

State of Canadian Pacific Salmon 2019 & 2020:

Responses to Changing Climate and
Habitats



**State of Salmon Program
Fisheries & Oceans Canada**

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Selbie, Keri Benner, Lucas Pon, & Joe A. Tadey

**3rd NPAFC-IYS Workshop on Linkages
between Pacific Salmon Production and
Environmental Change May 25-27 2021**

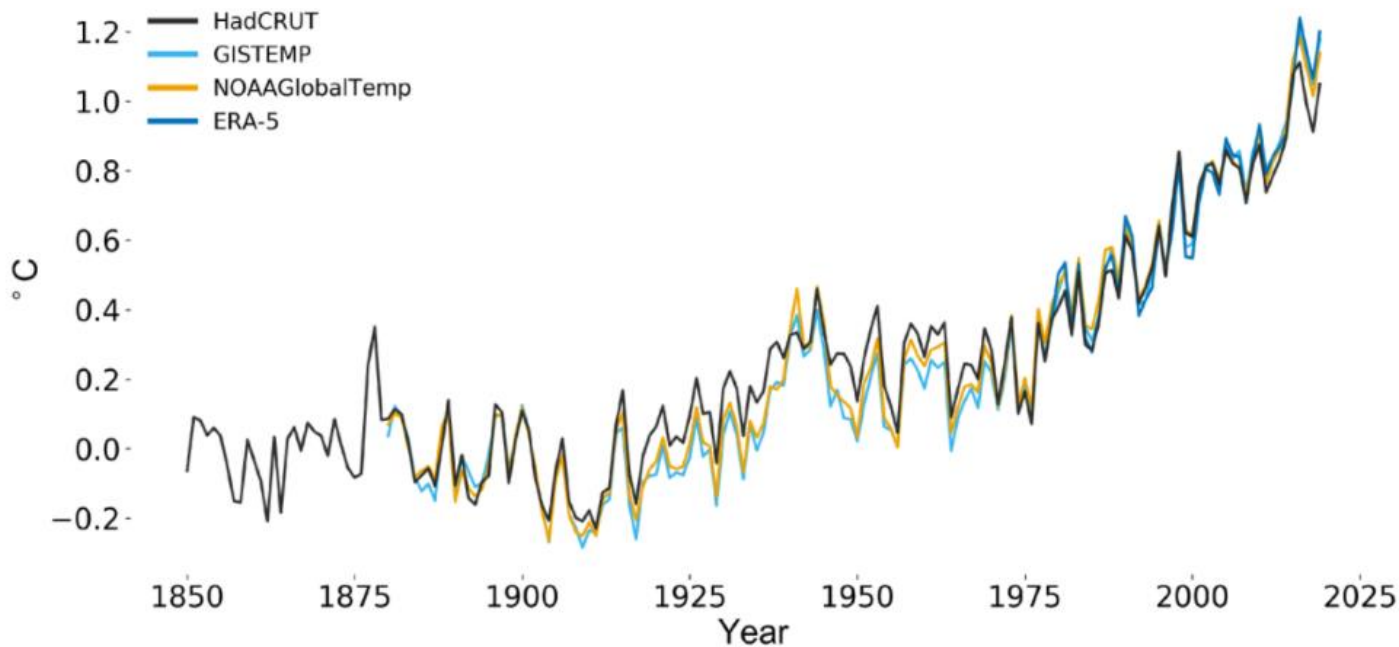
Videographer: DFO Matt Townsend



A Changing Global Climate

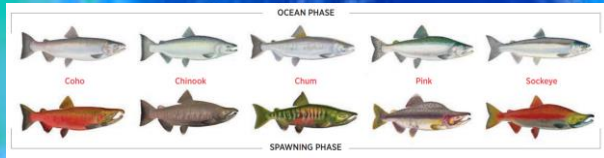
#1: 2016 (hottest year on record)

#2: 2020 #3: 2019 #4: 2015 #5: 2017



Source: Met Office Hadley Centre and the Climatic Research Unit at the University of East Anglia, UK (HadCRU) presented in World Meteorological Organization, 2020. WMO Statement on the State of Global Climate Change in 2019 (WMO-No. 1248), Figure 1, Page 6).





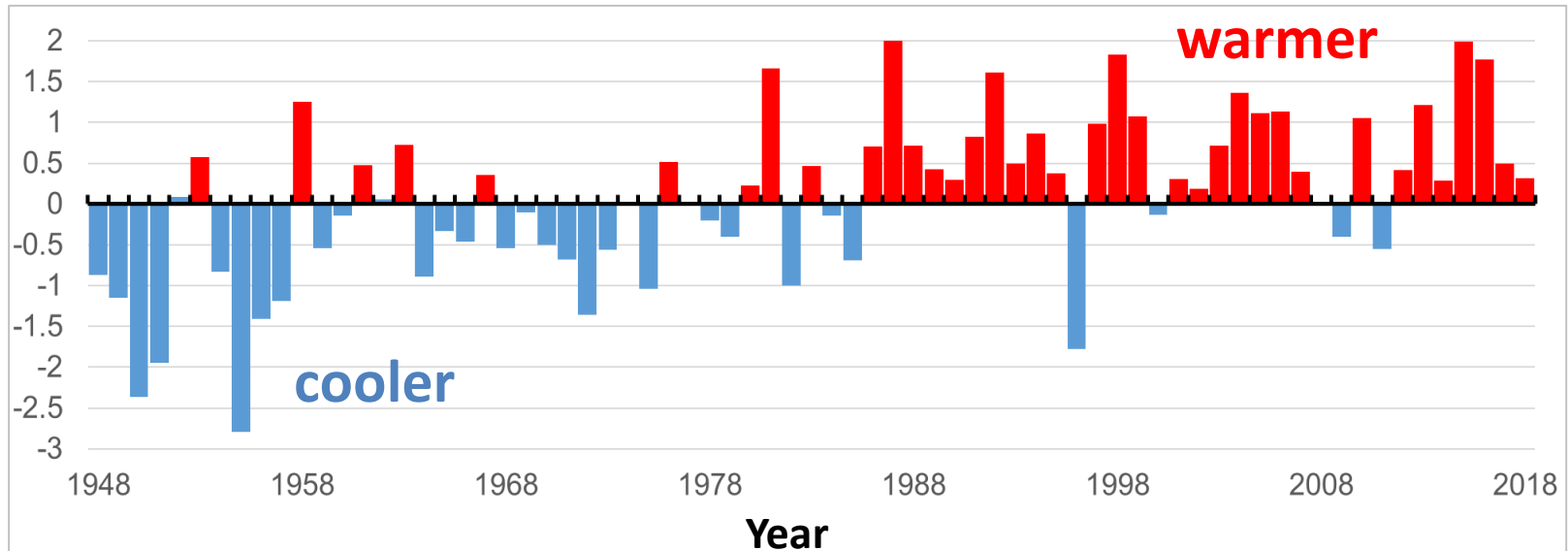
Canadian Pacific Salmon



British Columbia Air Temperatures



Air temperature anomalies (°C)

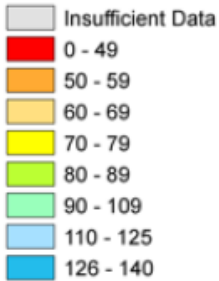


Canadian gridded air temperature anomalies (CANGRD) from the Government of Canada: <https://climate-change.canada.ca/climate-data/#/historical-gridded-data>

