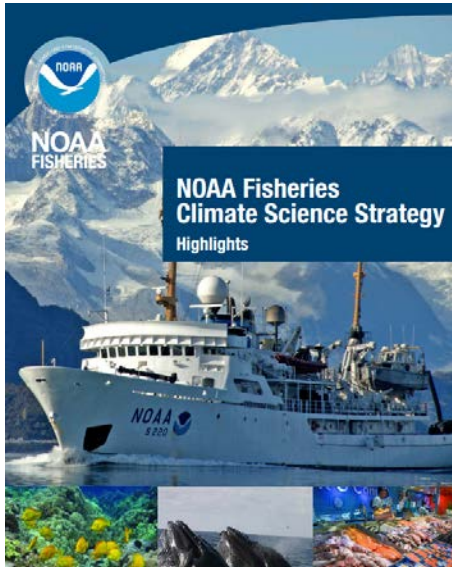




**NOAA**  
**FISHERIES**

# West Coast Regional Action Plan (WRAP) for the NOAA Fisheries Climate Science Strategy (NCSS)



*John Stein*  
*NWFSC*

*Cisco Werner*  
*SWFSC*

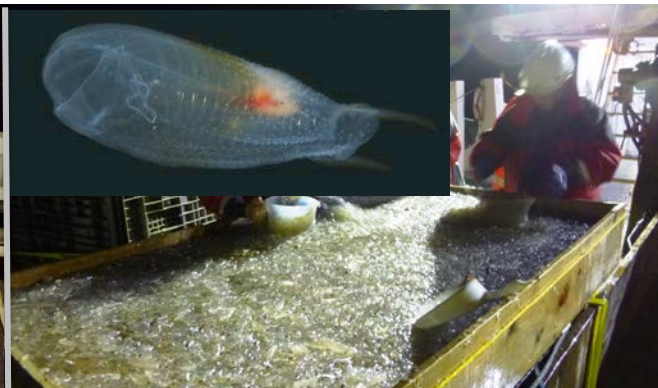
PFMC Meeting, Tacoma WA

June 27 2016





Shortbelly rockfish young, Pt. Sur



Salps and pyrosomes, Pt. Piedras Blancas



Pelagic red crabs, San Nicolas Isl.



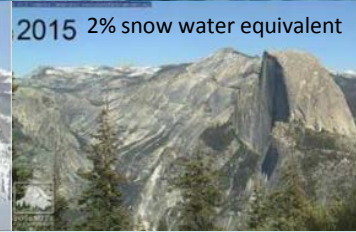
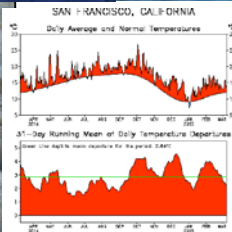
© Carl Sbarounis: bluefin tuna schools



False Killer Whales, 24 Feb 2015; Photo: M. Robbins



Photo: Sharon Melin, NOAA



2012

2015 2% snow water equivalent



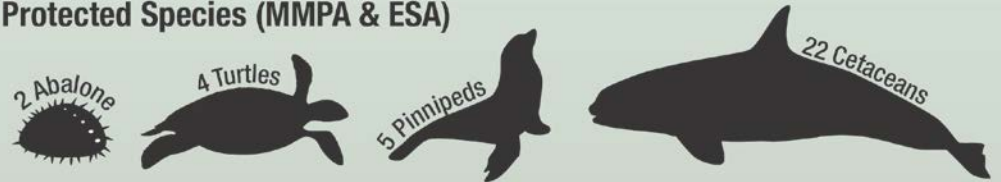
# Climate Variability and Change

Climate change acts with other drivers to affect most living marine resources (negatively or positively)

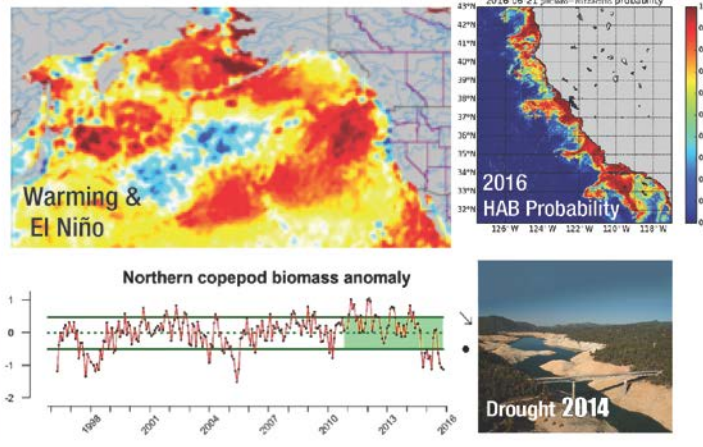
All interactions between humans and LMRs will be affected, governance is complicated

