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2013

Upwelling of cool water near the coast keeps temperature lower.

2014

With little wind to cool ocean, blob develops in winter. Very low snowpack in 2014 / 2015.

2015

Blob heat wave envelopes West Coast.
Elevated temperatures ashore.
El Niño develops.

2016

West Coast waters cool but Gulf of Alaska remains warm.

2017

Cooling continues, ocean trends back. Arctic remains warm.

OCEAN CONDITIONS

ECOLOGICAL CHANGES

Krill plentiful off West Coast.



Salmon migration routes shift.



Sardine spawning farther offshore.



IMPACTS

Elevated sea lion strandings in Southern California, as sardines farther away.



About 95 percent of endangered winter-run Chinook salmon eggs are lost to drought.

Krill and forage fish decline.

Harmful algal bloom spreads in shellfish from SE Alaska to Southern California.

Fish species move northward hundreds of miles.

Juvenile salmon going to ocean find poorer quality food.

Pyrosomes appear farther north than ever recorded before.

Clamming shut down, Dungeness crab season delayed by algal toxins.

Large whale unusual mortality event (UME) in Alaska.

Some 4,000 stranded California sea lions.

Seabird die-offs.

Reduced size and survival of salmon going to the ocean.

Cod in Alaska skinnier than usual.

Washington: coho, pink salmon, Dungeness crab

California: sardine, red sea urchin, Dungeness crab

Lacking krill, humpback whales feed on anchovy closer to shore, where crab traps are.



Shift in food web from crustaceans to gelatinous organisms with less value to fish.



Pyrosomes multiply to extent never seen before.

Fishing nets clogged with pyrosomes.

Dungeness crab season opens.

Increase in whale entanglements.

Some fish smaller, poorer body condition.

Reduced salmon survival leads to reduced returns.

Sea lion strandings continue.

Pacific cod decline in Alaska.

Return to cooler conditions.

Snowpack increases.



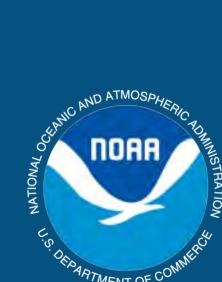
Surge in krill, increase in anchovy.

FISHERIES DISASTERS

Fraser River sockeye



Fraser River sockeye



**NOAA
FISHERIES**

The Rise and Fall of “The Blob”

* Sea surface temperature anomaly maps from NOAA National Centers for Environmental Information. The darker the red, the farther temperatures are above average. The darkest reds indicate about 3 degrees Celsius above average.