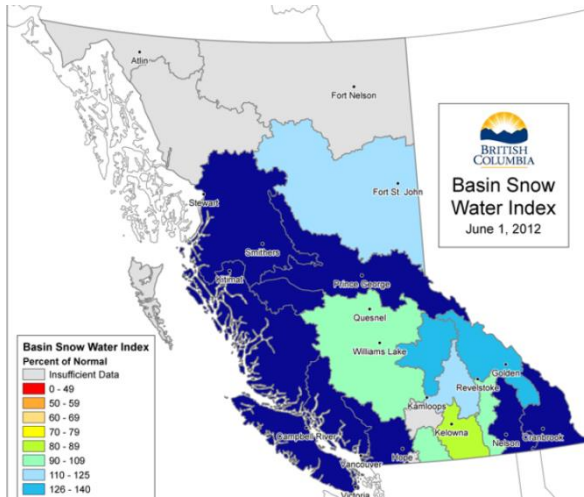
Reference period 1981-2010



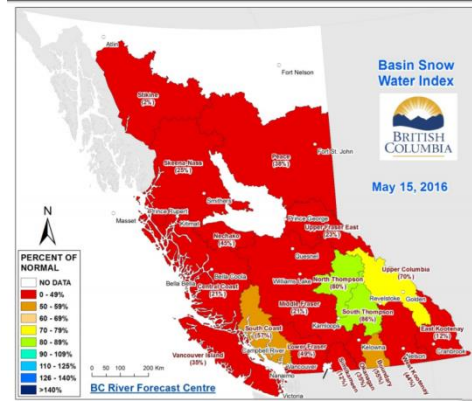
British Columbia June Snow Pack (Percent of Normal)



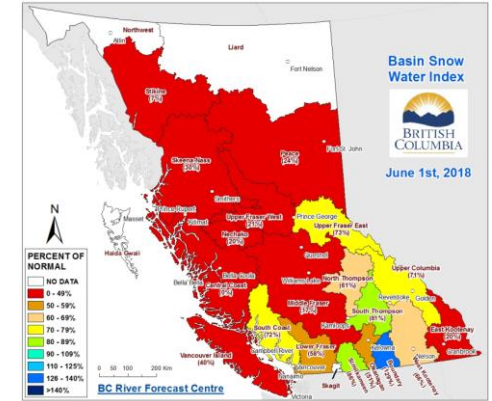
REFERENCE YEAR



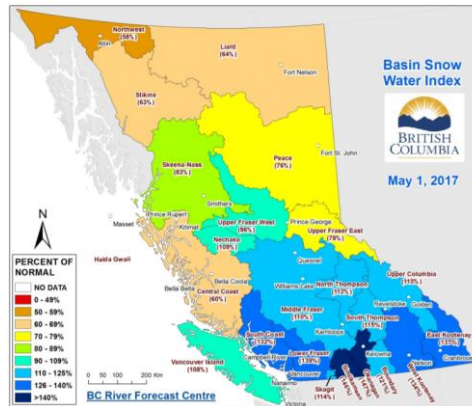
2012
(June)



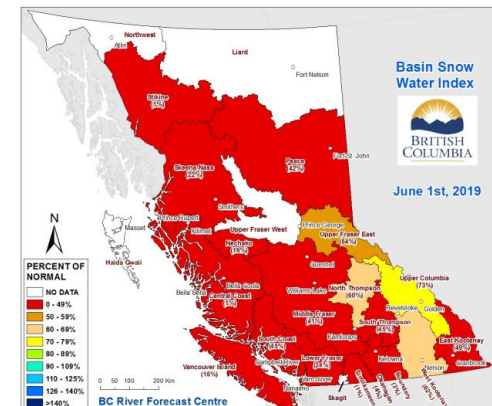
2016 (May)



2018 (June)



2017 (May)



2019 (June)





Warmer summer water temperatures exceeding 18-20°C can negatively influence survival of adult migrating salmon

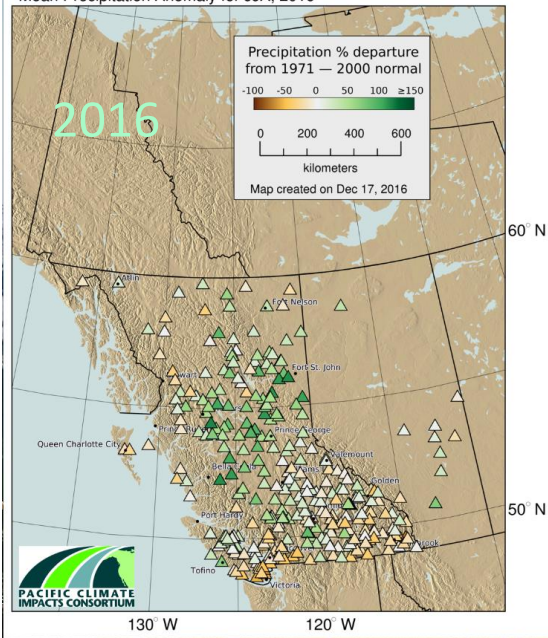
D. Patterson & K. Robinson
DFO Environmental Watch Program

Eagle River Sockeye

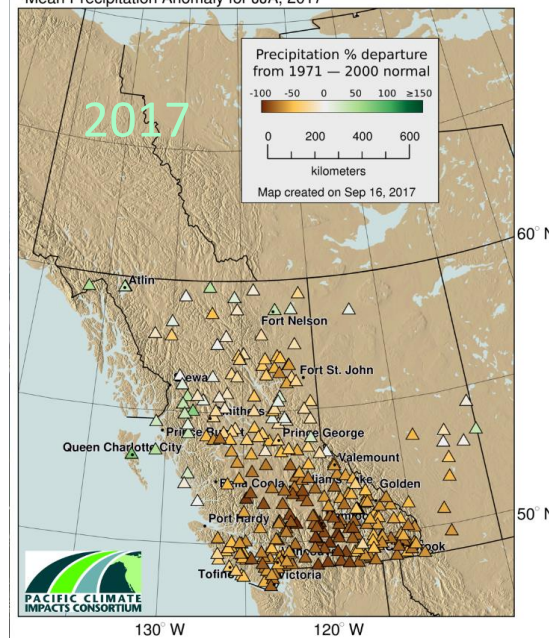
Photo: 4 Element Photos
S. Kalyn



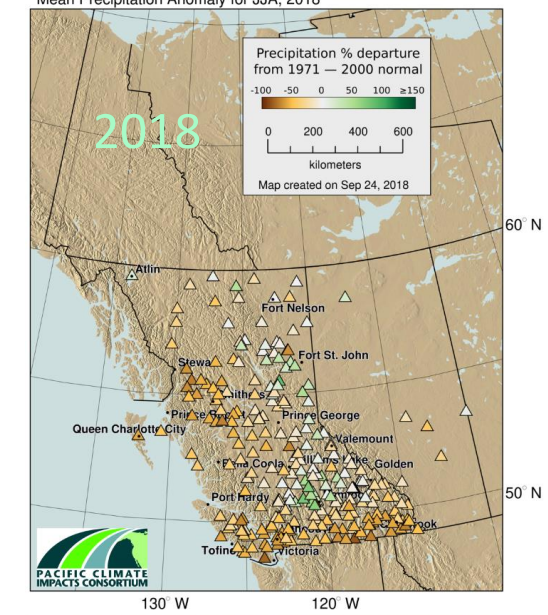
Mean Precipitation Anomaly for JJA, 2016