120+ MSA MANAGED SPECIES, 35+ ESA MANAGED SPECIES

## Protected Species (MMPA & ESA)



## Complex Habitats (from fresh water to open ocean)



Managed Fisheries

# Climate Variability and Change

Climate change acts with other drivers to affect most living marine resources (negatively or positively)

All interactions between humans and LMRs will be affected, governance is complicated







# NMFS Climate Science Strategy (NCSS)

## WHY

Growing demands and requirements for climate-related information.

## GOAL

Increase the production, delivery, and use of climate-related information to support agency and stakeholder decisions.

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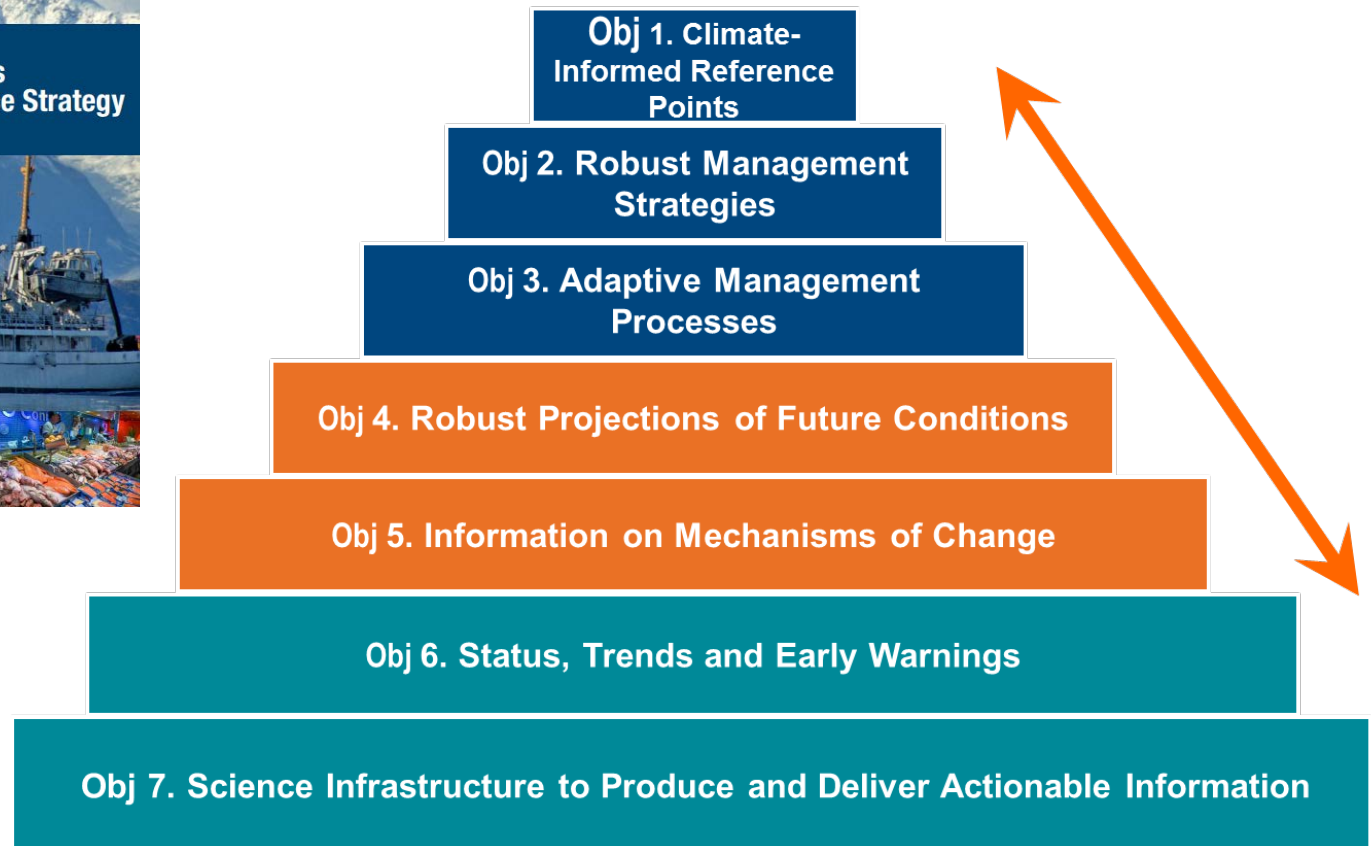
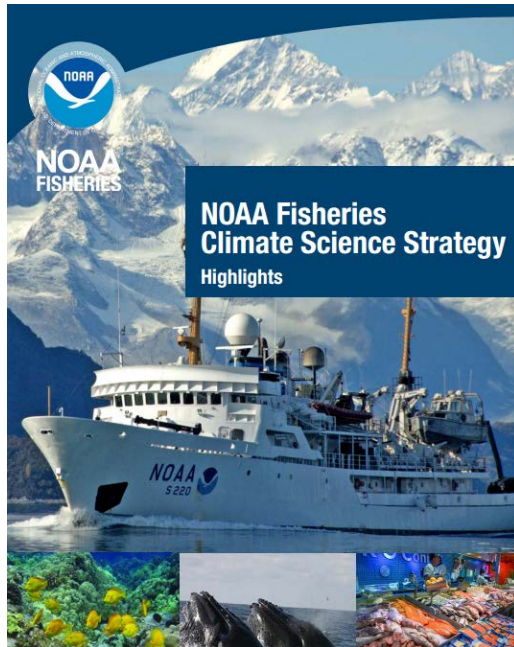
## GOAL

