Averages during the first, second and third 10-day July periods were 18.0, 20.5 and 21.5°C, respectively [18.0, 20.5, 21.4°C,]. At the **Santa Monica** pier (34°N) July average STWT was 20.9°C (16.8- 23.6), with [20.4, 21.2, 21.2°C]. In Southern **Monterey Bay** (36.6°N) average July STWT was 15.7°C (12.8-18.0°C) with [16.1, 15.1, 16.0°C]. **Arena Cove** (38.9°N) average STWT for July was 9.8°C (8.7-12.8°C), with [9.4, 9.6, 10.4°C]. **Crescent City** (41.7°N) average STWT was 13.5°C (9.5-16.8°C), with [13.0, 12.8, 14.6°C]. **Port Orford** 42.7°N average STWT was 9.2°C (7.5-13.8°C), with [9.1, 10.1, 8.4°C]. At **Neah Bay** (48.4°N) July STWT average was, 11.8° (9.3-14.8°C) with [11.5, 12.1, 11.9].

<https://tidesandcurrents.noaa.gov/stations.html?type=Physical%20Oceanography>

EQUATORIAL AND SOUTH PACIFIC

During July, the NOAA Oceanic El Niño Index indicated marginal El Niño presence in the Equatorial Pacific (EP). Negative SST_{Jy} anomaly ($\geq -2^{\circ}\text{C}$) became common in the EP east of 160°W. Eastern equatorial upper 300-meter (m) heat content anomaly was positive, but near zero. Negative subsurface temperature anomalies ($\geq -2.0^{\circ}\text{C}$) appeared at 50-100 m in the eastern and at 150-250 m in the western EP. Negative SST anomaly occurred along the cost of South America and poleward of 20°S throughout the southern oceans. The largest area of positive SST anomaly poleward of 20°S occurred in the western South Pacific northeast of New Zealand. Sea Level Height Anomaly (SLA) was negative in the eastern Pacific from 30°S to 40°N. Positive SLA anomaly occurred in two zonal bands from 140°W to 150°E, centered at about 5°S and 30°S, respectively, with a band of negative SLA between them.

https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf
<http://www.ospo.noaa.gov/Products/ocean/sst/anomaly/>
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ocean/weeklyenso_clim_81-10/wksl_anm.gif (current)

The NOAA **Oceanic El Niño Index** (ONI) (3-month running mean of SST anomalies in the Nino 3.4 region) appears to be weakening with 0.7 for April-June (AMJ) and 0.5 for MJJ. http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf For an alternate index computation see:

<https://climatedataguide.ucar.edu/climate-data/multivariate-enso-index>

The monthly NOAA/NCEI **Pacific Decadal Oscillation Index** (PDO), calculated from ERSST.v4, July 2019 value was 0.38, the highest value since April 2017. PDO and ONI indices are recalculated as data is assimilated into the data base.

<https://www.ncdc.noaa.gov/teleconnections/pdo/>

<http://research.jisao.washington.edu/pdo/PDO.latest.txt> (alternate calculation)

The **Pacific / North American Teleconnection Index** (PNA), computed from atmospheric pressure over the Pacific Ocean and North America had near neutral values (-0.03, 0.06) for June and July. <https://www.cpc.ncep.noaa.gov/data/teledoc/pna.shtml> (note computational alternatives)

July ERD/SWFSC coastal **Upwelling Indices** (UI) shows 54°-60°N with variable winds, 42°-51°N seasonal weakening of upwelling conditions, 33°-39°N robust upwelling conditions -- 30-40% stronger than seasonal average, and 24°-30°N robust seasonal UI for these latitudes. <https://upwell.pfeg.noaa.gov/products/PFELData/upwell/monthly/table.1907>

PRECIPITATION and RUNOFF (late July)

Drought conditions persisted from Oregon's north coast into Canada. These conditions were particularly severe in northwestern Washington.

<https://droughtmonitor.unl.edu> Cumulative water-year precipitation totals for California stations remained 90-120% of normal at the end of July, but there was little additional rain. The **Fraser River**, measured at Hope (130 km upriver from Vancouver, B.C.), was flowing near the July median at 3,500 m³/s (141,240 cubic feet /sec or cfs).

<https://wateroffice.ec.gc.ca> The **Puyallup River** at Puyallup, WA was flowing at 1,720 cfs [2,290 historical median as cfs in brackets]. The **Skagit River** was flowing at 10,500 [13,260 cfs] near Mount Vernon. **Stillaguamish River** discharge was 259 [442 cfs] at Arlington. **Columbia River** discharge at the Dalles was 157,000 [199,000 cfs] and 175,000 cfs [near median] at Vancouver WA. At Elkton, OR the **Umpqua River** transport was 1,010 [1,250 cfs]. **Rogue River** flow was 1,580 [1,510 cfs] at Grants Pass and 2,030 [1,930 cfs] at Agnees. The **Klamath River** near Klamath, CA was transporting 3,500 [3,150 cfs]. The **Smith River** near Crescent City discharged at 334 [366 cfs]. **Eel River** at Scotia had transport of 294 [171 cfs]. At the **Battle Creek**, Coleman National Fish Hatchery, the flow was 344 [255 cfs]. **Butte Creek** at Chico had discharge of 213 [131 cfs]. **Sacramento River** transport was 20,400 [15,300 cfs] at Freeport. **San Joaquin River** flow was 3,190 [1,140 cfs] at Vernalis. The **Salinas River** was flowing at 42 [2 cfs] near Spreckles and the **Carmel River** at Carmel was flowing at 8 [1 cfs]. Water runoff is important to nearshore ocean dynamics.

<https://waterdata.usgs.gov/ca/nwis/current/?type=flow>

<https://www.cnrfc.noaa.gov/awipsProducts/RNOWRKCLI.php> = (current)

https://wateroffice.ec.gc.ca/search/real_time_results_e.html

https://www.cpc.ncep.noaa.gov/products/global_monitoring/precipitation/global_precip_accum.shtml

NOTES

California coastal pelagic species (cps) landings totaled about 13,909 metric tons (mt) on 31 July 2019. The catch included 4,634 mt Pacific mackerel, 1 mt of jack mackerel, 850 mt of Pacific sardine, 4,428 mt of northern anchovy and 3,996 mt of market squid,

abbreviated [4634, 1, 850, 4428, 3996] for the respective catches. Total catch may fluctuate due to availability, regulation and demand. For comparison, total cps landings through July of 2000 and 2009 were 97,284 mt [10087, 1,159, 37144, 0, 48894] and 81,602 mt [2678, 247, 44118, 9700, 24859], respectively.

<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=31118&inline>

In late June 2019, rock from a 125-meter cliff slid into the **Fraser River**, creating a five-meter high inclined water fall. Early analyses suggested **salmon migrating** upstream would be severely impeded by the slide. By 31 July radio tagged salmon released below the slide had not been detected above the slide. The migration of sockeye through both marine and Fraser River environments has been very low in 2019 and migration timing has been later than usual, making responses to the slide essential. Since 12 July, approximately 40,000 salmon, both sockeye and chinook, have been monitored at hydro-acoustic sites downstream of the slide.

<https://www.psc.org/publications/fraser-panel-in-season-information/fraser-river-panel>

<https://www2.gov.hc.ca/gov/content/safety/emergency-preparedness-response-recovery/emergency-response-and-recovery/incident-summaries/big-bar-landslide-incident>

This Narrative may be found,

https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html

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