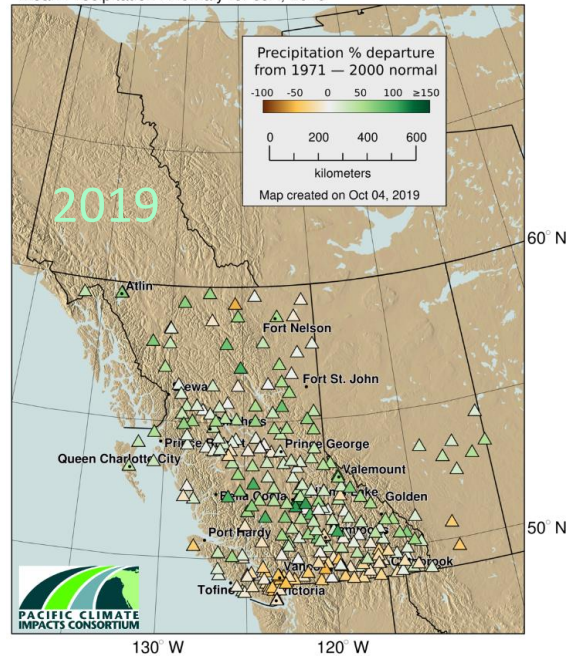
Mean Precipitation Anomaly for JJA, 2017



Mean Precipitation Anomaly for JJA, 2018



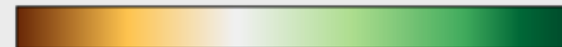
Mean Precipitation Anomaly for JJA, 2019



Dry

Precipitation % departure from 1971 – 2000 normal

-100 -50 0 50 100 ≥150



Wet



Drought conditions in Skeena/Nass in summer months

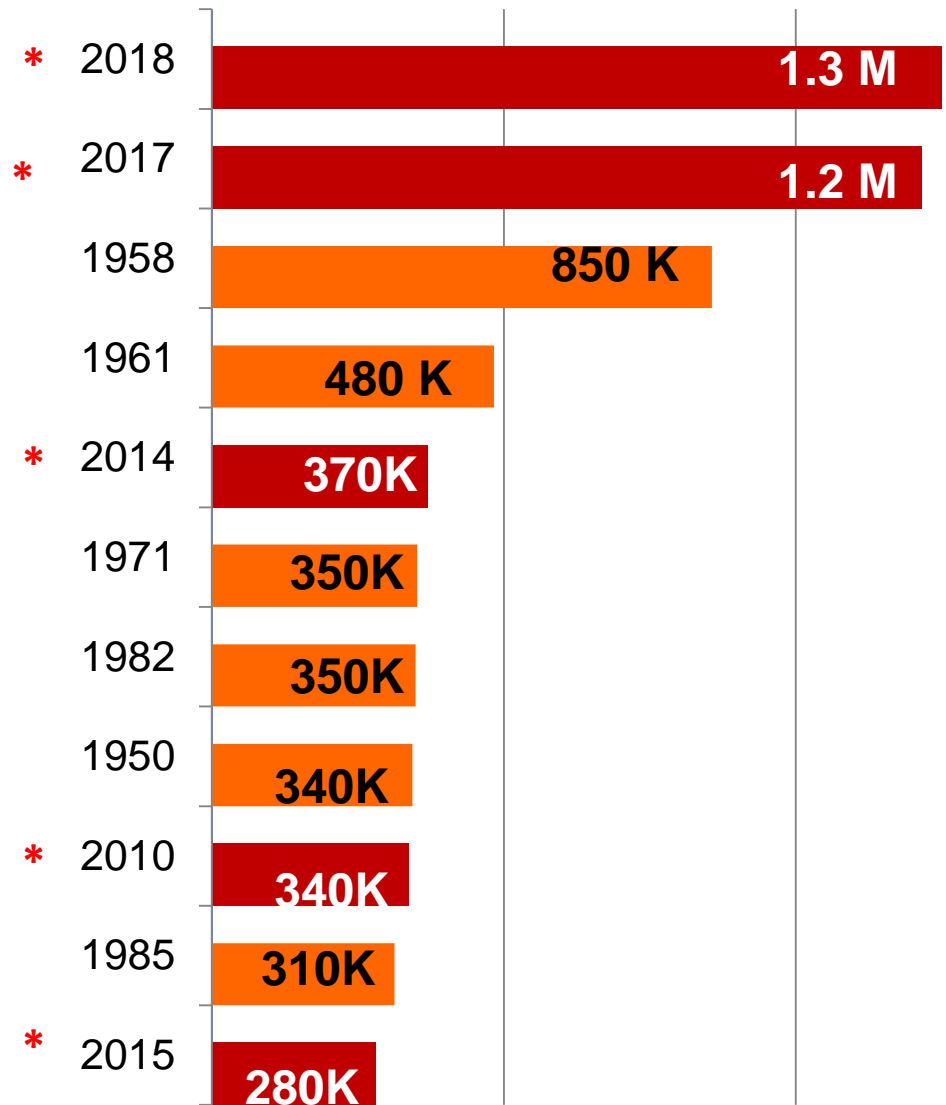
C. Carr-Harris, DFO

Bonaparte River from mid August 2018
Source: C. Parken, DFO



Forest Fires
recent records
for hectares
burned:
implications
for our
salmon in
freshwater are
not entirely
known

Hectares Burned in British Columbia (Size of BC: 95 M)



Slope Destabilization

“Loss of forest canopy due to fire, pine beetle and logging has pushed a number of streams over the “tipping point” and there is considerable loss of stability”