Increase the production, delivery, and use of climate-related information to support agency and stakeholder decisions.

## WRAP

Conforms to the national framework, identifies strengths, weaknesses, priorities, and actions to implement the Strategy on the West Coast over the next 3-5 years
























# NOAA Climate Science Strategy (NCSS)

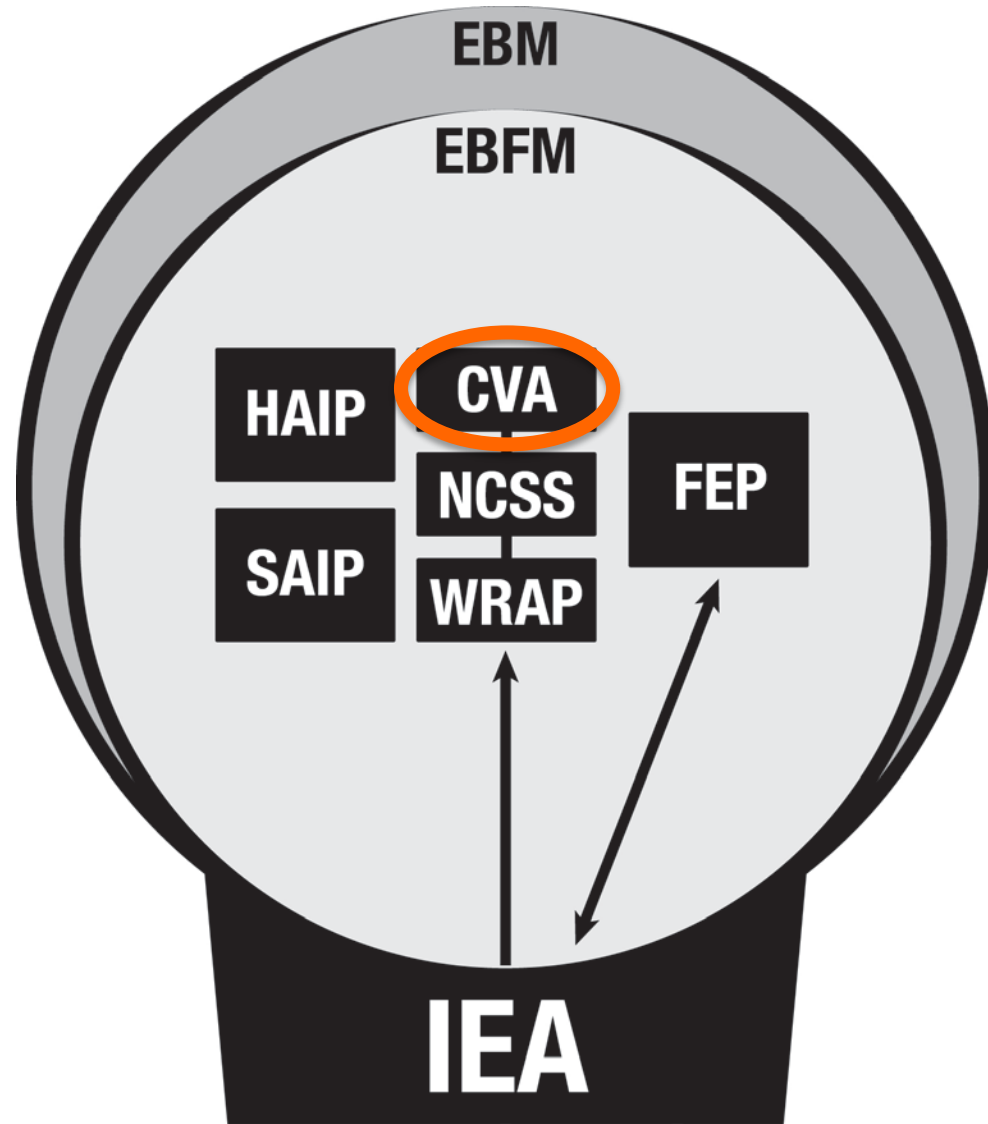


<https://www.st.nmfs.noaa.gov/ecosystems/climate/national-climate-strategy>



# Relation to ongoing ecosystem-related activities and context

Levels	Scientific Advice	Management Framework
