If you read the newspapers or follow internet blogs, you might know that 2014 was a wild and crazy year throughout much of the North Pacific Ocean.

2015 WAS EVEN CRAZIER
Development of the warm blob

• November 2013, Aleutian Low fails to develop
  – Surface waters of GOA did not cool due to lack of deep mixing; by summer 2014 SST anomalies were 3.5°C which was 1.5°C greater than any year since at least 1948.

• Blob persists through summer 2014 across the entire North Pacific
  – Weak westerly winds along 40°N (weakest zonal winds on record (1.6 m s⁻¹ vs 4.5 m s⁻¹)
  – No SW winds along west coast of US in winter

• Blob collapses eastward in autumn 2014
The Blob – Jan-July 2014

- Jan-Apr: The Blob confined to GOA
- May-June: Warm anomalies seen in Bering Sea and in western Pacific
- June-July + 2 to + 3°C anomalies, but California Current cool at the coast due to coastal upwelling
17-23 August 2014: SST Anomaly

Note: (1) Cooler waters off WA, OR and N. CA due to upwelling
(2) Lack of any SST anomaly at the equator
SST at a Buoy 20 miles off Newport: 1 Jan 2014 - 31 Aug 2015

- On 14 Sep 2014 upwelling winds weakened allowing the Blob to come onshore. SST jumped 6°C in 6 hours.
- Anomalies of +2°C during 2015 and now +4°C are seen off Newport.
On both cruises, only the upper 20-30 m was excessively warm
8 Nov 2014
Newport Line

By early November the thick lense of “Blob Water” is seen, with excessive warmth to depths of 50-80 m. Same pattern seen through March 2015.

In fact at 50 m, temperatures were 2°C above anything we have seen in our 19 year time series.
By late November, The Blob has moved eastward and occupies the entire California Current and eastern GOA. The equator is warm as well and a positive PDO pattern is established. Winter PDO values the highest on record.
Deep shelf waters anomalously warm and fresh

50 m temperatures were **3°C above** average, the warmest in the past 19 years
NH-5 copepod community

Copepod Community Composition Index (CCI)

Year

Monthly anomaly axis 1 scores

-3 -2 -1 0 1 2

NH-5 copepod community

Pacific Decadal Oscillation

PDO

similar pattern at NH-25
Anomaly of the number of copepod species (species richness) in samples from station NH 5: 2015 had values higher than during the big 98 Niño event.

8 copepod species new to the northern California Current and 8 others rarely observed occurred in 2014-2015. Many are Transition Zone and Central Gyre species, not coastal southern species that appear off during El Niño events.
Some unusual bugs seen since Oct 2014

**TRANSITION ZONE**
- Rhincalanus nasutus
- Scolecithricella ovata
- Centropages bradyii
- Pleuromamma borealis
- Acartia pacifica *
- Clausocalanus farrani *
- Clausocalanus furcatus *
- Calocalanus pavo

**SUBTROPICAL GYRE**
- Mecynocera clausi
- Euchaeta media
- Eucalanus hyalinus
- Eucalanus subcrassus *
- Pleuromamma xiphias *
- Calocalanus pavoninus *

**TROPICAL NERITIC**
- Acartia negligens *
- Temora discudata *
- Penilia spp (Cladoceran)

* New record for the N. California Current
Consequences of a warm North Pacific: all kinds of tropical fish and birds have shifted north in 2014/15

• Gulf of Alaska
  – Pomfret, skipjack tuna, thresher shark. Ocean sunfish common everywhere
• Prince William Sound
  – Sunfish
• Oregon/Washington
  – Green turtle, Florence, 5 Sep 2014
  – Opah, 21 September 2015
• California
  – Opah (moonfish) seen regularly off San Diego
  – Velella (by-the-wind sailors) seen commonly everywhere (off Oregon as well)
  – Green turtle off San Francisco
  – Mahi mahi caught commonly
  – 335 lb yellowfin tuna caught at Cabo (a record)
  – 50 lb wahoo caught off Dana Point (first record for CA)
  – Market squid fishery shifted north from Monterey Bay to Eureka
• Salmon
  – Fraser River sockeye all returned through Johnstone Strait (Canadian Waters), none through Strait of Juan de Fuca.
  – Columbia River sockeye and summer-run Chinook suffered mortality in summer 2015 due to drought, low flow and high temperatures in the River.
Notable seabird issues

• Unusual (tropical) seabirds seen off OR during the tri-annual west coast mammal survey
  – Band-rumped storm petrel, black storm petrel, brown booby
• Two major mortality events of Cassin’s auklets
  – 16 Nov 2014, Marin County
  – 22 Dec 2014, Seaside OR
• Story in Audubon magazine in March/April 2015 on the auklet mortality events, featuring Bill Peterson.
Funding Sources over the past 20 years

- FATE
- Fisheries and the Environment
- GLOBEC
- Global Ocean Ecosystem Dynamics
- Bonneville Power Administration
- NOAA
- National Oceanic and Atmospheric Administration
- U.S. Department of Commerce
- NSF
- NASA
- POBEX
- Pacific Ocean Boundaries Ecosystem and Climate Study
- CAMEO
- Comparative Analysis of Marine Ecosystem Organization