R.E. Bailey

BC Interior
Source: R.E. Bailey



Rock slide

60m

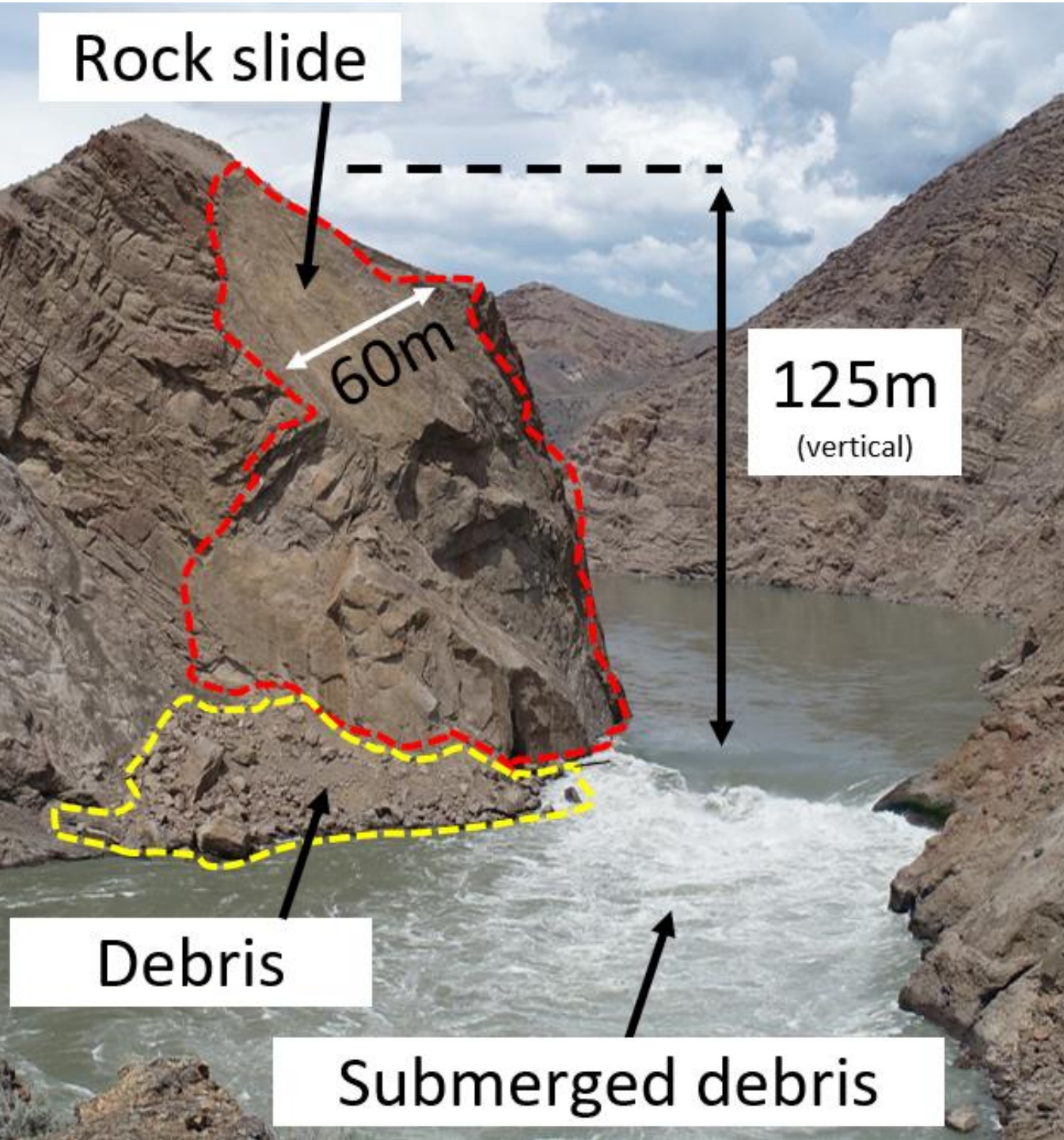
125m
(vertical)

Debris

Submerged debris

Big Bar Landslide

Fraser River 2019-2021

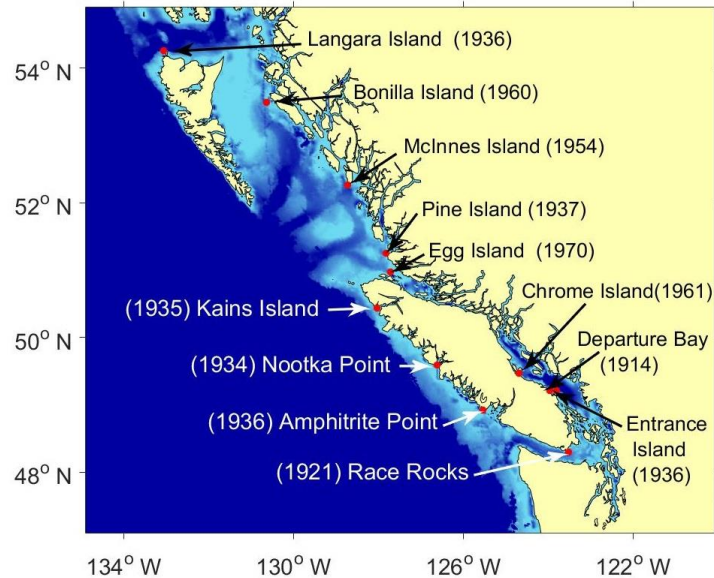


A bathymetric map of the Pacific Ocean basin, showing the continental shelves and deep ocean trenches. A large, irregularly shaped area in the central and eastern Pacific is highlighted in a light cyan color, representing the range of Canadian Pacific Salmon. The text "Canadian Pacific Salmon" is overlaid on this highlighted area, preceded by a small Canadian flag icon.