<b>EBM</b> Ecosystem Based Management	 Fisheries  Development  Energy  Eco Tourism  Oil & Gas  Conservation  Marine  Sanctuaries  Aquaculture  Etc	 Regional Ocean Plans
<b>EBFM</b> Ecosystem Based Fisheries Management	 Fisheries  Climate  Habitat  Predator	 Fisheries Ecosystem Plan
<b>EAFM</b> Ecosystem Approach to Fisheries Management	 Fisheries  Climate  Habitat  Predator	 Fishery Management Plan
<b>SS</b> Single Species	 Fisheries	 Fishery Management Plan





# CLIMATE VULNERABILITY ASSESSMENT

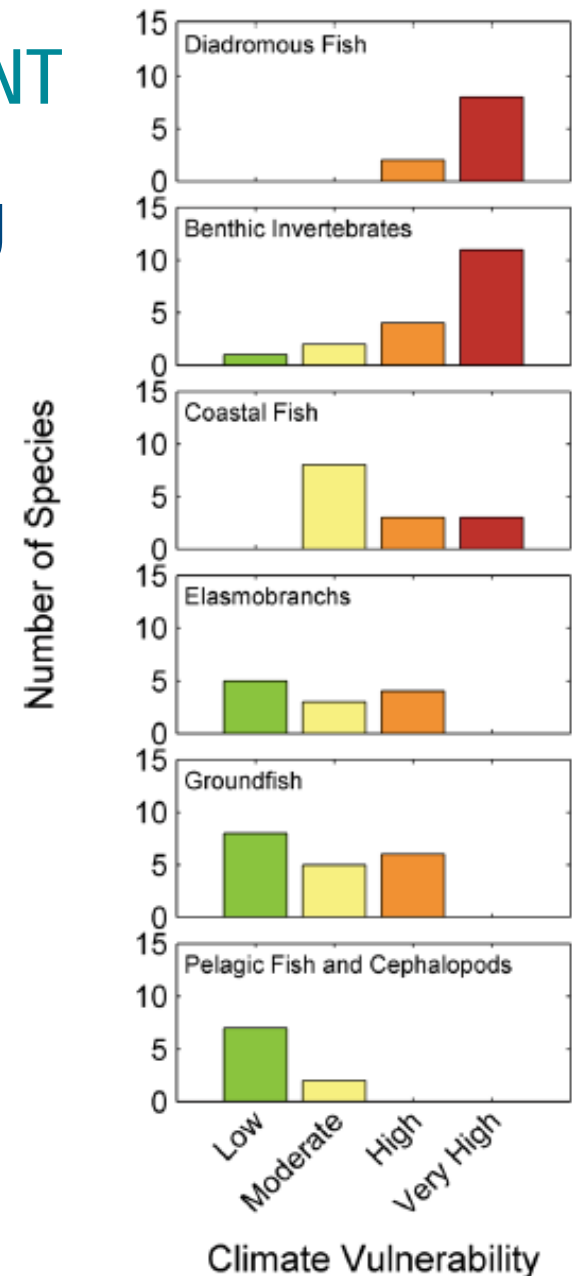
A practical and efficient tool for assessing the vulnerability of a wide range of fish stocks to a changing climate

A triage approach: identified and scored vulnerability (April, 2016)

