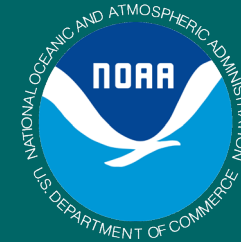


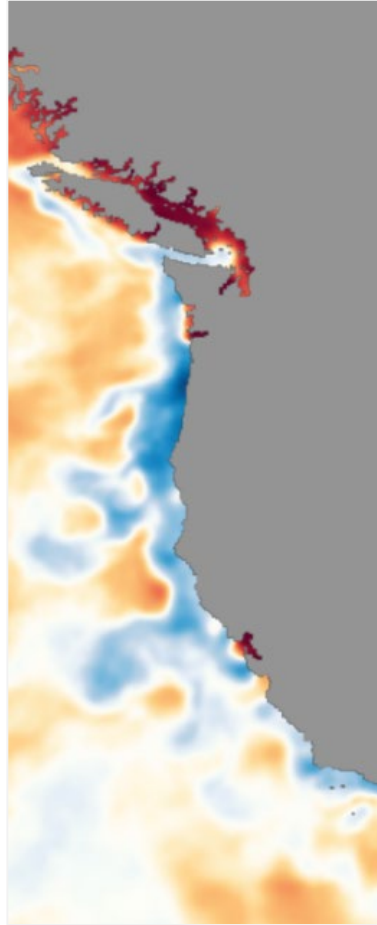
# NOAA Fisheries Science Centers – Ocean Science – El Nino, Warming and Acidity

Kevin Werner, Northwest Fisheries Science Center  
Toby Garfield, Southwest Fisheries Science Center



# Outline

- Summary of marine and terrestrial environmental conditions
- Staffing of labs and cruises
- Uncrewed technologies
- Making it all matter – CFI and beyond
- SWFSC updates
- NWFSC updates



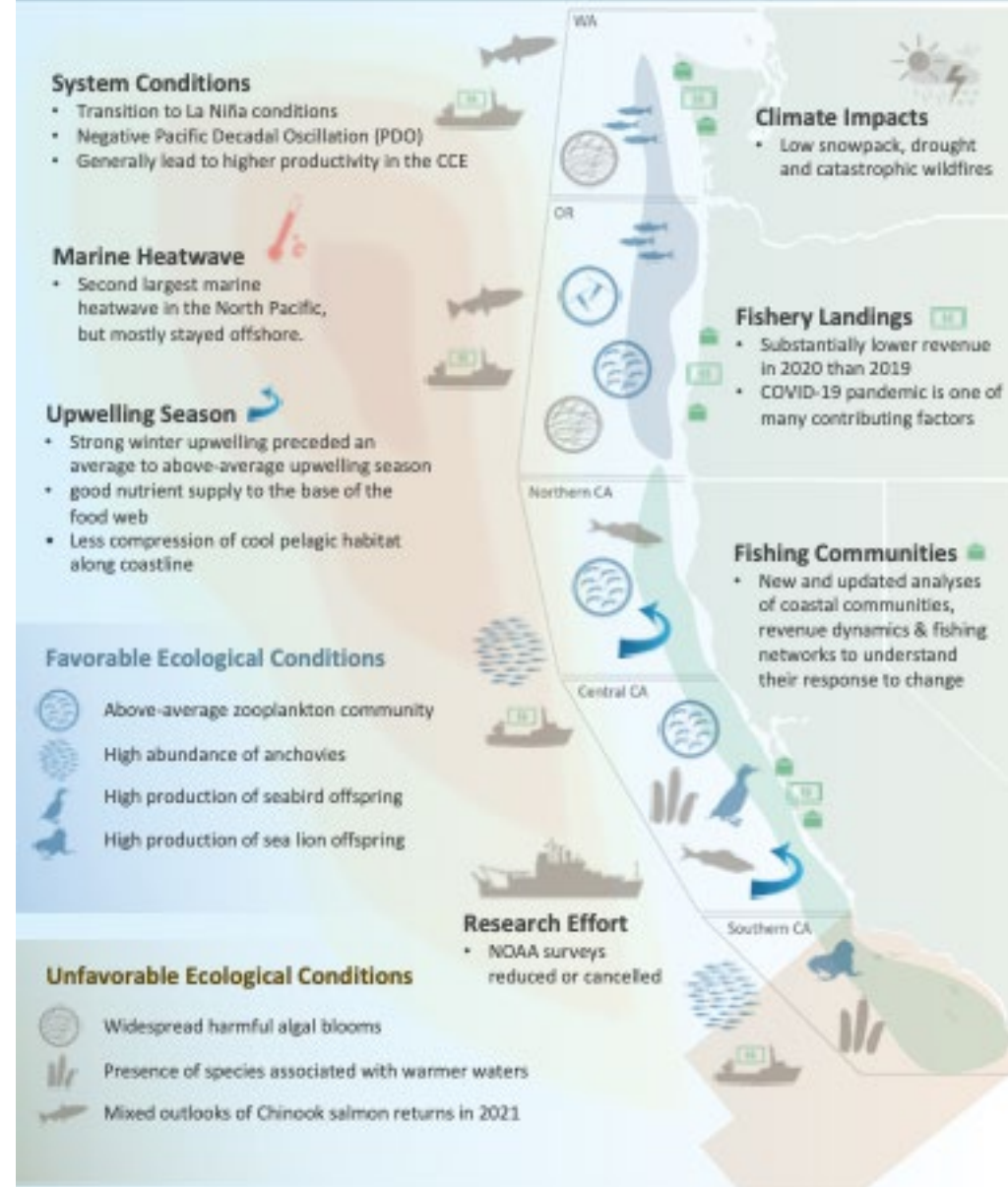
This graphic illustrates the major conditions and trends over the last year.