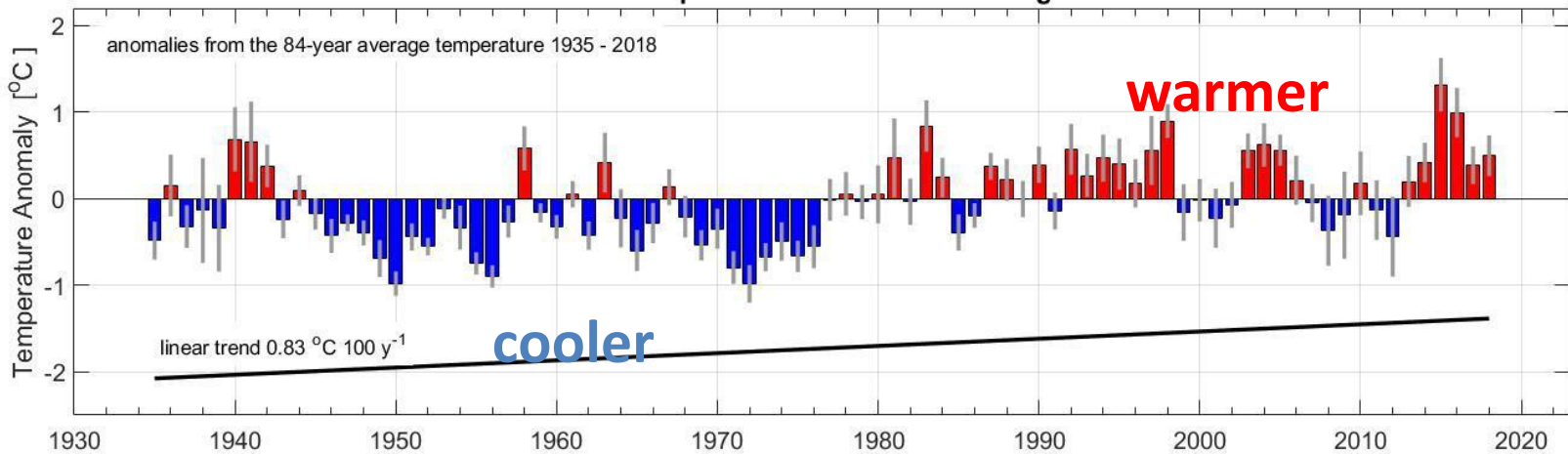
 Canadian Pacific Salmon



Lighthouse Temperatures



Sea Surface Temperature Anomalies at BC Lighthouses

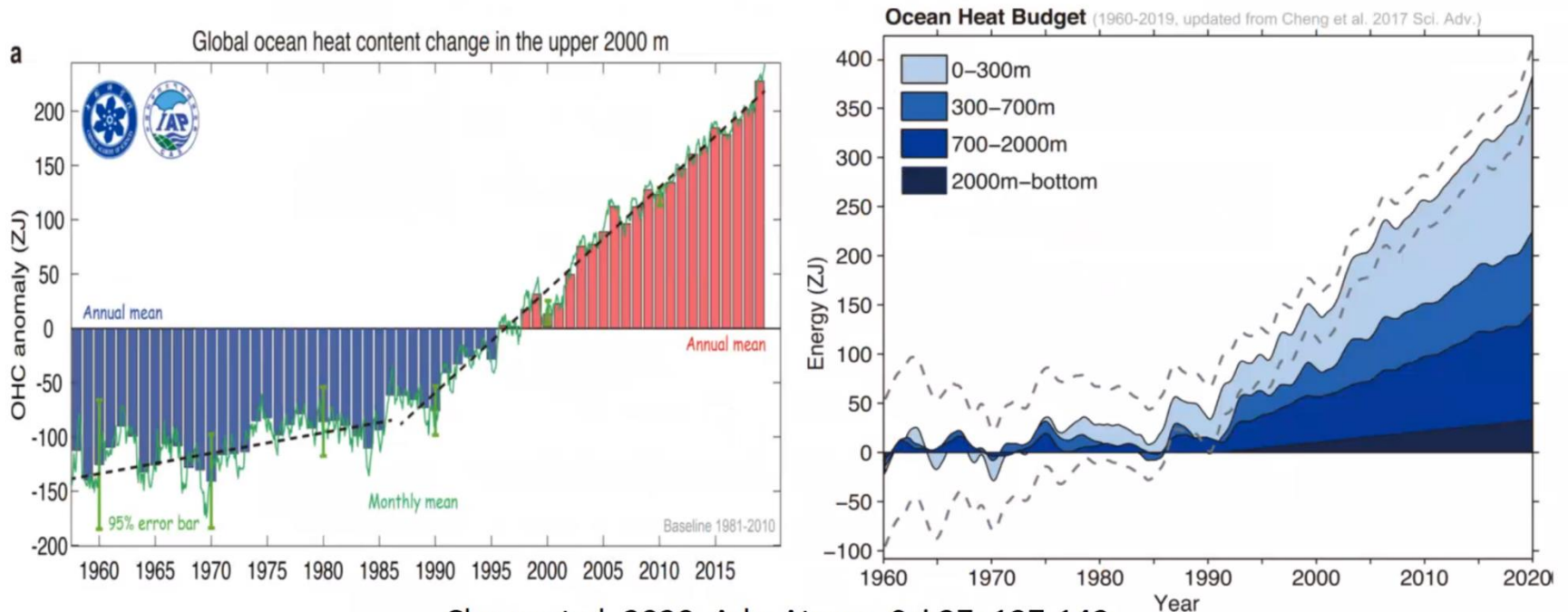


Source: Peter Chandler



The ocean has absorbed 90% of earth's excess heat

Global warming = ocean warming

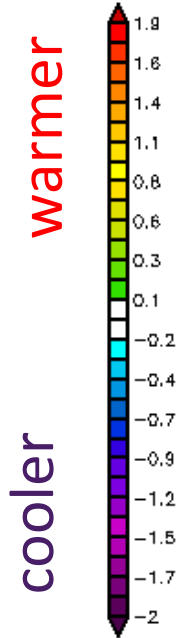


Cheng et al. 2020. Adv. Atmos. Sci 37: 137-142
(1 ZJ = 10^{21} J)

Presentation by Laurie Weitkamp, NOAA, December 2020



Deviations from seasonal average



Reference Period:
1981-2010

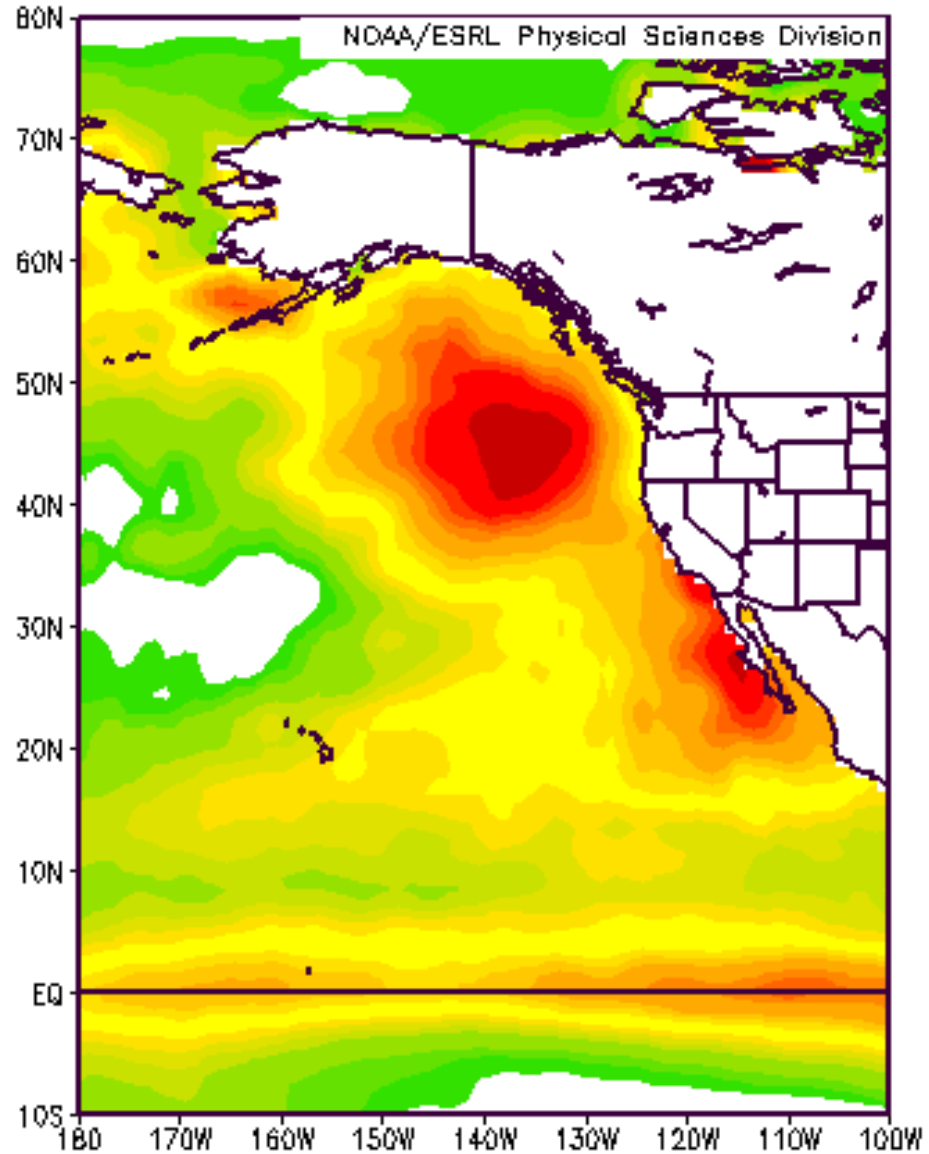
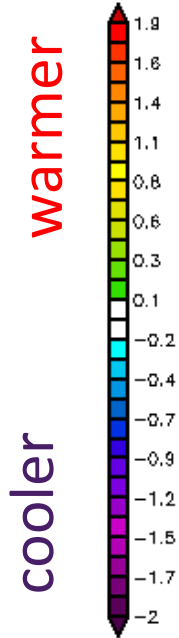


Image provided by the NOAA/ESRL Physical Sciences Division, Boulder Colorado from their Web site at <http://www.esrl.noaa.gov/psd/>