NOAA [NWFSC, SWFSC](\*) and Academic (UC-Davis, UC-Santa Cruz, Oregon State, U. South Carolina) – covering fisheries biology, oceanography, climate

(\*) Michelle McClure (NWFSC), Steven Bograd (SWFSC), Melissa Haltuch (NWFSC), Elliott Hazen (SWFSC)

Final assessment anticipated by early-mid FY2017



Taken from Hare et al. (2015)

# WEST COAST CLIMATE VULNERABILITY ASSESSMENT

## 62 Species [Groundfish, CPS, HMS, Salmon]

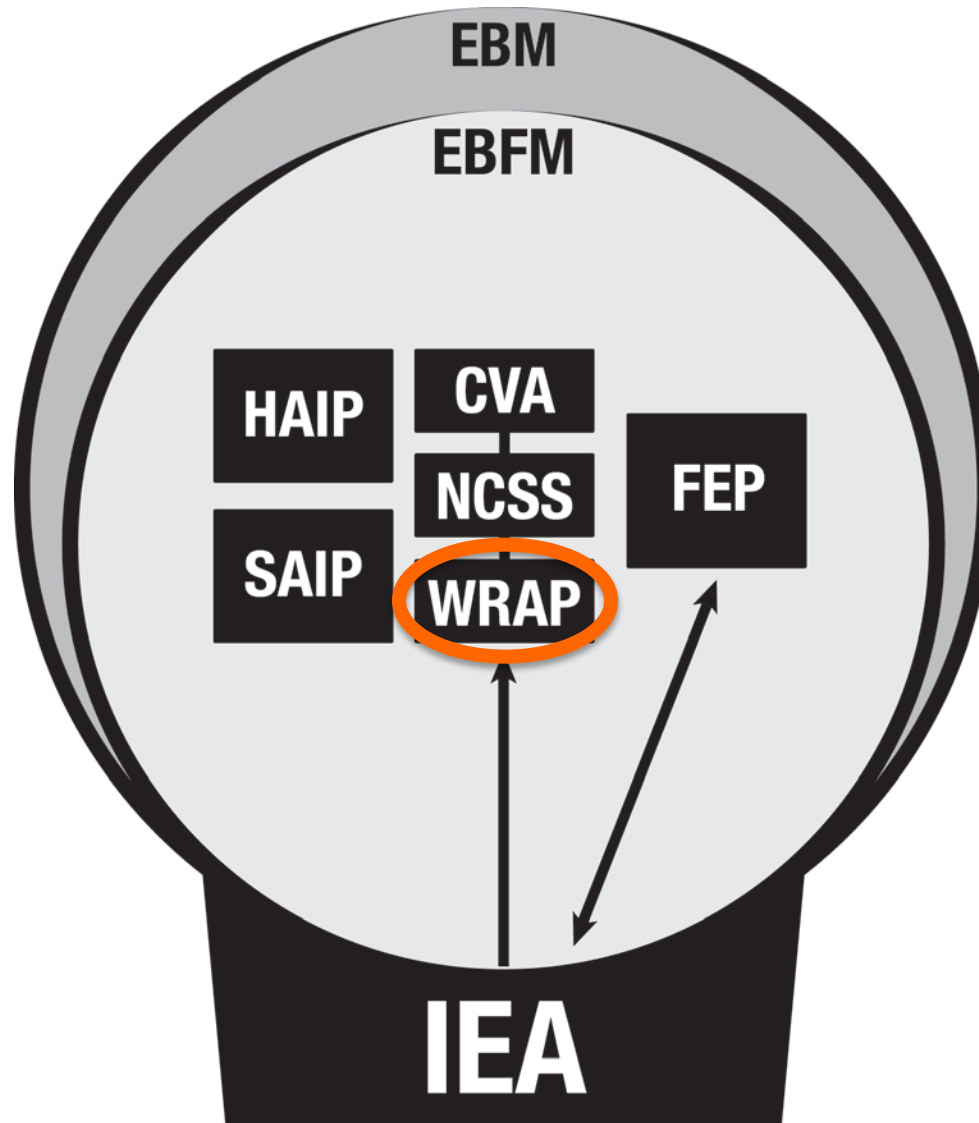
### Sensitivity Attributes

- Habitat Specificity
- Prey Specificity
- Adult Mobility
- Dispersal of Early Life Stages
- Early Life History Survival
- Complexity in Reproductive Strategy
- Spawning Cycle
- Sensitivity to Temperature
- Sensitivity to Ocean Acidification
- Population Growth Rate
- Stock Size/Status
- Other Stressors

