

West Coast waters shifting to lower-productivity regime, new report finds

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Many sea lion pups in California's Channel Islands are underweight and are washing up on beaches starving or dead. Biologists suspect unusually warm ocean conditions are reducing marine productivity, causing female sea lions to struggle to find sufficient food to nurse the pups. Credit: NOAA Fisheries/Alaska Fisheries Science Center

Large-scale climate patterns that affect the Pacific Ocean indicate that

waters off the West Coast have shifted toward warmer, less productive conditions that may affect marine species from seabirds to salmon, according to the 2015 State of the California Current Report delivered to the Pacific Fishery Management Council.

The report by NOAA Fisheries' Northwest Fisheries Science Center and Southwest Fisheries Science Center assesses productivity in the California Current from Washington south to California. The report examines environmental, biological and socio-economic indicators including commercial fisheries and community health.

"We are seeing unprecedented changes in the environment," Toby Garfield, Director of the Environmental Research Division at the SWFSC, told the Council when presenting the report, citing unusually high coastal water and air temperatures over the last year. Climate and ecological indicators are "pointing toward lower primary productivity" off California, Oregon and Washington, he said.

That could translate into less food for salmon and other marine species, added Chris Harvey of the Northwest Fisheries Science Center. High mortality of sea lion pups in Southern California and seabirds on the Oregon and Washington coasts in recent months may be early signs of the shift.

Among the highlights of the new State of the California Current Report:

- Record-high sea surface temperatures combined with shifts in the Pacific Decadal Oscillation, North Pacific Gyre Oscillation and weaker upwelling of deep, cold waters indicate declining productivity in the California Current.
- After several productive years the biomass of tiny energy-rich

organisms called copepods, which support the base of the West Coast food chain and provide important food for salmon, has declined significantly.

- California sea lion pups and seabirds called Cassin's auklets found dying and emaciated in large numbers in recent months may reflect the transition to less productive marine conditions.
- Although commercial fishery landings have remained high in recent years, the fishing fleet has become more specialized in terms of targeting specific fisheries. That may expose the vessels to more fluctuations of catch and revenue if those fisheries decline.



Unusual warm-water copepod collected off the Oregon Coast this winter. Copepods form the foundation of the West Coast marine food chain but the lean copepods associated with warm water provide far less energy for salmon and other species that rely on them for food. Credit: NOAA Fisheries/Northwest Fisheries Science Center

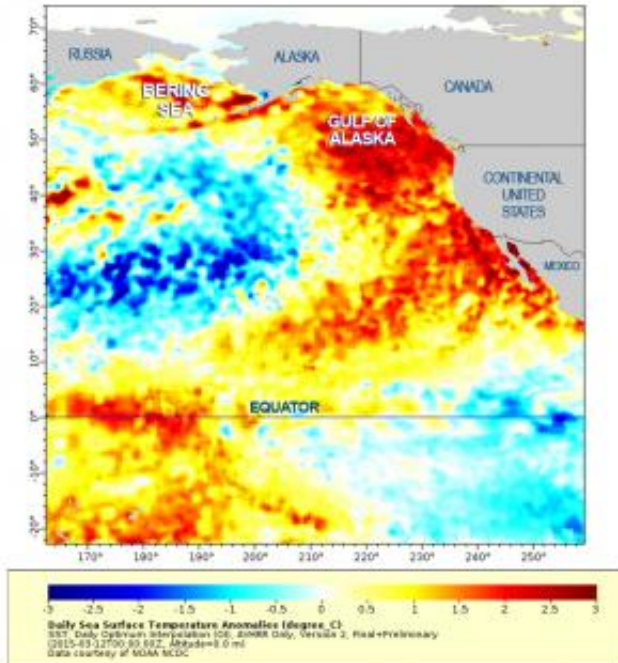
"This year's report is very useful," said Council Chair Dorothy Lowman. "We're looking forward to working with the science centers to find ways to integrate this information into management."

Scientists produced the report as part of NOAA's Integrated Ecosystem Assessment Program, which tracks conditions across coastal ecosystems to provide insight into environmental and human trends and support decisions on fisheries and other activities. The California Current Ecosystem is one of seven U.S. ecosystems monitored by the program.

"We're seeing some major environmental shifts taking place that could affect the ecosystem for years to come," said John Stein, Director of the Northwest Fisheries Science Center. "We need to understand and consider their implications across the ecosystem, which includes communities and people."

In recent years the California Current Ecosystem enjoyed highly productive conditions, with strong upwelling of deep waters from the north flush with energy-rich copepods that supported high salmon returns and high densities of juvenile rockfish, sanddabs and market squid. In 2014 waters off Southern California and in the Gulf of Alaska turned unusually warm, and these so-called warm "blobs" have since grown and merged to encompass most of the West Coast.

The coastal warming includes an influx of warmer southern and offshore waters with leaner subtropical copepods that contain far less energy and are often associated with low productivity and weaker salmon returns. Overall the warm conditions off the West Coast are as strong as anything in the historical record. The tropical El Niño recently declared by NOAA could extend the warm conditions and reduced productivity if it persists or intensifies through 2015.



A sea surface temperature map shows a large expanse of unusually warm ocean water encompassing much of the West Coast. Darker red shades indicate sea surface temperatures farther above average. Credit: NOAA Fisheries/Southwest Fisheries Science Center

"We are in some ways entering a situation we haven't seen before," said Cisco Werner, Director of the Southwest Fisheries Science Center in La Jolla, Calif. "That makes it all the more important to look at how these conditions affect the entire ecosystem because different components and different species may be affected differently."

For example, warmer conditions in the past often coincided with increases in sardines and warmer-water fish such as tuna and marlin and

drops in anchovy and market squid. Salmon also fare poorly during warm conditions. Cooler conditions in contrast have often driven increases in anchovies, rockfish and squid. Anchovy and sardines have both remained at low levels in recent years, the report notes.

NOAA researchers will continue tracking how species respond to the shifting temperatures and conditions.

Salmon face the potential "double jeopardy" of low snowpack in the Northwest and rivers and streams shrunk by drought in California, plus reduced ocean productivity when juvenile salmon enter the ocean this year looking for food, Harvey said. However the impacts on salmon may not become apparent until a few years from now when the fish that enter the ocean this year would be expected to be caught in fisheries or return to the Columbia and other rivers as adults.

More information: [www.pcouncil.org/wp-content/up ...
S_Rpt2_MAR2015BB.pdf](http://www.pcouncil.org/wp-content/uploads/2015/03/S_Rpt2_MAR2015BB.pdf)

Provided by NOAA Headquarters

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