Deviations from seasonal average



Reference Period:
1981-2010

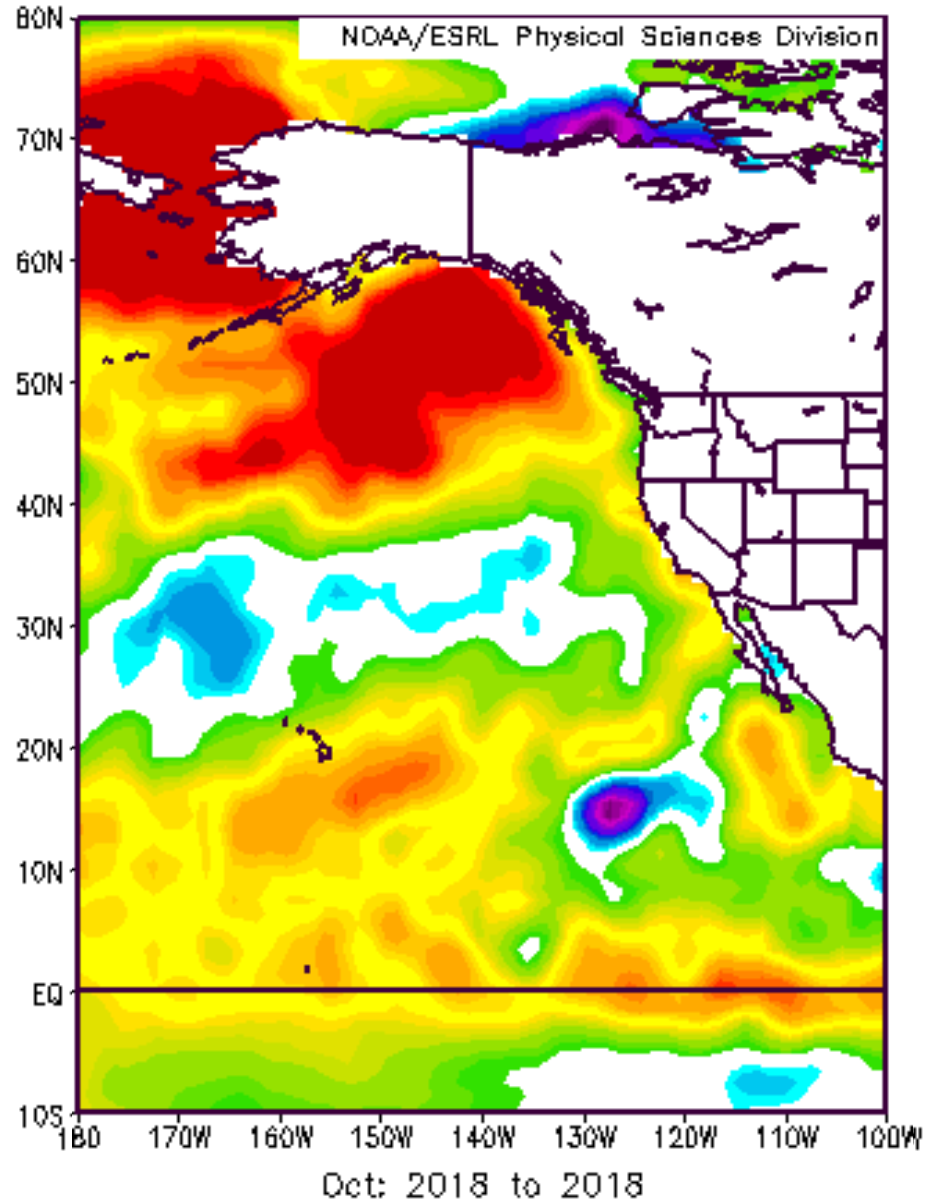
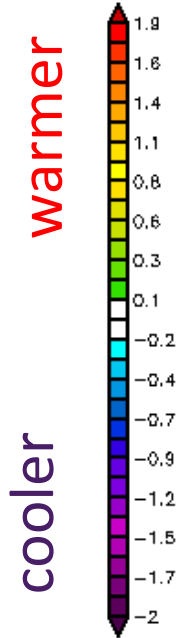


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Deviations from seasonal average



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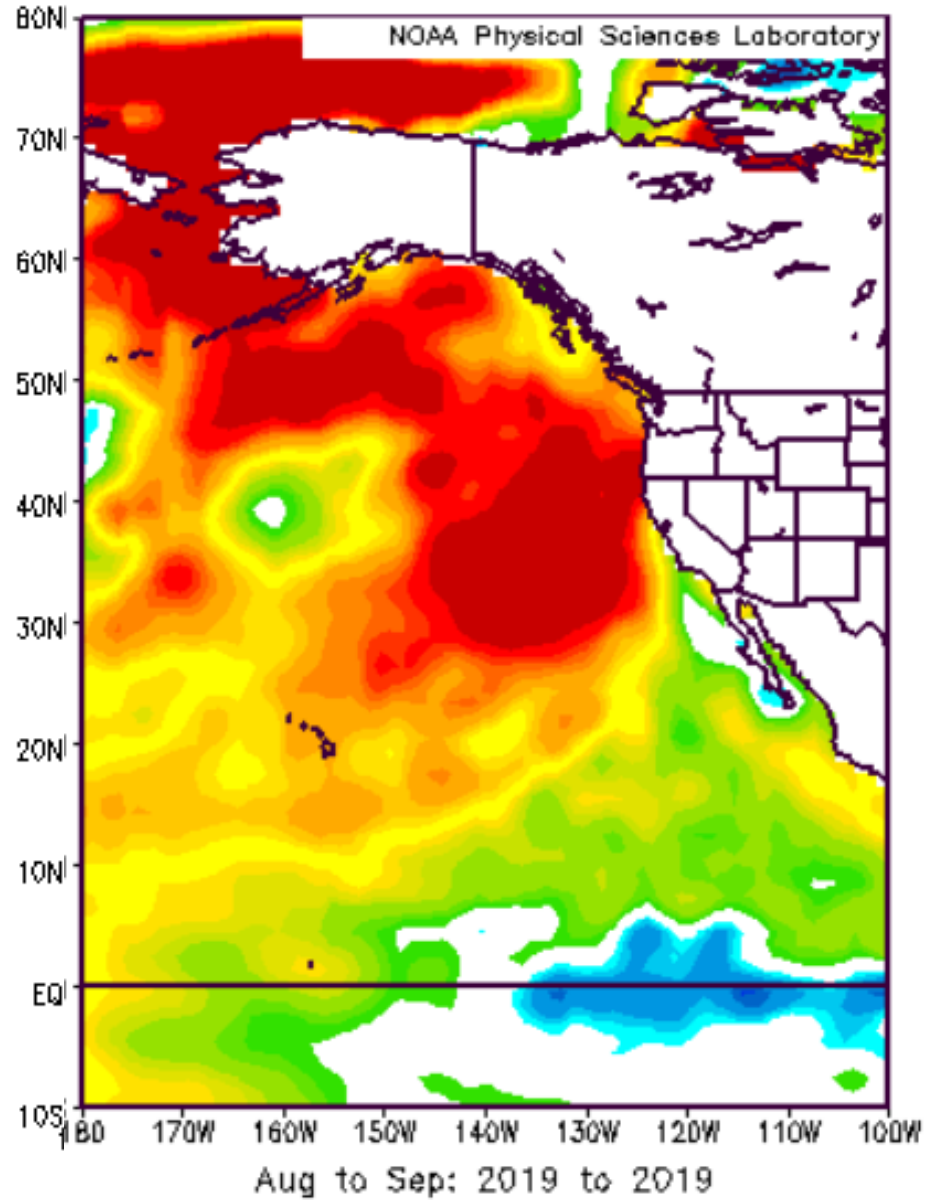
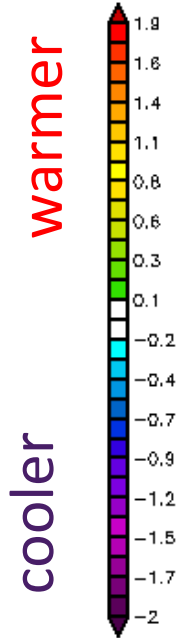


