Fraser Sockeye Forecast Supplement 2017

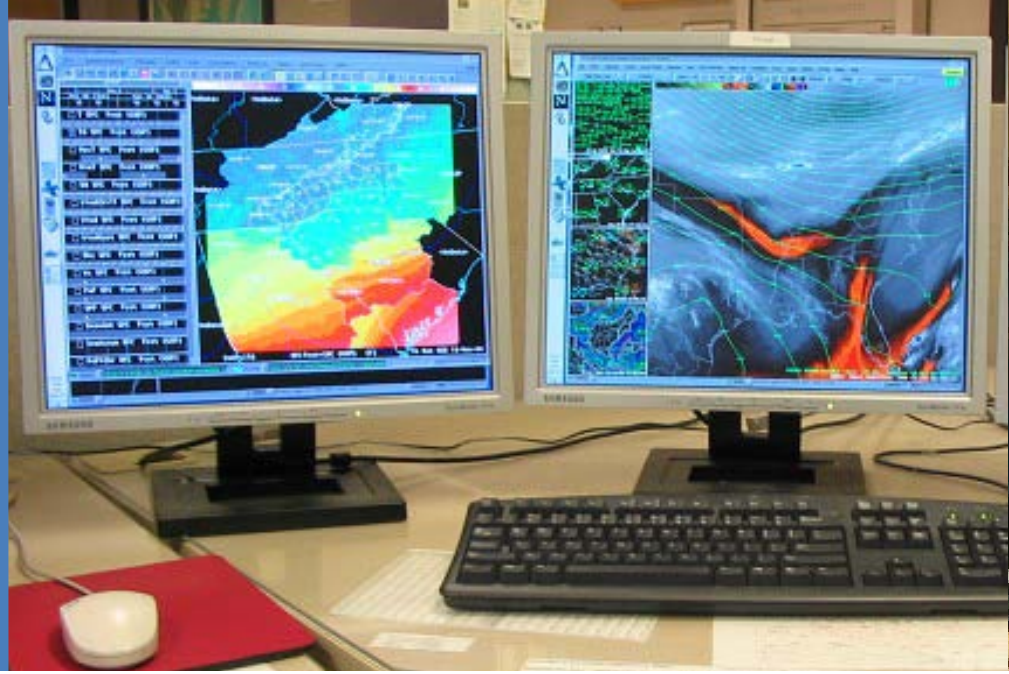
Annual Canadian Science Advisory Secretariat (CSAS) Process: 2014-2017

CSAS Science Process initiated by DFO Science to improve our understanding of Fraser Sockeye Population Dynamics

Programs:

DFO Sockeye Analytical Program: S. Grant/B. MacDonald; M.Hawkshaw
DFO Sockeye Operational Program: K. Benner (incorporates information from various First Nation and DFO groups)
Pacific Salmon Commission Stock ID: S. Latham; M. Lapointe

Environmental Watch Program: D. Patterson/J. Hills
Lakes Research Program: D. Selbie/L. Pon
Mission Smolt Program: J. Tadey/T. Whitehouse
Strait of Georgia Salmon Program: C. Neville
High Seas Salmon: M. Trudel…transitioning to J. King
Ocean Conditions: I. Perry



Fraser Sockeye Forecast Supplement 2017

Age of Maturity

Most Fraser Sockeye Mature as Four Year Olds

Marine
2 Winters

May-June 2015

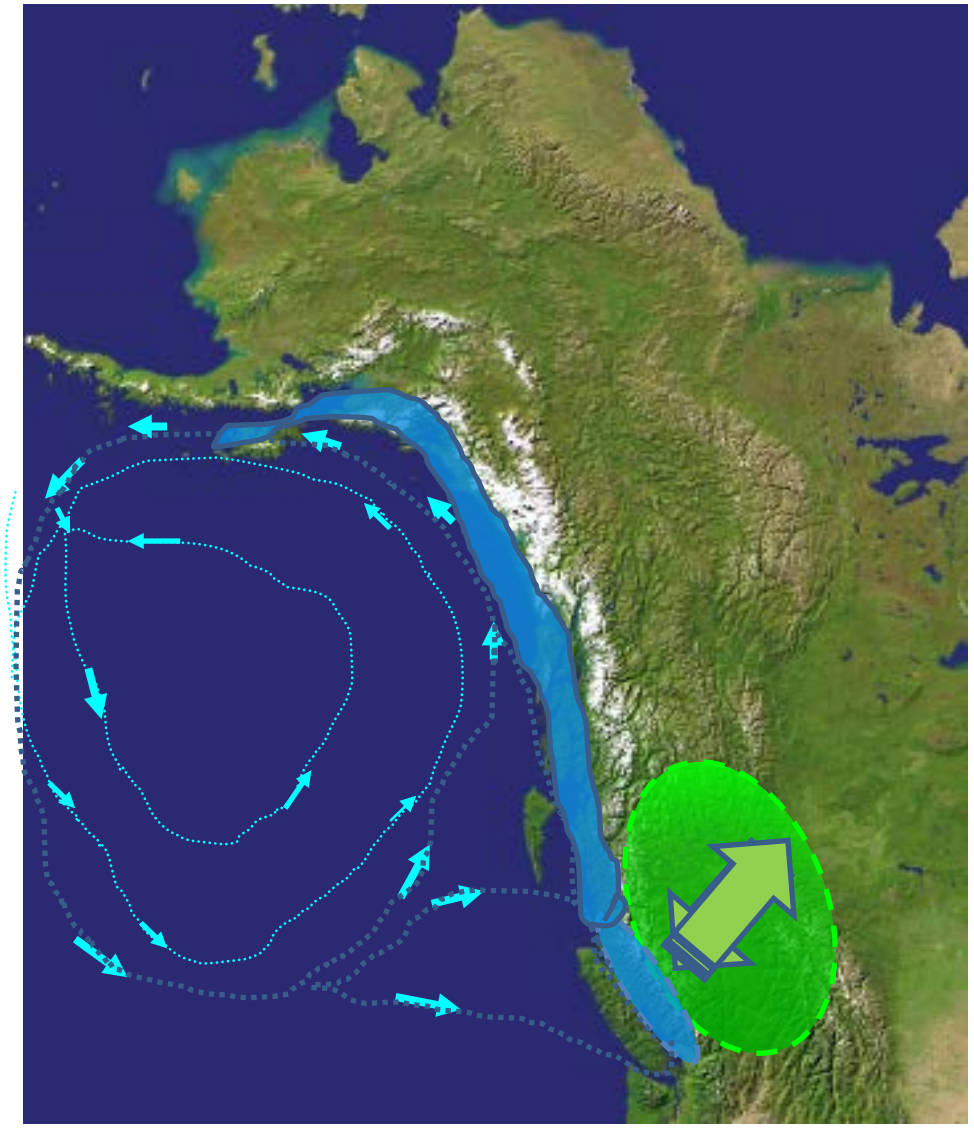
June-October 2015

First Winter 2016

Second Winter 2017

July-Oct 2017

Return: 4 yrs



Freshwater
2 Winters

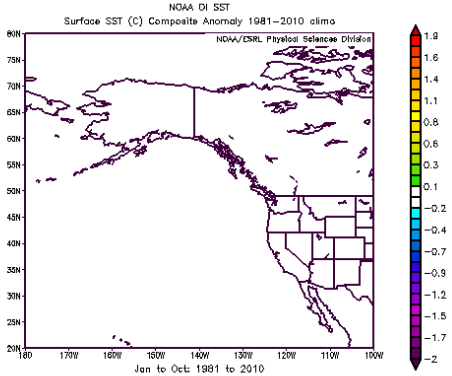
Brood Year

July-Oct 2013

April-May 2014

April-May 2015

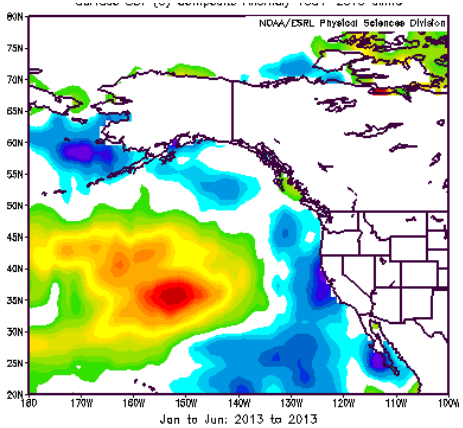

THE
BLOB



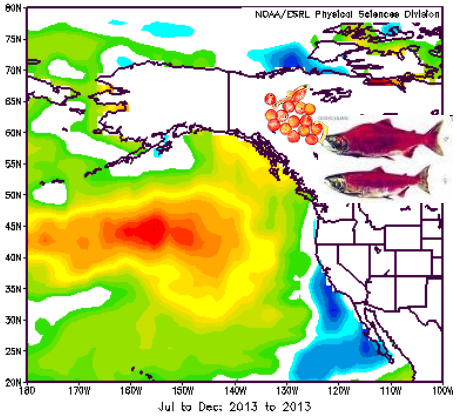
Reference Period from 1981 to 2010

Earth System Research Laboratory
Physical Sciences Division

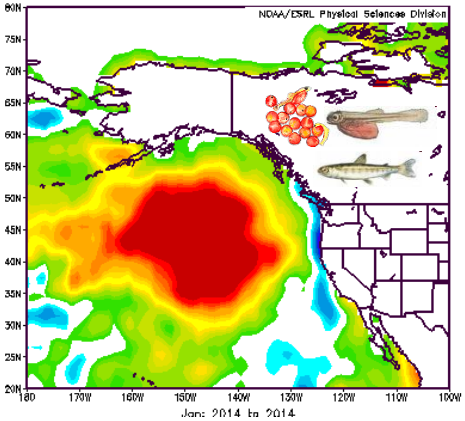
2013 (Jan-June)



