CLIMATE NARRATIVE, May 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 May 2020, **satellite derived sea surface temperatures** (SST_{My}) for the U.S. west coast from 20-250 km offshore showed positive SST_{My} anomaly (≤ 2.5°C) persisting off central and southern California and northern Mexico (30°-37°N). Positive SST_{My} anomalies from northern California to southeastern Alaska (39°-55°N) developed and intensified during May. Temperatures were above average over much of the northeastern Pacific Ocean during late May. However, between 30°-43°N, a band of neutral to negative SST_{My} anomaly (≥-1.5°C) extended intermittently westward from the coast of the US to the coasts of Japan and China (130°E). Generally, the western north Pacific had above average SST_{My} south of 30°N and average to below average SST_{My} north of 30°N. Negative SST_{My} anomaly (≥-2°C) was found off the west coast of Mexico between 15°-28°N and across the equatorial ocean from 90°W to the dateline (180° E/W). 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

Late May **Sea Level Height Anomaly** (SLA) analyses for the north Pacific Ocean show predominately negative SLA (>-15 cm) between the equator and 10°N and also extending northward along the eastern boundary north of 40°N. Positive SLA occurred in a broken band 12°-26°N, 90°-165°W. Most of the North Pacific north of 28°N and west of 140°W had positive SLA (≤15 cm). The southwestern north Pacific, west of 180°, had generally positive anomaly south of 10°N and negative SLA anomaly 10°-22°N. The SLA analyses referenced include 30°S-40°N and 75°W-120°E.
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ocean/weeklyenso_clim_81-10/wksl_anm.gif (current)

During May, surface **chlorophyll-a** (chl-a) of 0.5- 4.0 mg/m^3 was seen more than 100 km offshore between southern California and Vancouver Island (34°-50°N). This coastal zone of high chl-a appeared widest between 33°N and 39°N and over a more narrow band from 40° to 45°N. Chl-a concentrations from 5 to more than10 mg/m^3 occurred locally inshore. Chl-a rich coastal zones increased to 30-100 km width off southern California and northern Mexico. Offshore water (≤ 0.2 mg/m^3) entered the Southern California Bight from the south and was found as close as 150 km offshore. Derived surface layer chl-a concentrations and distributions may vary depending on satellite sensors and compositing techniques.
https://coastwatch.pfeg.noaa.gov/coastwatch/CWBrowserWW180.jsp#
https://coastwatch.pfeg.noaa.gov/erddap/griddap/erdVHNchla8day.graph?chla[(2020-05-30T00:00:00Z)][(0.0)][(83.65125):(-0.10875)][(-193.76625):(-110.00625)]&.draw=surface&.vars=longitude%7Clatitude%7Cchla&.colorBar=%7C%7C%7C%7C%7C&.bgColor=0xffccccff
https://www.star.nesdis.noaa.gov/sod/mecb/color/ (current)

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

This list gives shore and nearshore water temperature measurements in decreasing latitude. Each line begins with a shore station or buoy abbreviation followed by latitude. Within the list, 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 ending thirds of the month (tercile), are within the second parens, followed by the multiyear monthly average, where available from sources. Subscripts H and L indicate the tercile that contains the Highest and Lowest monthly temperatures.

The seasonal warning trend from April to May was strong (≥2°C) from the Neah Buoy (Neah) to the Cape Elizabeth Buoy (CpEz) and off San Diego (Tory, LaJo), but the seasonal change was less than 1°C in the upwelling regions from Point Arena (ArCv) to the Santa Barbara Channel (SBCh). North of the San Francisco Buoy (SFran), the highest temperatures generally occurred in the second tercile.

Amphitrite Point, B.C. 48.9°N

Neah,48.5°N,124.7°W [12.2(10.3-15.1)2.9(11.6, 13.2$_{LH}$, 11.7$_{L}$)10.4°C]

Cape Flattery 48.4°N

NeBy,48.4°N [12.1 (9.4-15.2)2.5(11.5, 13.0$_{LH}$,11.8°C)

CpEz,47.4°N,124.7°W [13.2 (10.5-15.8)3.2(12.6$_{LH}$,13.8$_{H}$,13.1) 12.0°C]

TlMk,46°N,125.8°W [11.9(10.8-13.9)1.5(11.5$_{L}$, 12.5$_{H}$, --)12.8]

Cape Blanco 42.8°N

PrtO,42.7°N [11.4(7.8-14.3)0.9(11.8,12.8$_{H}$,9.5$_{L}$)°C]

CCty,41.7°N [13.2 (10.8-15.3)1.6(12.5$_{L}$,13.5,13.5$_{H}$)°C]

EelR,40.7°N,124.5°W [12.9(11.0-14.3)1.2(13.0, 13.1$_{H}$, 12.7$_{L}$)11.4°C]

Point Arena 39°N

ArCv,38.9°N [11.0 (9.3-13.5)0.3(10.4$_{L}$,12.0$_{H}$,10.5$_{L}$)°C]