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Deviations from seasonal average



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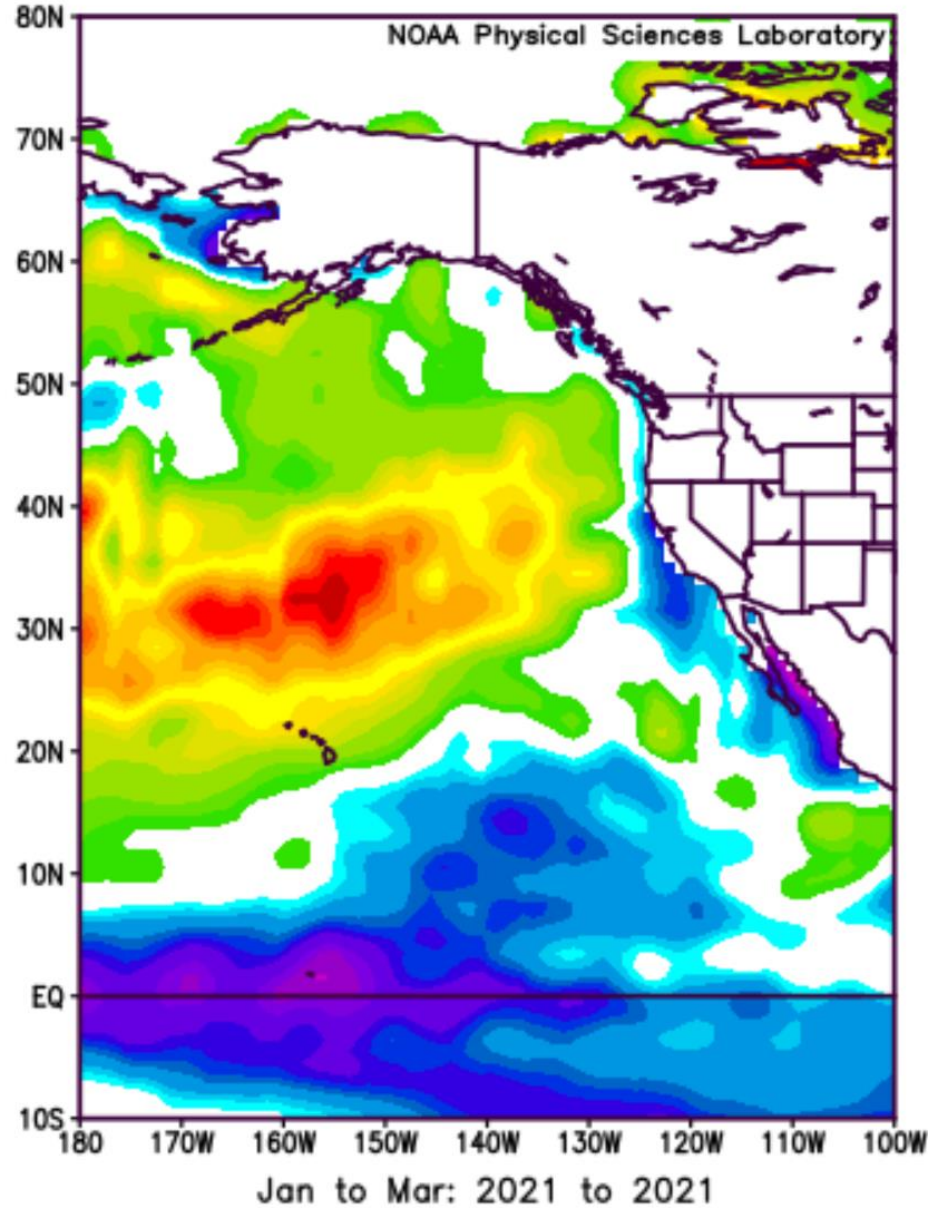


Image provided by the NOAA/ESRL Physical Sciences Division, Boulder Colorado from their Web site at <http://www.esrl.noaa.gov/psd/>