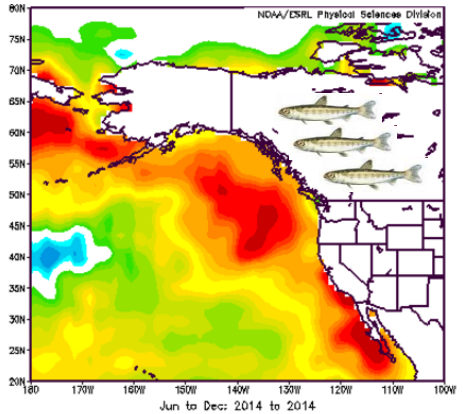
2013 (Jul-Dec)



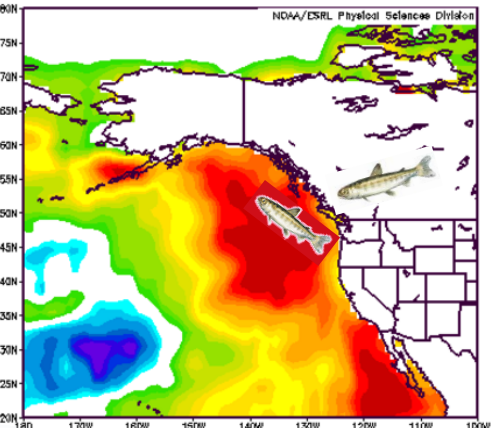
2014 (Jan-June)



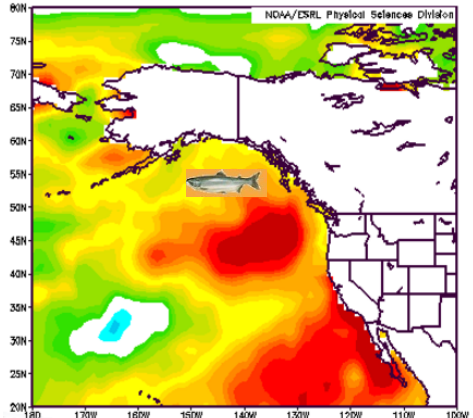
2014 (June-Dec)



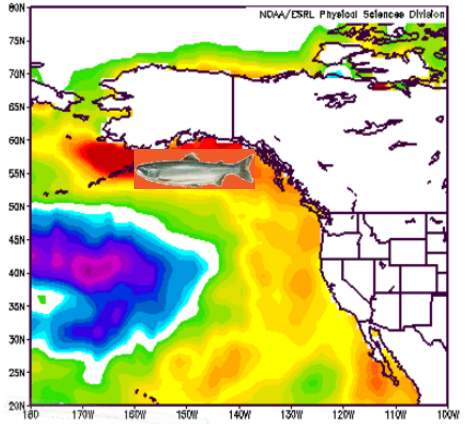
2015 (Jan-June)



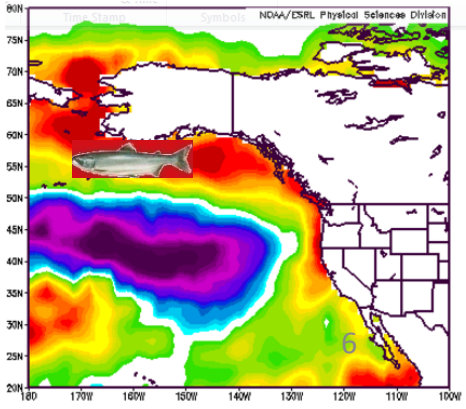
2015 (Jul-Dec)



2016 (Jan-June)



2016 (June-Dec)

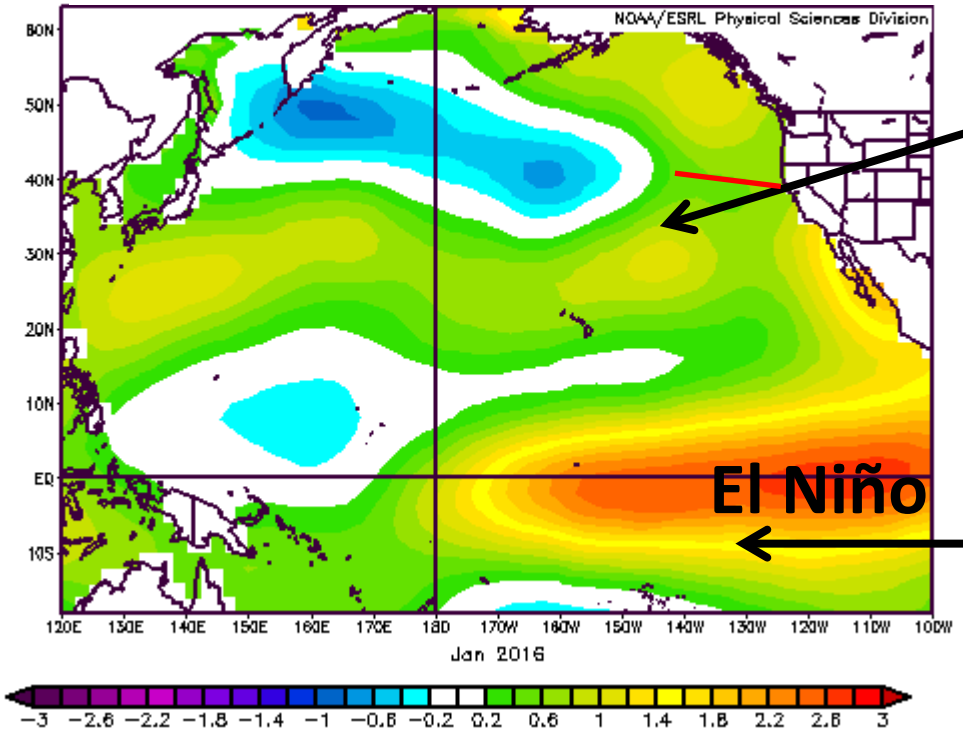


Evolution of Ocean Temperature

Jan 2016

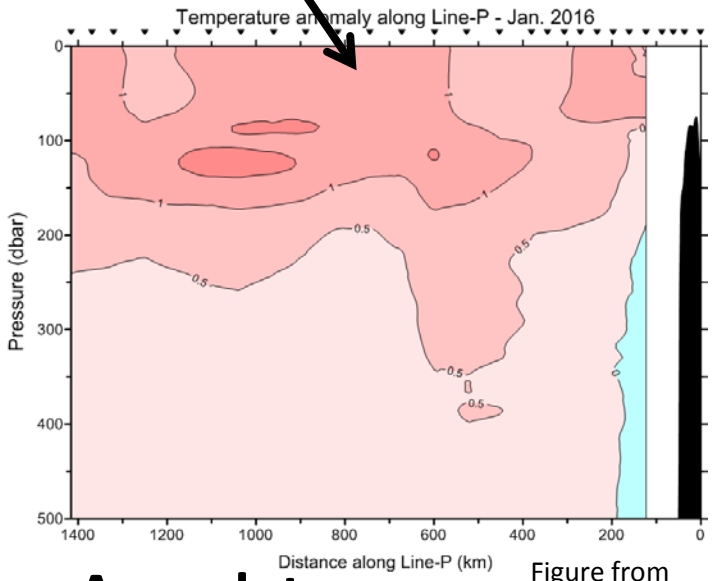
T. Ross. 2016. Can. Tech. Rept. Fish. Aquat. Sci. 3179

Sea Surface Temperature Anomaly



Blob gone?