COVID-19 continues to disrupt commercial activities

The ocean is returning to more favorable conditions for ecosystem health

Terrestrial conditions have deteriorated with exceptional warmth, early snowmelt and drought, all leading to increased wildfires.

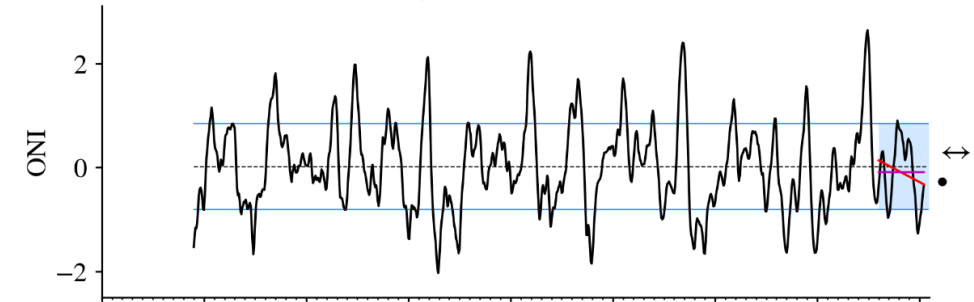
## 2020-21 CCIEA Ecosystem Status Report Highlights



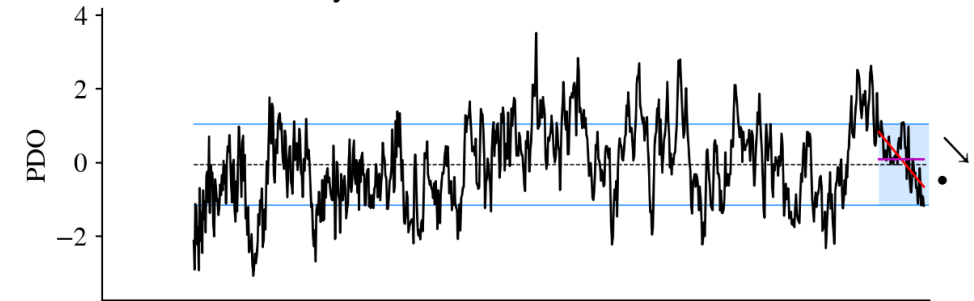
# Basin Scale Indicators: ONI, PDO, NPGO

- Oceanic Niño Index (ONI) shifted to La Niña conditions, which generally favor higher productivity in the CCE.
  - 80% chance of Niña neutral persisting through July 2021
- Pacific Decadal Oscillation (PDO) became increasingly negative, which indicates a cooler ocean and favors higher productivity in the CCE
- North Pacific Gyre Oscillation (NPGO) remained strongly negative, which indicates lower water transport in the CCE, and favors lower productivity.
  - Lowest NPGO values of the time series.