Point Reyes 38°N

SFrn,37.8°N,122.8°W [11.9(10.1-14.8)0.0(11.1$_{L}$, 12.8$_{H}$, 11.8)11.5°C]

Mtry,36.6°N [15.2 (12.4-18.5)-0.4(14.0, 15.2$_{L}$, 16.4$_{H}$)°C]

Point Sur 36.3°N

PrtS,35.1°N [13.1(11.0-15.7)0.2(12.2$_{L}$, 13.2, 14.0$_{H}$)°C]

PtCn,34.5°N,120.8°W [13.5(11.0-16.6)0.3(12.7$_{L}$, 14.3, 13.6$_{H}$)°C]

Point Conception,34.4°N

SBCh,34.3°N,119.9°W [14.5(12.7-17.4)0.1(14.3$_{L}$,14.6$_{H}$,14.7)13.5°C]
SMca,34°N [18.3 (14.3-22.8)1.6 (18.9$_{H}$,18.9, 17.2$_{L}$)]

Tory,32.9°N,177.4°W [18.3 (15.5-21.4)2.4(19.2$_{H}$,17.9,17.8$_{L}$)°C]
LaJo,32.9°N [18.3 (12.3-22.5)2.0(19.0$_{H}$,19.0$_{L}$,17.0$_{L}$)°C]

Point Loma, 32.7°N

Shore measurements, in italics, from a 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), Try (46225). https://www.ndbc.noaa.gov/station_page.php?station=46087

EQUITORIAL AND SOUTH PACIFIC

May neutral El Niño conditions are expected to continue into boreal summer. By the end of May, positive (≤2°C) sea surface temperature (SST_{My}) anomalies that had persisted across the Equatorial Pacific (EP), were replaced by negative SST_{My} anomaly east of 160°W. Eastern EP upper 300 m negative heat content anomaly continued negative, as negative subsurface temperature anomalies (≥-3°C) from 150 m to the surface persisted east of 170°W. The eastern South Pacific Ocean had mainly neutral to negative SST_{My} anomalies, except for an area of positive SST_{My} anomaly off Chile (30°-58°S). West of 138°W the South Pacific was dominated by positive SST_{My} anomaly. Large areas of negative SST_{My} anomaly persisted south of Australia and extended westward between 30°S and 60°S into the Indian Ocean.
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 May **Sea level height anomaly** (SLA) analyses for the south Pacific Ocean (0°-30°S) showed negative SLA (≥-10 cm) along the South American coast. This area (> 3 x10^6 km^2) extended westward to 160°W and to 130°W at the equator and 10°S, respectively. North of 25°S and east of 135°W negative SLA was typical. Although some large areas of negative SLA anomaly persisted at 15°-20°S west of 140°W, positive SLA (≤15 cm) was more characteristic of the western South Pacific.
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) increased to 0.5 for October-November-December (OND), then remained ≥ 0.5 through FMA. The ONI remained positive for MAM but was near neutral (0.3). 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 NOAA/NCEI **Pacific Decadal Oscillation Index** (PDO), calculated from Pacific Basin wide ERSST.v4 was less than -1.30 from January through April. Then increased to -0.70 in May, **PDO** and **ONI** indices are recalculated and may change as data are assimilated into ERSST.v4. https://www.ncdc.noaa.gov/teleconnections/pdo/ ,
http://research.jisao.washington.edu/pdo/PDO.latest.txt 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, had neutral to positive values during May, with a monthly PNA of 0.77.
https://www.cpc.ncep.noaa.gov/data/teledoc/pna.shtml (see computational alternatives).

May monthly ERD/SWFSC west coast Upwelling Indices (UI) remained strongly positive at coastal locations from 24°N to 36°N, with neutral to weakly positive UI anomalies. UI anomalies were weakly negative at computation locations from northern California (39°N) to the Gulf of Alaska (60°N). Normal seasonal upwelling at 39°N was interrupted by low pressure passage during 10-17 May.
https://upwell.pfeg.noaa.gov/products/PFELData/upwell/monthly/table.2005 (see computational alternatives)
https://oceanview.pfeg.noaa.gov/products/upwelling/dnld (current)

PRECIPITATION and RUNOFF (May)

Central Washington and large sections of Oregon and northern California received rain during May, but remained in drought conditions for the water year. Western Oregon and northern California had 68-71% of normal precipitation with water year departures as great as -39 inches. https://droughtmonitor.unl.edu. https://waterdata.usgs.gov/ca/nwis/nwis
https://www.cpc.ncep.noaa.gov/products/global_monitoring/precipitation/global_precip_accum.shtml

Northwest and Washington River Discharge

Fraser River discharge, measured in late May at Hope (130 km upriver from Vancouver, B.C.), was 8,800 m3/s (310,728 cubic feet /sec or cfs). The late May multi-year median for Hope is 7,500 m3/s. https://wateroffice.ec.gc.ca

The **Queets** at Clearwater, WA was flowing at 2,420 [2,300/ -900 cfs -historical median and change from previous month in brackets and separated by "/" cfs] The **Puyallup** at Puyallup was flowing at 7,630 [4,140/ 4,060 cfs]. **Skagit** flow was 32,600 [21,500/ 10,600 cfs] near Mount Vernon. **Stillaguamish** discharge was 2,670 [1,680/ -30 cfs] at Arlington. **Columbia** transport was 364,000 [378,000/ 96,000) cfs] at Vancouver, WA.