Line P



El Niño

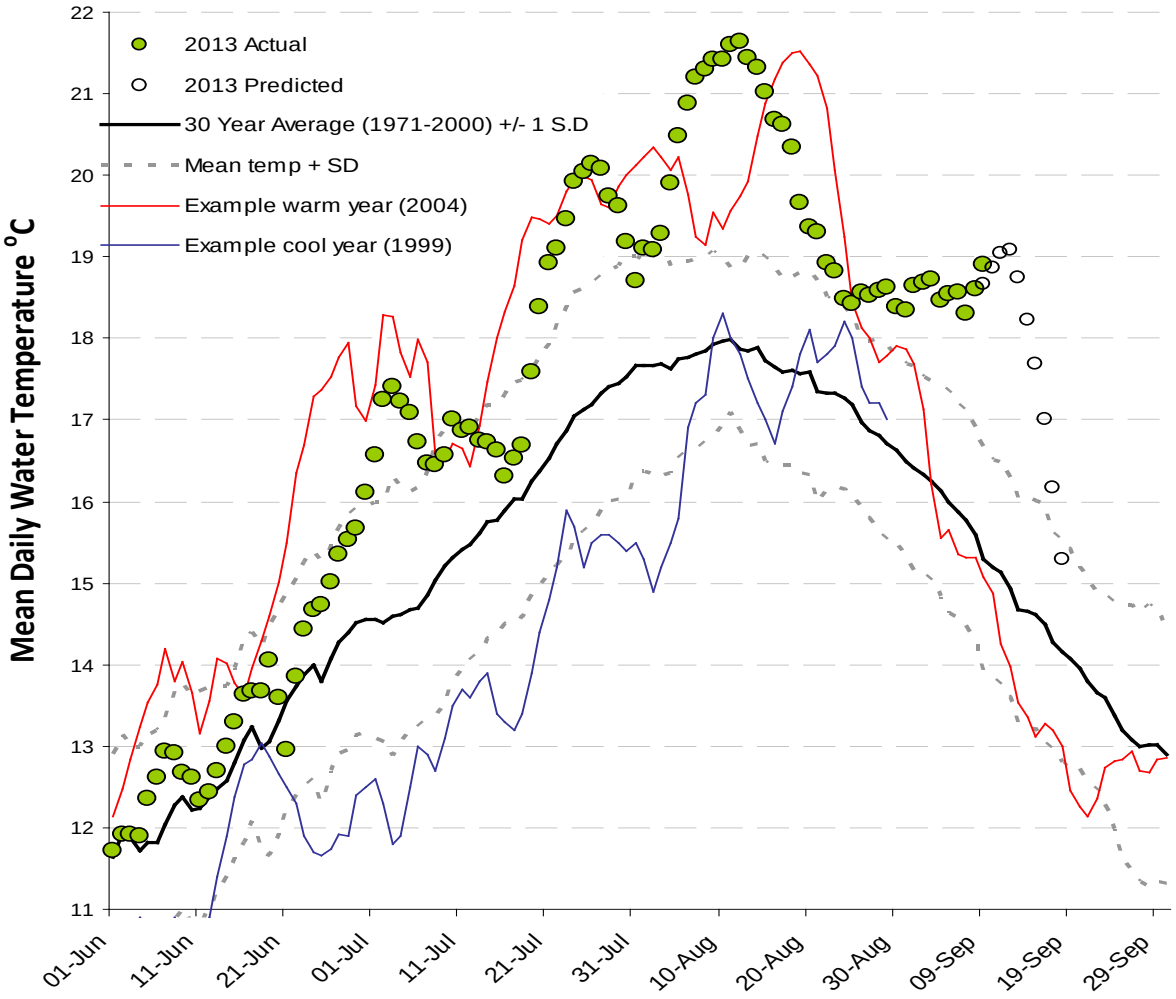
Argo data

Figure from Howard Freeland

Perry. CSAS Regional Advisory Process, Fraser Sockeye 2017 Return Forecast Suppl. Meeting, Vancouver, 17 January 2017

2013 Adult Migration

Summer Fraser River Temperature exposure



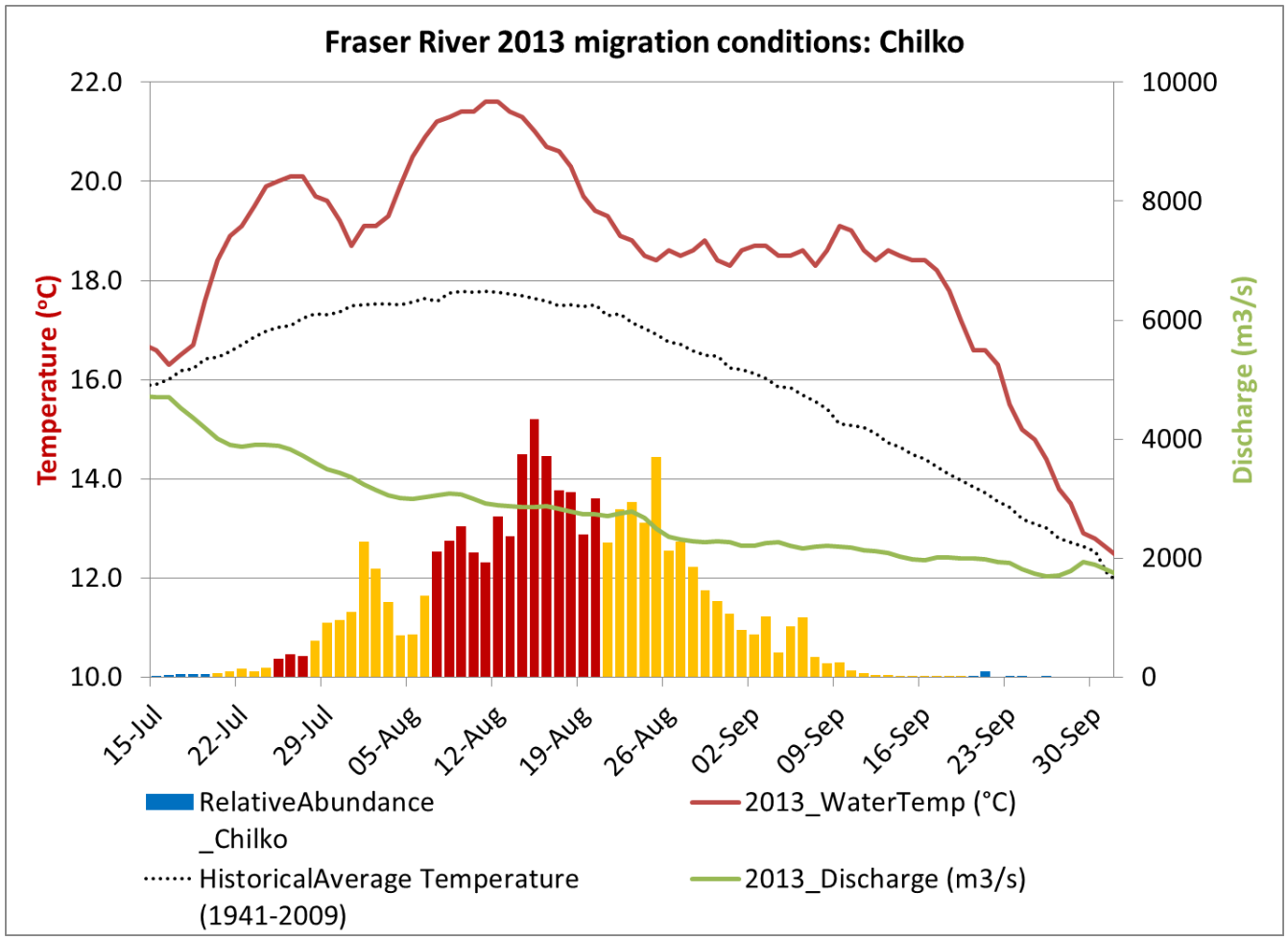
Did it get hot?

YES!

What stocks were possibly affected?

MOST

Adult Migration Conditions Overall look: 2013 Temperature : Chilko



Early Summer, Summer and Late runs experienced above average temperatures

2013 Fraser Sockeye

Escapement by Run-Timing Group

Management Group	Spawning Escapement	Spawning Success	% Fraser Total
Early Stuart	86,311	87%	3%
Early Summer	210,690	90%	8%
Summer	1,952,358	99%	76%
Late	322,748	96%	13%
Total	2,572,107	97%	100%

Why do we care about Adults in 2013?