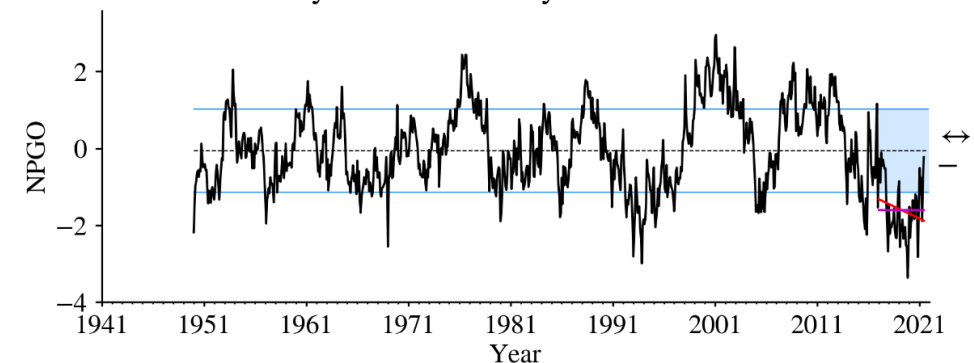
Monthly Oceanic Nino Index



Monthly Pacific Decadal Oscillation Index

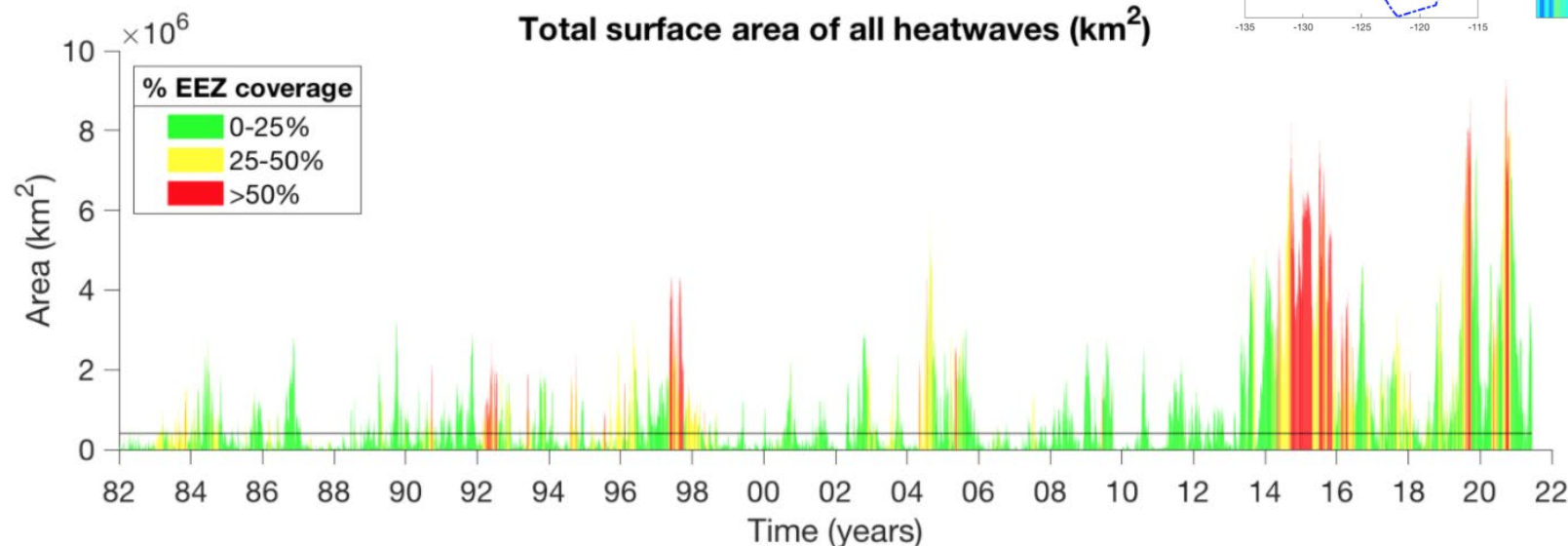
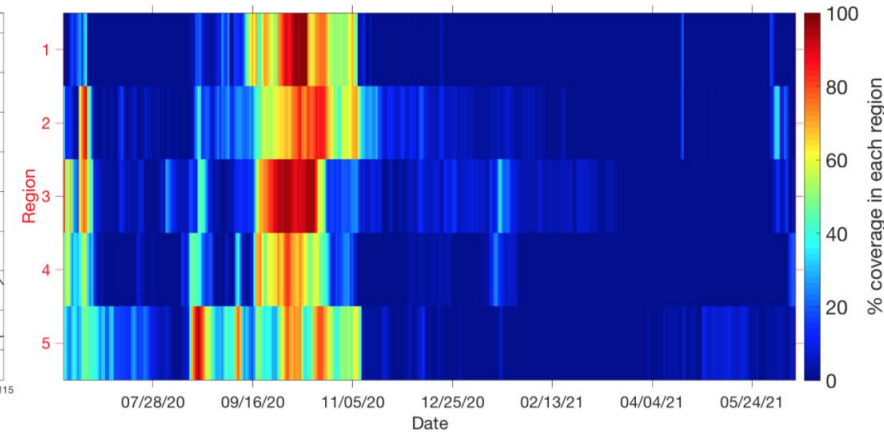
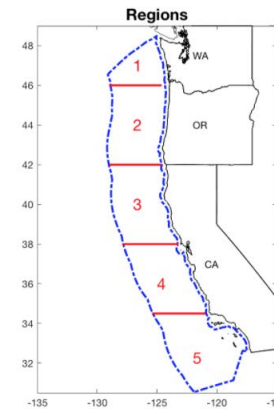
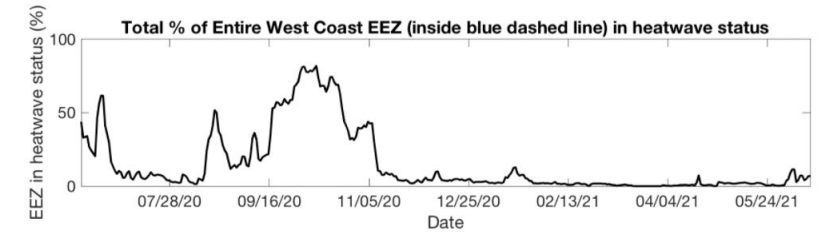
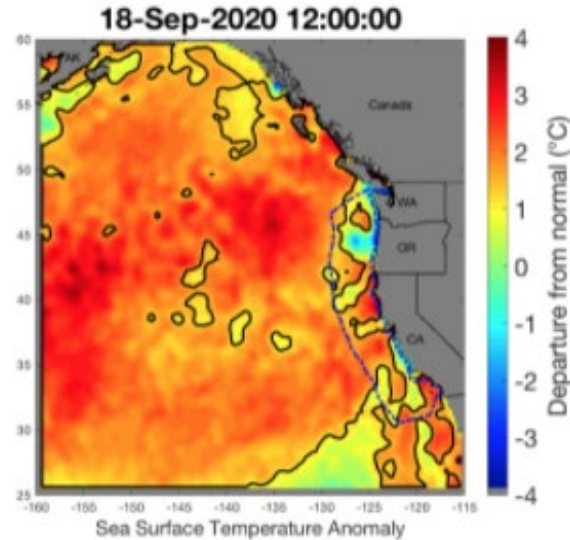
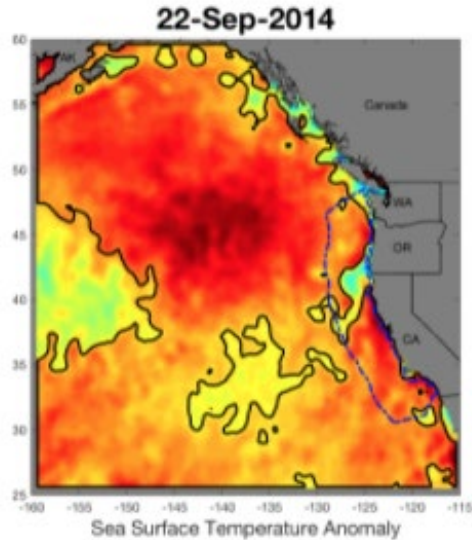


Monthly North Pacific Gyre Oscillation Index



# Marine Heatwaves (MHW) demands new consideration

## Consideration of climate stress tests



The 2014-2016 Marine Heatwave (MHW) brought attention to the impacts of significant ecosystem variability.