### Climate Exposure Factors

- Air Temperature
- Sea Surface Temperature
- Salinity
- Ocean Acidification
- Winds (alongshore wind stress)
- Precipitation
- Sea Level Rise
- Subsurface Oxygen
- Upwelling Phenology
- $\Delta$ Mean,  $\Delta$ variance for all variables

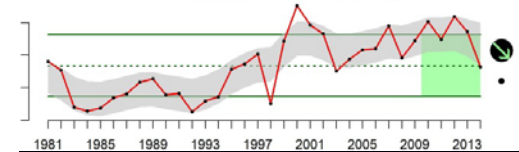




# West Coast Regional Action Plan

The WRAP will identify strengths, weaknesses, priorities, and actions to implement the NCSS on the U.S. West Coast over the next 3 - 5 years.

1. Establish a Climate Committee and Program
2. Continue CCIEA development (✓)
3. Review, coordinate and standardize exiting observational efforts (✓)
4. Sustain scientific expertise (conduct CVA) (✓)
5. Conduct Management Strategy Evaluations (hake, sablefish, N. Pacific albacore) (✓)
6. Disseminate new climate-related science and information





# West Regional Action Plan

**Strengths** – data (surveys), models, scientific capabilities, partners, knowledge of CA current

**Challenges** – magnitude of issue, complexity of scientific and management questions, resource constraints (level funding)

**Strategies** – define actions, enhance partnerships, build on IEA, work collectively

# WRAP Timeline

- Executed a WRAP roll-out plan
- Draft WRAP is in circulation for external review
  - PFMC (including Advisory Bodies)
  - Circulated to other key constituents and within Science Center
  - Reviewed by Ecosystem Review Panels
- August 1 deadline for comments
- Evaluate comments and generate final WRAP
- Submit completed WRAP to HQ in September 2016

Draft report is available on three websites: NWFSC, SWFSC and NOAA Fisheries sites



# Seeking your advice and input

Figure 1. Average Global Sea Surface Temperature, 1880–2014

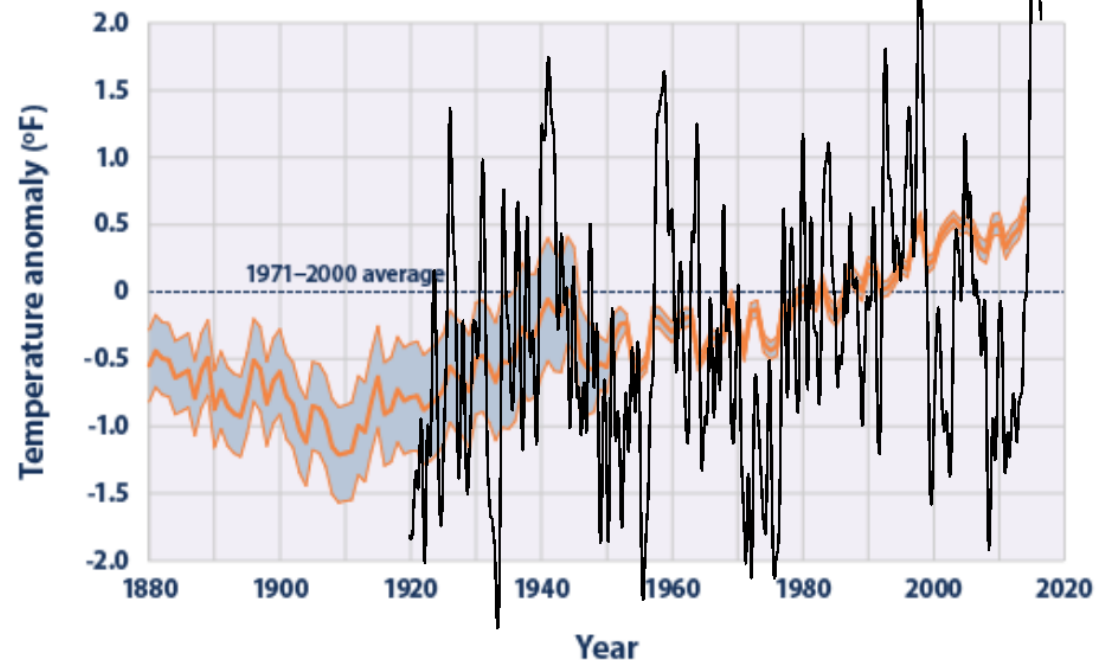


Figure from Paul Fiedler

Thank you