Parental Experiences Matters:

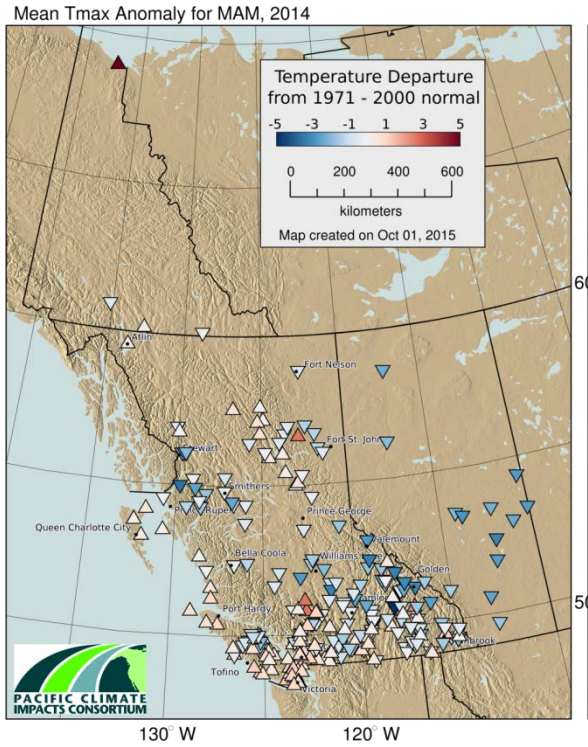
- Egg size, fry size – maternal discharge/temp exposure
- Gamete viability – parental temp/discharge exposure
- Fry swim performance – maternal stress, disease status
- Predator avoidance – maternal stress

- **Current challenge is to link individual level research to population level consequences**

D. Patterson & J. Hills

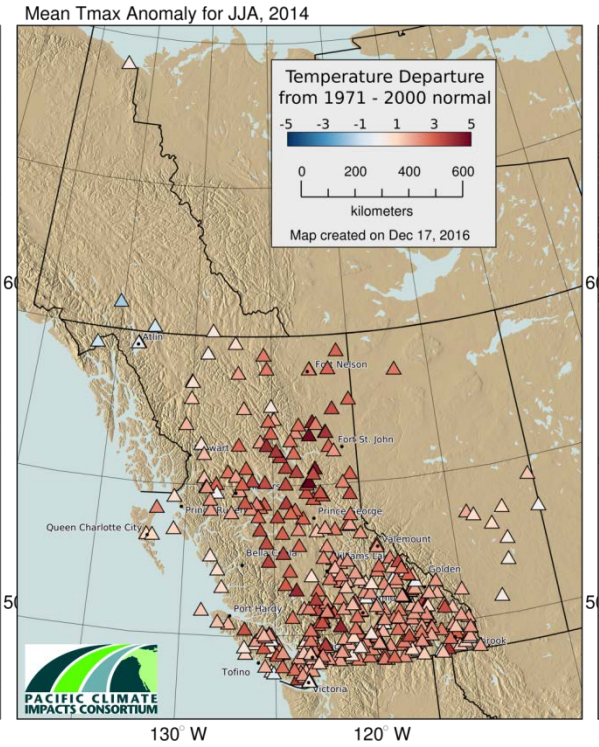

2014 Lake Rearing
2015 Downstream smolt migration

Seasonal Temperature Anomaly Fry Rearing (2014)



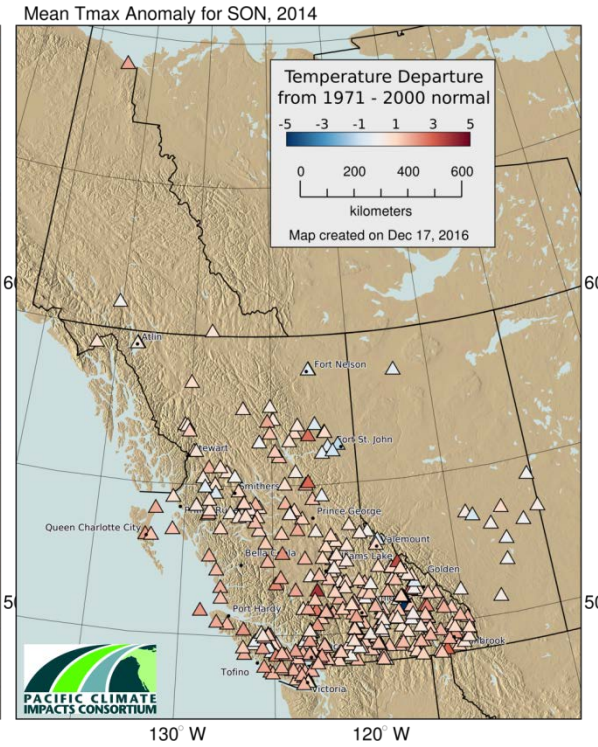
Spring 2014

- Cool



Summer 2014

- Hot

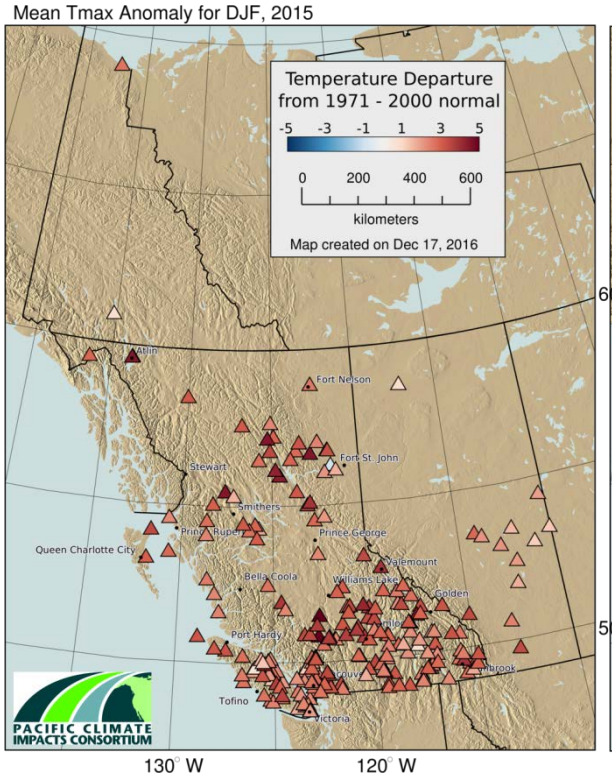


Fall 2014

Varied

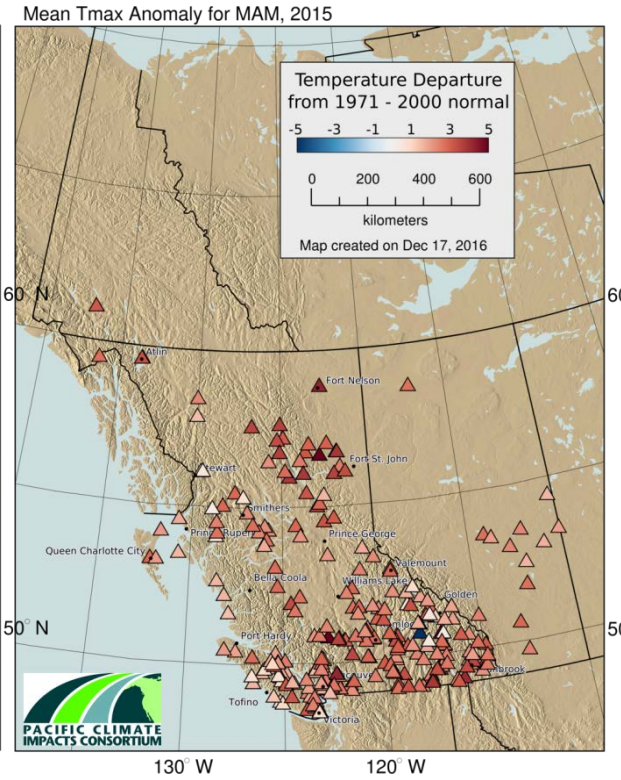
D. Patterson & J. Hills

Seasonal Temperature Anomaly Juvenile Overwinter & Outmigration (2015)