Northern Zooplankton



↓
LARGER
ENERGY RICH
ZOOPLANKTON
DECREASE IN
WARM CONDITIONS

Southern Zooplankton



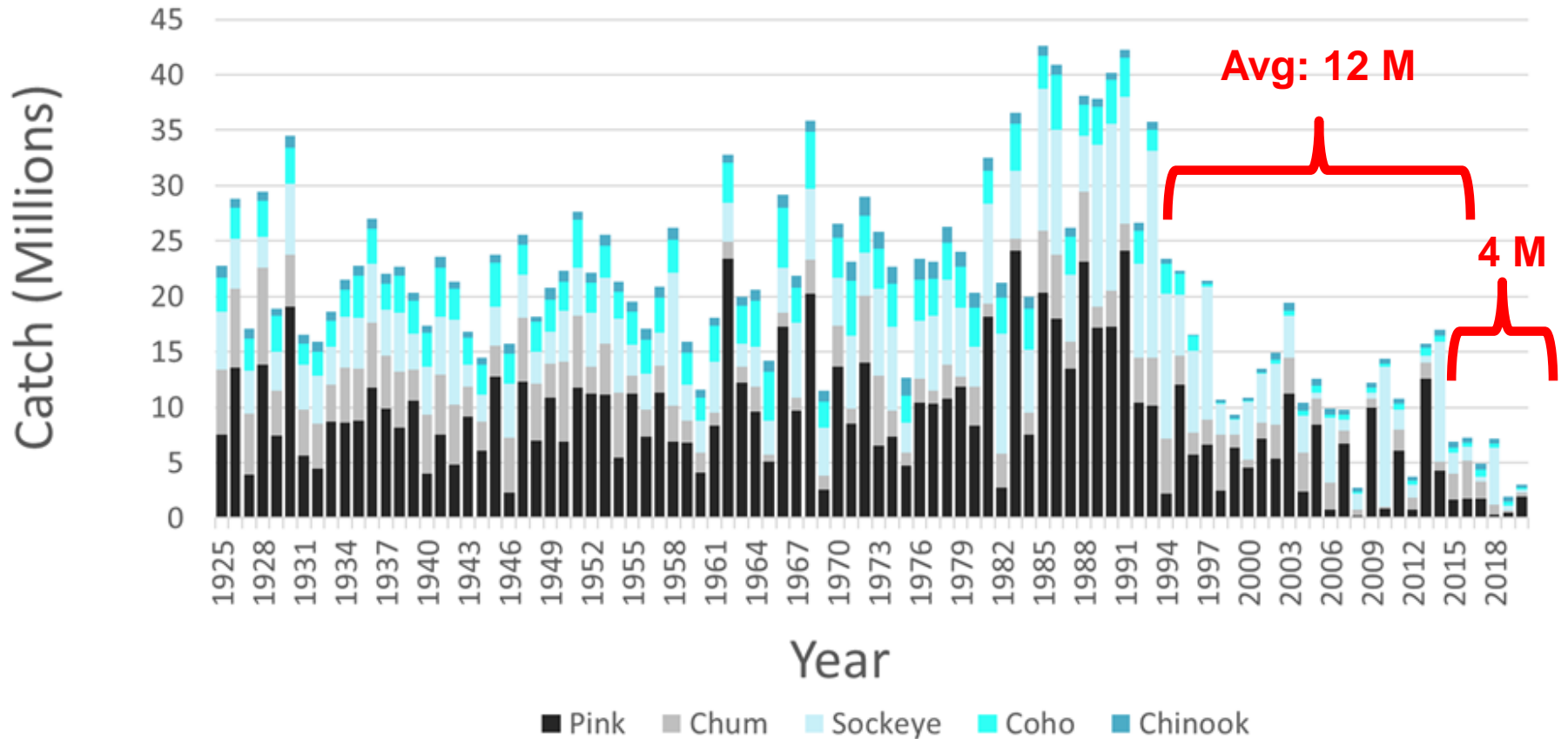
↑
SMALLER
ENERGY POOR
ZOOPLANKTON
INCREASE IN
WARM CONDITIONS

M. Galbraith, DFO, La Perouse Zooplankton Program



Canadian Pacific Salmon Catch

Avg: 24 M



Chinook

- Declines throughout their range

Many populations in the south are facing an imminent threat of extinction

- Younger age-at-return, smaller sizes, fewer eggs-per-female
- Poor returns in 2019 & 2020
- Exceptions:
 - Upper and lower Georgia Strait
 - Georgia Strait Spring and Summer

Data Quality
Med-High

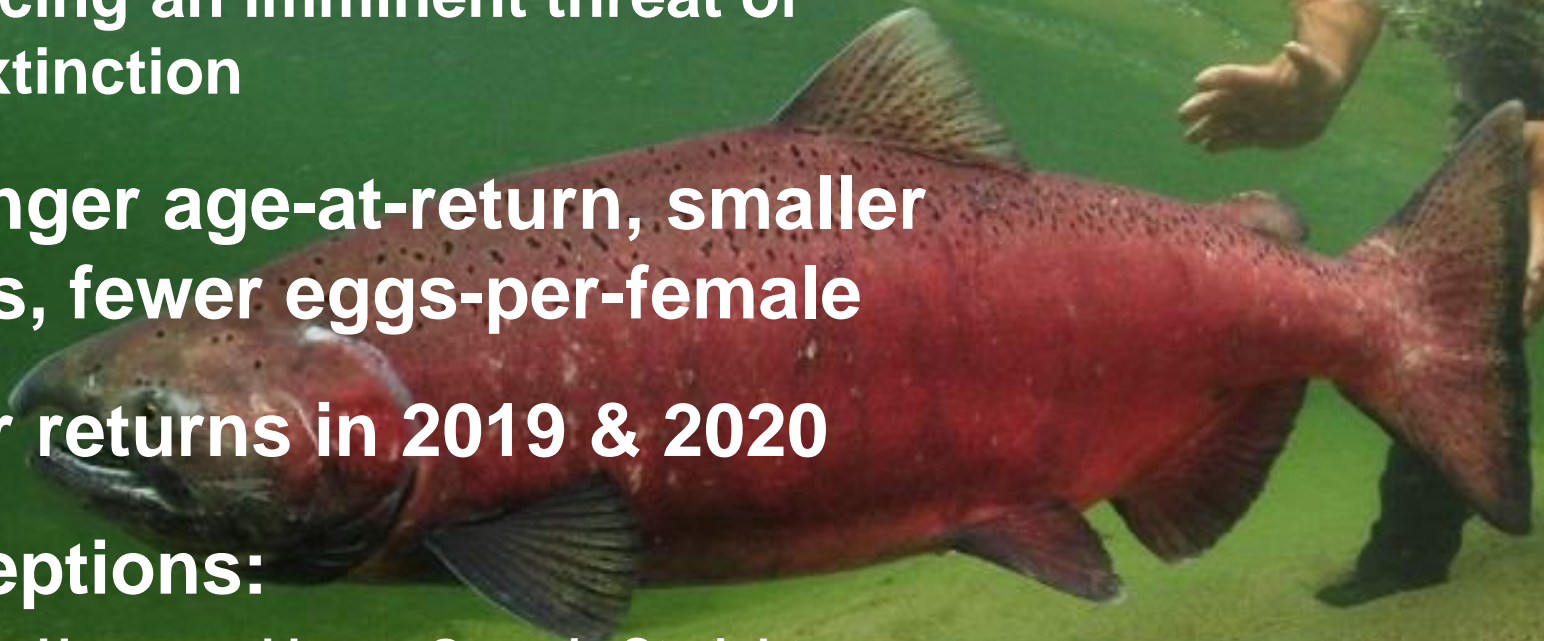


Photo: Paul Vecsei

Sockeye

Data Quality
Med-High

- Southern populations declining & some facing an imminent threat of extinction
- Northern populations show recent declines
- Poor returns in 2019 & 2020 for most SK
- Exceptions:
 - Taku River of the Northern BC-Alaska transboundary region.

Photo: Paul Vecsei

Sue Grant...

Coho

- **Southern populations declining**
- **Mixed returns in 2019 & 2020**
 - Interior Fraser: average
 - Transboundary: below average
 - North Coast: below average
 - WCVI: below average

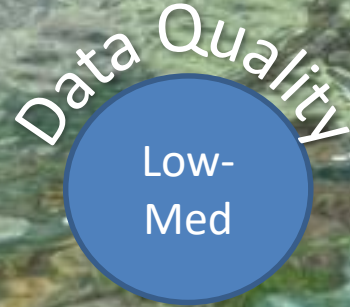


Photo: Paul Vecsei

Chum

- Generally doing well; some exceptions
- 2019 & 2020: very poor returns

Photo: Paul Vecsei

Pink

- Generally doing well; some exceptions
- 2019 & 2020: generally good returns

Photo: S.Kalyn, 4 Element Photos



We need to stop managing salmon by looking in the rear view mirror



The future of salmon is going to look very different under climate change

Need to start adapting now for these changes

DFO E-Book for State of Canadian Pacific Salmon:
Responses to Changing Climate and Habitats: [www.dfo-
mpo.gc.ca/species-especes/publications/salmon-saumon/state-etat-
2019/ebook/index-eng.html](http://www.dfo-mpo.gc.ca/species-especes/publications/salmon-saumon/state-etat-2019/ebook/index-eng.html)

State of Canadian Pacific Salmon: Responses to
Changing Climate and Habitats DFO Canadian
Fisheries & Aquatic Sciences Technical Report:
[http://www.dfo-mpo.gc.ca/species-especes/publications/salmon-saumon/state-etat-
2019/abstract-resume/index-eng.html](http://www.dfo-mpo.gc.ca/species-especes/publications/salmon-saumon/state-etat-2019/abstract-resume/index-eng.html)

Report of the Proceedings for the IYS
Workshop International Year of the Salmon
Workshop on Salmon Status and Trends
https://npafc.org/wp-content/uploads/2019/08/Tech-Rep-13_Final_16Aug2019.pdf

Photo: Paul Vecsei



Contributors



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Photo: Paul Vecsei





DFO State of Salmon Contributors

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Lil'wat First Nations
Little Shuswap Indian Band
Shuswap Nation Tribal Council / Secwepemc Fisheries
Commission

...

Instream Fisheries Research Inc.

DFO, Salmonid Enhancement Program

Pacific Salmon Foundation
Pacific Salmon Commission

Photo: Paul Vecsei