Oregon River Discharge

The **Columbia** at the Dalles, OR was 352,000 [402,000/ 205,000) cfs]. The **Wilson** at Tillamook, was flowing at 352 [339/ -97 cfs]. At Elkton, **Umpqua** transport was 3,310 [4,170/ -2,390 cfs]. **Rogue** R. flow was 4,670 [3,260/ 2350 cfs] at Grants Pass and 3,660 [4,200/ 1,070 cfs] at Agness, OR.

California River Discharge

The **Klamath** near Klamath, CA was transporting 9,050 [13,500/ -3,750 cfs] **Smith** discharge was 1,800 [1,470/ 720 cfs] near Crescent City. The **Eel** at Scotia had 1,800 [1,419/ 600 cfs] transport. The **Battle Creek,** National Fish Hatchery flow was 369 [474/ -39 cfs]. **Butte Creek** at Chico had 182 [340/ -41 cfs] transport. **Sacramento** R. transport was 8,450 [13,800/ 870 cfs at Verona and 14,500 [16,000/ 2,200 cfs] at Freeport. **San Joaquin** flow was 1,710 [3,080/ -100 cfs] at Vernalis. **Pescadero Creek** transport was 5 [9/ -3 cfs] near Pescadero. **San Lorenzo** R. discharge was 23 [37/ -12 cfs] at Santa Cruz. The **Pajaro** at Chittenden was flowing at 30 [18/ -24 cfs]. The **Salinas** R. near Spreckels had flow 19 [3/ -73 cfs]. The **Carmel** at Carmel was flowing at 33 [16/ -60 cfs]. The **Big Sur R.** near Big Sur, CA discharged at 54 [38/ -28 cfs]. At the end of **May**
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
https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5

Notes -May 2020

On 21 May. the Oregon and Washington Departments of Fish and Wildlife closed spring Chinook salmon fishing on the mainstem Columbia River. Adult Chinook passage at Bonneville Dam through 19 May totaled 43,029 fish, which is approximately one third of the 10-year (2010-19) average cumulative count and about half of the 5-year (2015-19) cumulative average for this date. The recent 5-year average 50% passage date at Bonneville Dam is May 12. A total run estimate of 72,000 spring Chinook adults indicates the lowest run since 1999. Concerns about hatcheries throughout the interior basin being able to meet brood stock collection targets and overall run conservation led to the closure. Recreational and commercial interests appear to support the closure. https://www.dfw.state.or.us/news/2020/

Microplastics particles are pervasive and accumulating in marine systems. Significant portions of marine plastic pollution have land-based sources, particularly in urban drainages. Studies led by Theresa Talley of an estuarine reach at the mouth of urbanized Chollas Creek in **San Diego Bay**, CA found: 1) surface sediments (0–5 cm depth) contained about 10,000 small plastic pieces (<5 mm) per m^2 and more than 25% of the fish examined contained identifiable microplastic, 2) plastic-associated semi-volatile organic compounds (SVOC) were found in the two fish species tested. SVOCs leach from degrading plastics, where ever they are, into the environment, 3) of the 25 types of small plastics distinguished in sediments, 40-50% of these types were identified in the resident fish. Talley T, Venuti N, Whelan R, (2019). Natural history matters: Plastics in estuarine fish and sediments at the mouth of an urban watershed. *PLOS ONE* doi:10.1371/journal.pone.0229777

Published estimates suggest that observed **floating plastic** accounts for less than 1% of all plastic that has entered the ocean. Understanding ocean plastic transport and accumulation depends on finding the 99% of presently sequestered plastic, a question addressed by Talley's study in San Diego Bay. In another recent study, Matthias Egger and others addresses sinking plastic debris of the **North Pacific Garbage Patch** (NPGP). Numerical and mass concentrations of plastic fragments (0.5-50 mm in size) suspended in the water column below the NPGP follow a power law decline with water depth, reaching values <0.001 pieces/m^3 and <0.1 µg/m^3 in the deep sea (300-1,800 m). The predominately polyethylene and polypropylene polymer composition of plastic in the NPGP water column is similar to debris circulating at the surface. Correlations between the amount of plastic debris at the sea surface and the depth-integrated plastic concentrations in the water column suggest that the subsurface fragments come from sinking and degradation of NPGP surface debris. Egger, M., Sulu-Gambari, F. & Lebreton, L. First evidence of plastic fallout from the North Pacific Garbage Patch. *Sci Rep* **10,** 7495 (2020). https://doi.org/10.1038/s41598-020-64465-8