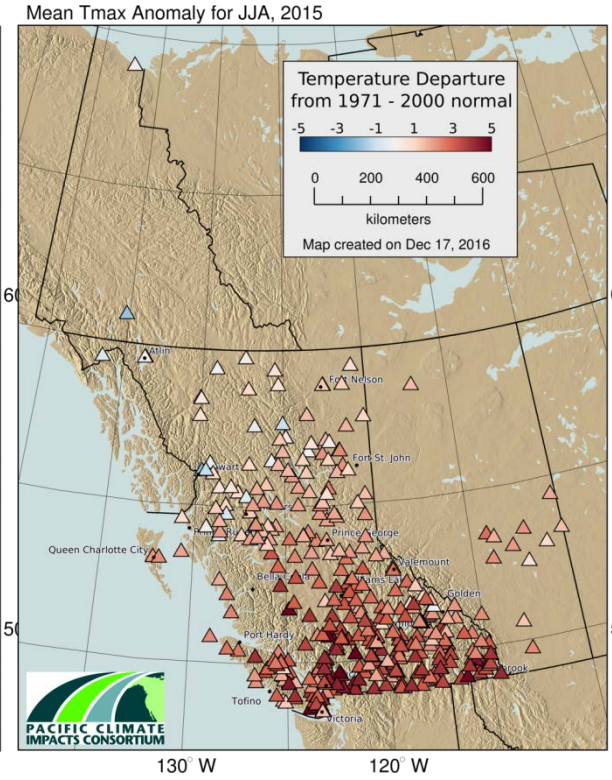
Winter 2015

- Hot



Spring 2015

- Hot



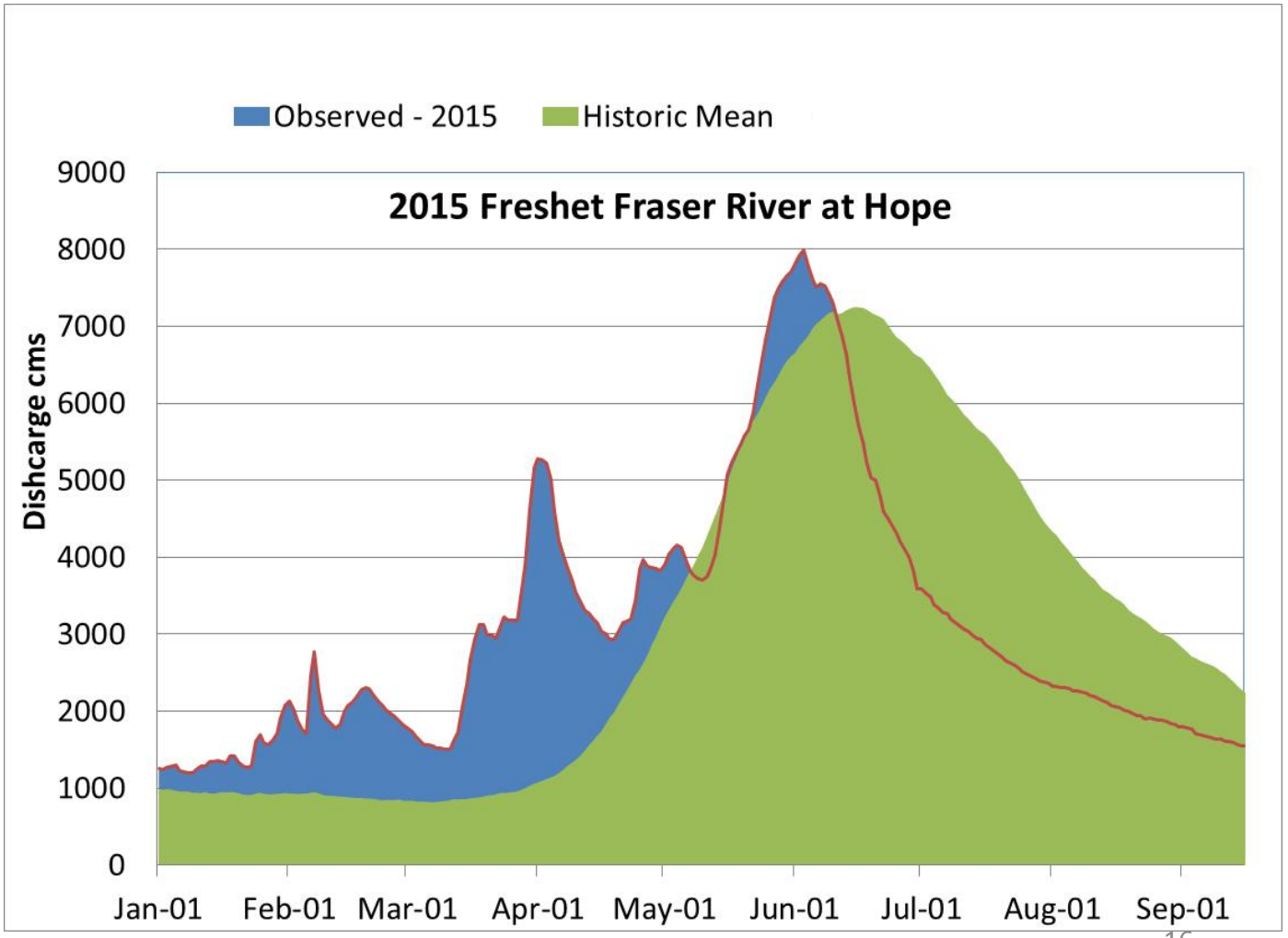
Summer 2015

D. Patterson & J. Hills

Hot

Winter/Spring 2015: Fraser River at Hope Discharge

- Very early freshet
- Higher than average run-off Jan to May
- Day of year records



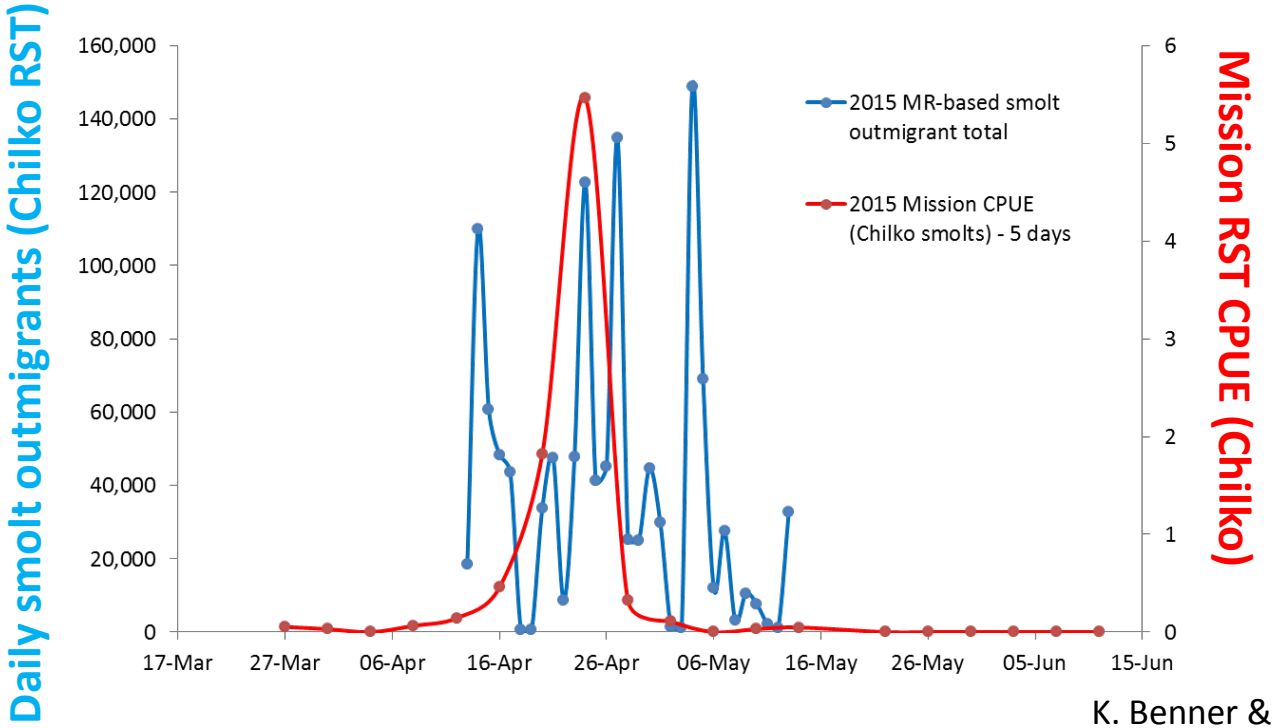
Data Source: Water Survey of Canada 1910 to present

Chilko Sockeye in 2015

K. Benner

Chilko River RST

Mission (Fraser) RST



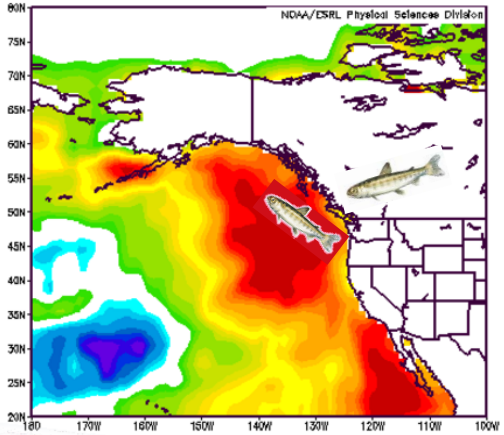
K. Benner & J. Tadey

Smolt lengths were a bit below average in 2015, compared to previous three years in the Fraser but nothing unusual

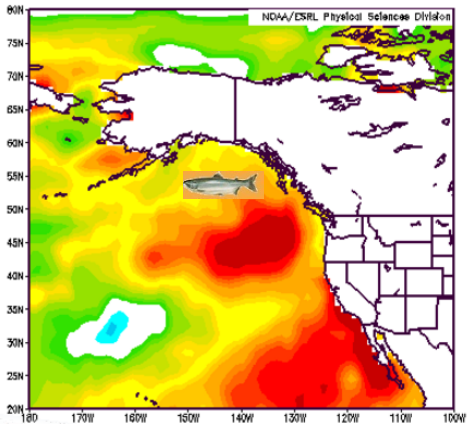
Hey, but us Chilko fish were a bit smaller (79 mm vs 85 mm average)

2015-2017 Ocean Rearing

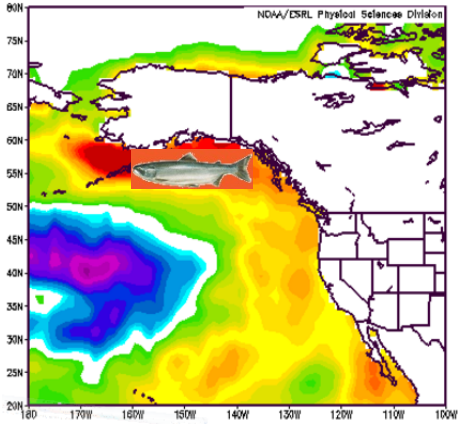
2015 (Jan-June)



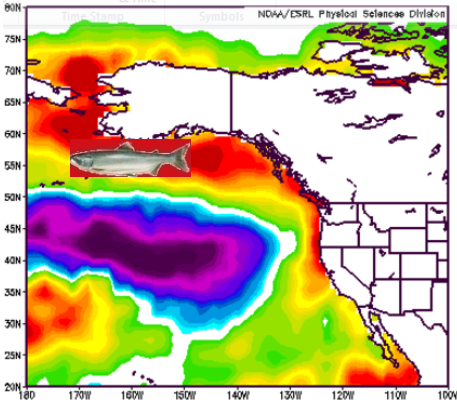
2015 (Jul-Dec)



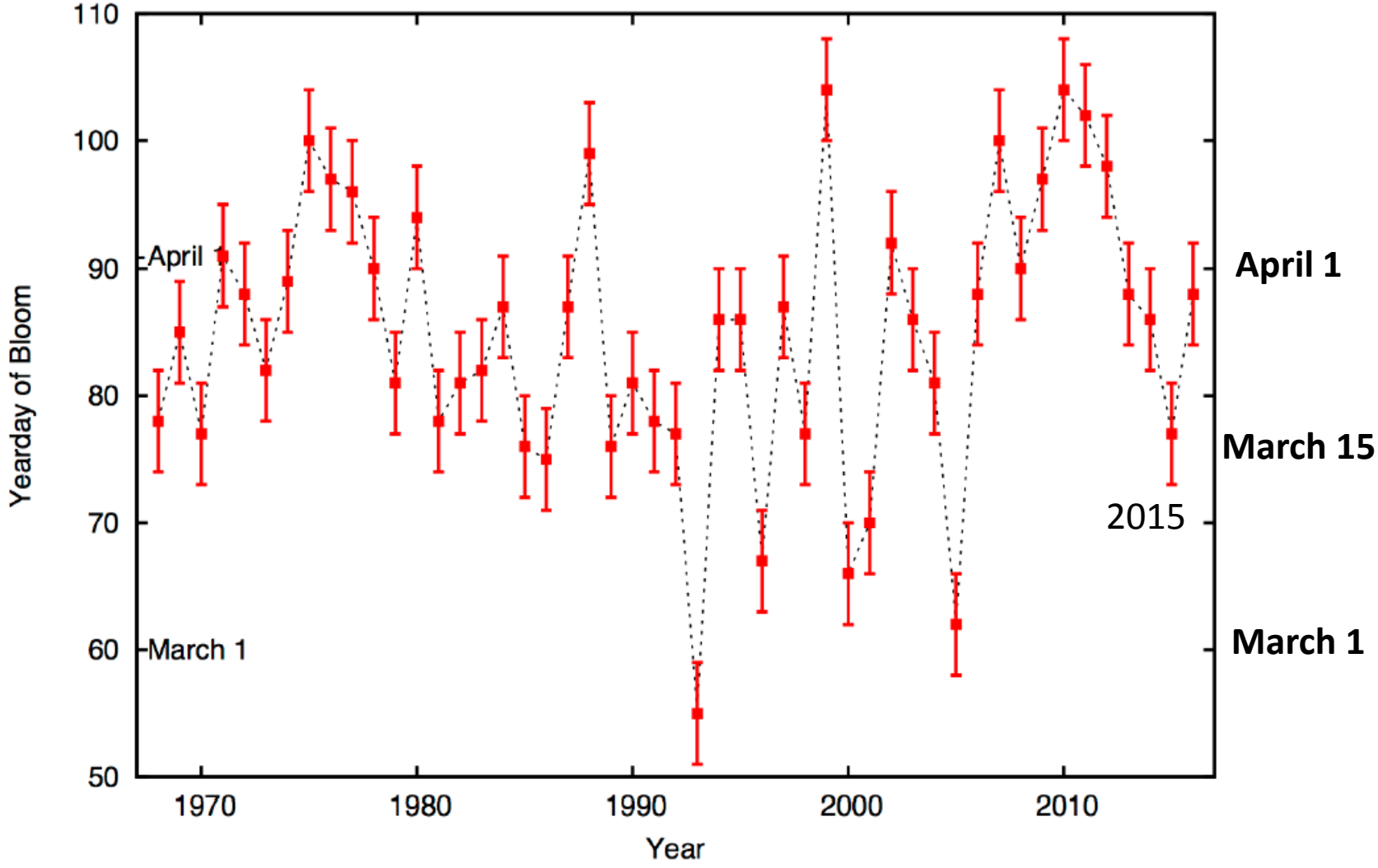
2016 (Jan-June)



2016 (June-Dec)

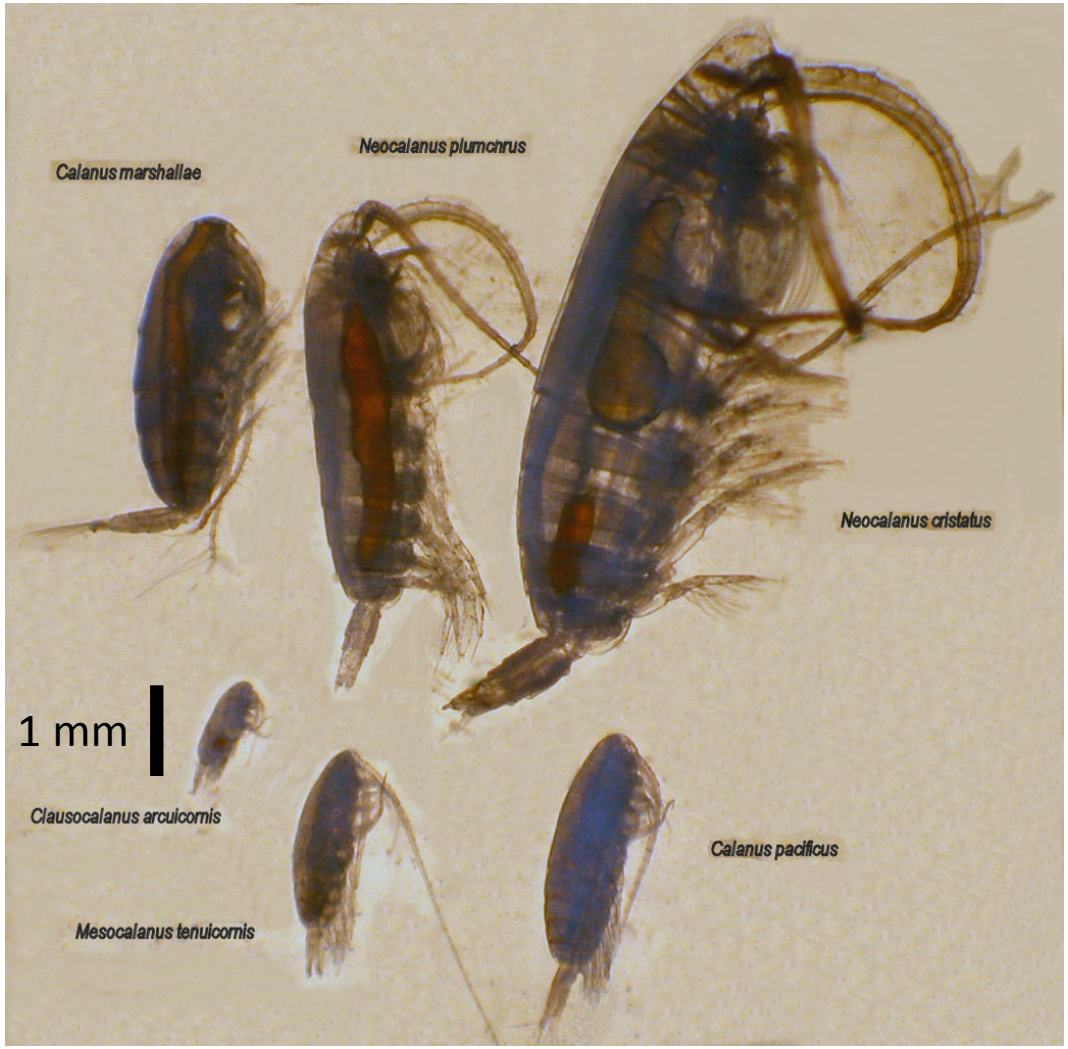


Strait of Georgia: (Modelled) timing of spring phyto bloom



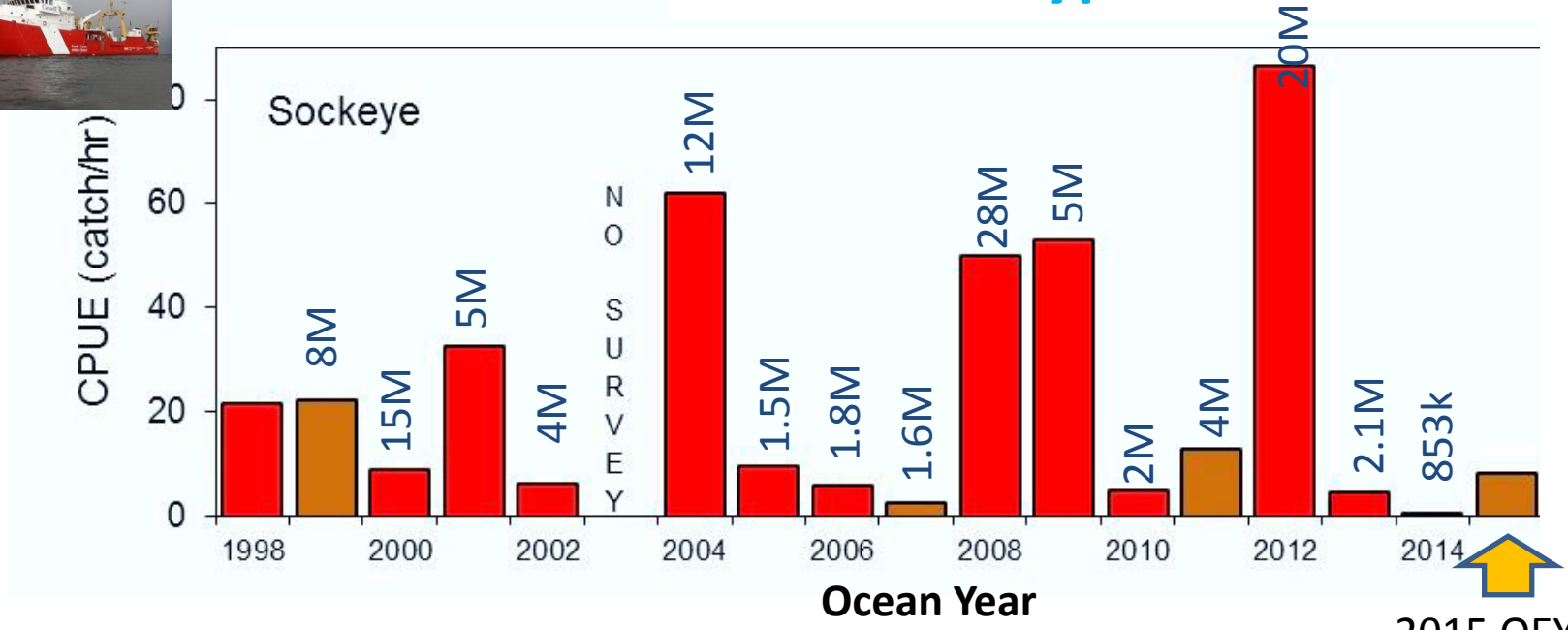
S. Allen et al. 2016. Can. Tech. Rep. Fish. Aquat. Sci. 3179.

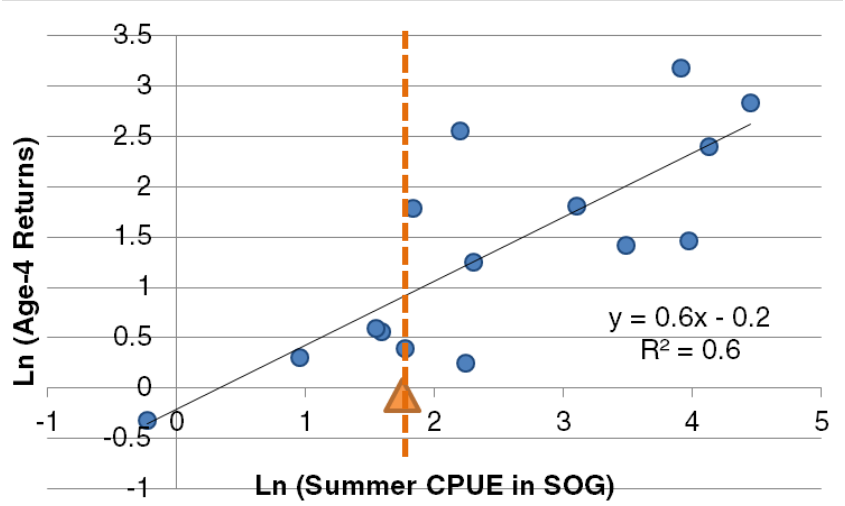
Changes in water temperature are reflected in changes in zooplankton species composition



- northern-type zooplankton occurred along Vancouver Island in 1st half of 2014 when water was cool (large nutritious species, good for fish)
- but, southern-type zooplankton in 2nd half of 2014 and in 2015 when water was warm (small poor quality species)

2014 Lake-Type Juveniles in SOG





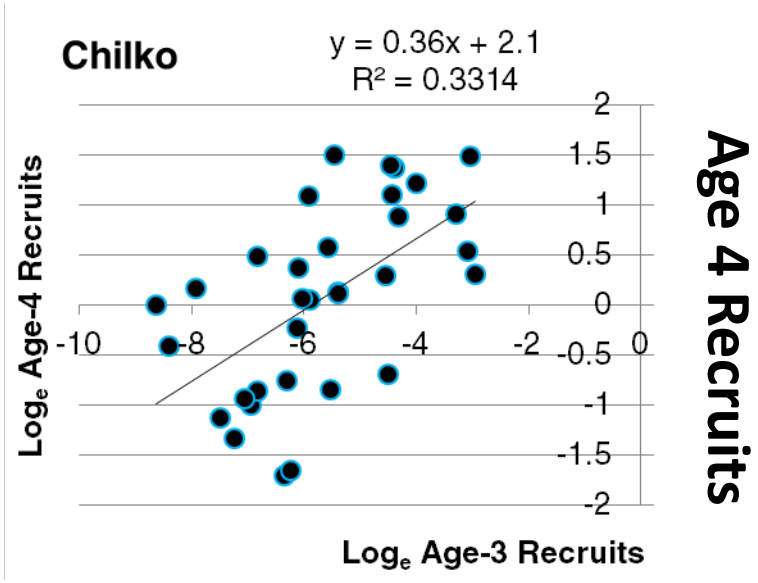
VERY UNCERTAIN
(this program only samples the tail-end of the sockeye migration)

Prediction range: 1-6 M (median: 2.5 M)

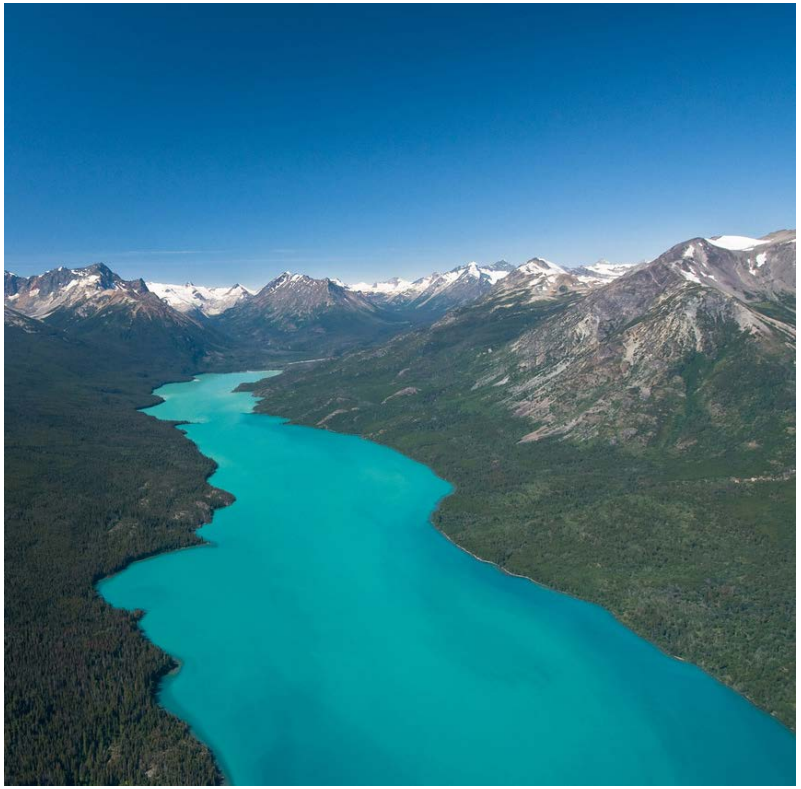
Neville: 2017 Supplement

Chilko

Age 3 (Jacks) Recruits



Age 4 Recruits

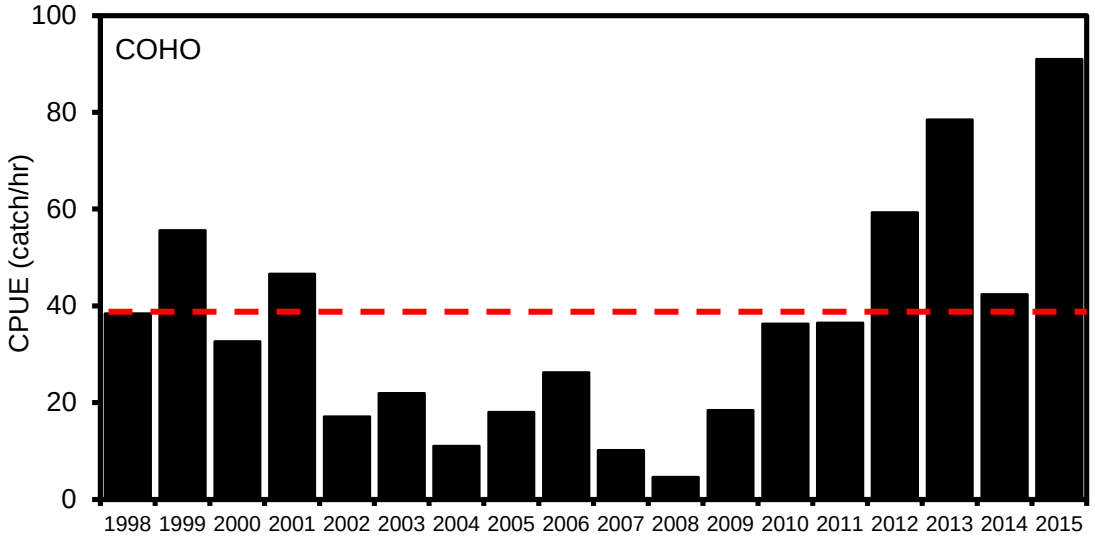


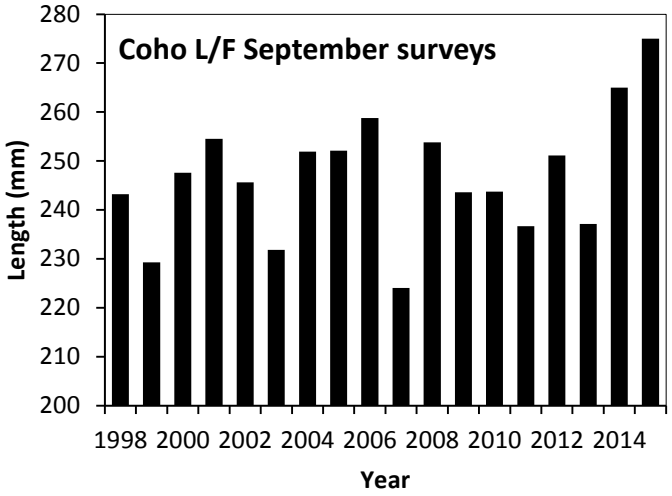
Preliminary 2016 Jack Spawners: 145 (K. Benner)

2017 Sibling Four Year Old 50% p-level Forecast : 350,000

2017 Larkin Four Year Old 50% p-level Forecast : 2,000,000

September 2015 - Coho





1. The Coho were larger and more abundant than have previously been seen in time series
2. Higher percentage of Jacks
3. Returns in 2016 good





CONCLUSIONS (1)

Supplement process is a learning process to better integrate information from monitoring/research Programs

- **Warm Blob in NE Pacific** occurred from 2013 to present
  - Influenced both marine and freshwater

- **Very warm upstream migration** in 2013
  - High spawner success on spawning grounds
  - Possibility of legacy effects on offspring condition due to poor migration conditions





CONCLUSIONS (2)

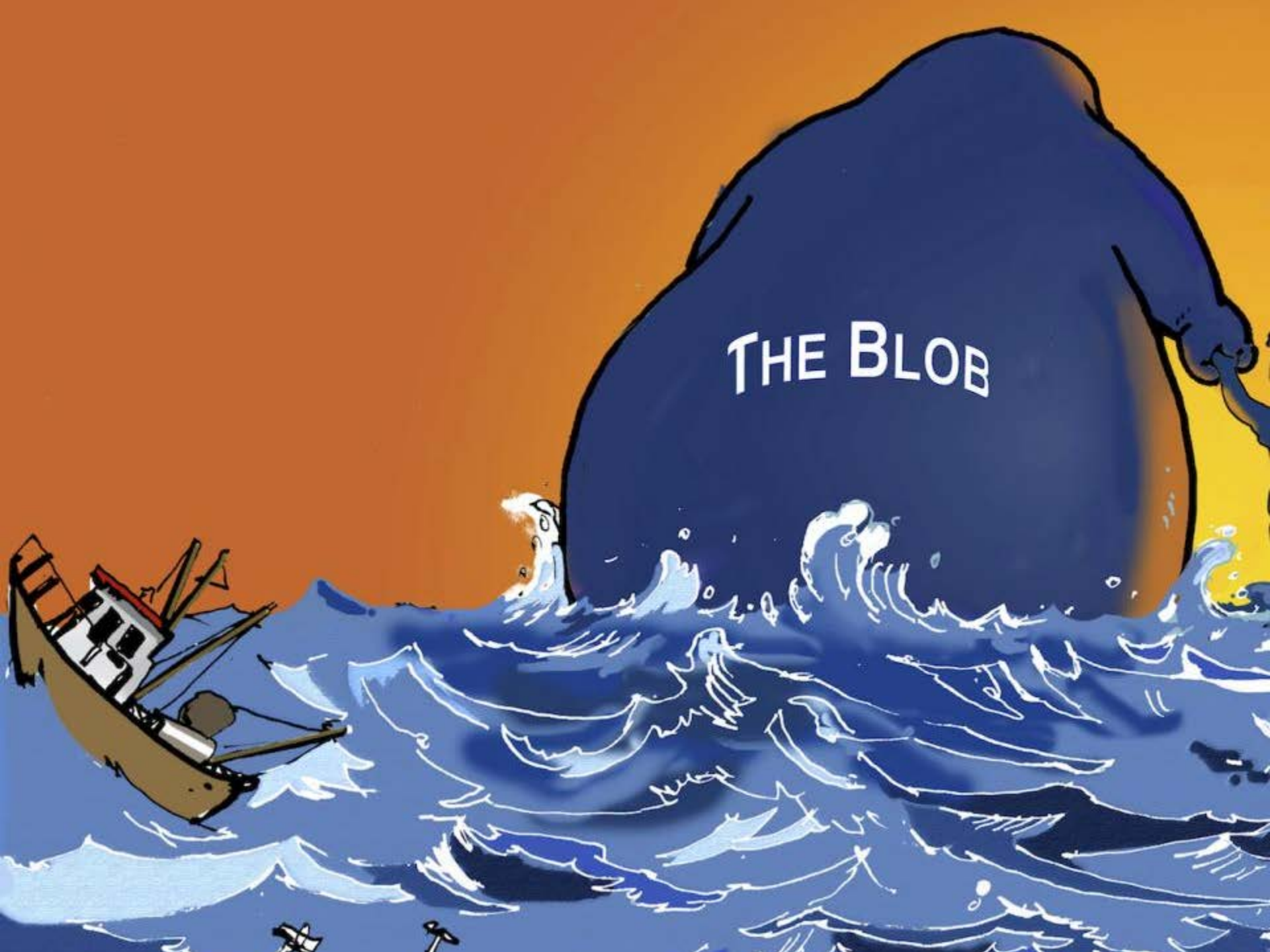
- **Warm Lake Rearing and Very Early Freshet 2014-2015**
  - Warm rearing conditions for juveniles in lakes
  - Chilko smolt fence was not installed in 2015 (high water); uncertain whether smolt abundance very low or migration was very early
  - Early Spring freshet and above average temps during 2015 smolt outmigration
- **Small smolt sizes leaving Chilko in 2015**
  - Productivity has increased in lake in last decade
  - small sizes potentially indicate high competition in lake (or other hypotheses)





CONCLUSIONS (3)

- **Warm Northeast Pacific from 2015 to 2017**
- **Strait of Georgia WARM in 2015;**
- Early Spring phytoplankton bloom
- SOG zooplankton biomass: nothing unusual
- SOG Fraser Sockeye CPUE and proportion of empty stomachs, coho abundance, not signalling anything extremely poor in SOG
- Smaller lipid-poor copepods
- **Large jacks; Chilko jacks in 2016 small numbers**


THE BLOB