# Launch a whale entanglement dashboard

Whale icon represents key events and environmental conditions during 2016 (click on each whale for info)  
(Select Indicators from side menu)

Choose Indicators:

## Habitat Compression

☒ Habitat Compression Index

## Oceanographic Indicators

☒ Oceanic Nino Index  
☒ North Pacific High Jan - Feb Mean  
☒ Upwelling Index - CUTI 39N monthly

## Whale Abundance

☒ Population size - Humpback Whales  
☒ Humpback whale relative abundance, central CA

## Entanglement Reports

☒ Humpback Whale  
☒ Gray Whale  
☒ Blue Whale  
☒ Other/Unidentified Whale  
☒ Total Whales

## Prey Abundance - Central CA

☒ Krill  
☒ YOY anchovy  
☒ Adult anchovy

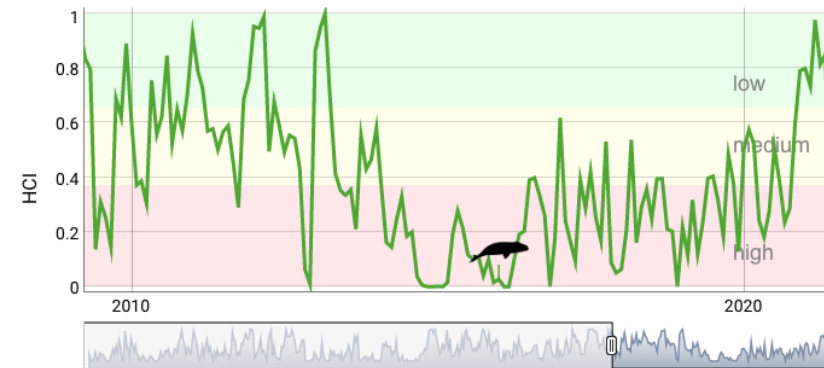
## Fixed Gear Fishery - Landings

☒ Dungeness crab landings, US West Coast  
☒ California Dungeness crab landings  
☒ Oregon Dungeness crab landings  
☒ Washington Dungeness crab landings

## Habitat Compression

Shaded regions indicate relative likelihood of compressed habitat heightening entanglement risk

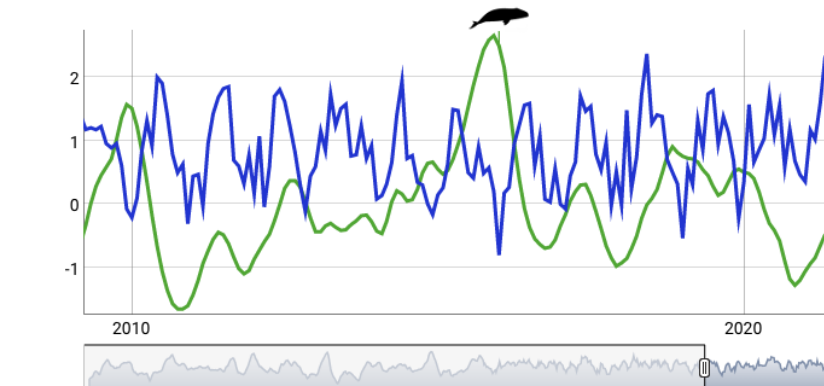
— Habitat Compression Index (fraction below monthly threshold)



## Oceanographic Indicators

Choose a single indicator to view periods of the likelihood of strong upwelling conditions

— Oceanic Nino Index (degree\_C)  
— Upwelling Index - CUTI 39N monthly ( $m^2 s^{(-1)}$ )



A new dashboard allows individual comparison of different indices that contributed to the whale entanglement.

1. The time slider allows looking various time frames.
2. Build frames of multiple indices of interest
3. At present, the RAMP indices are updated manually every two weeks.

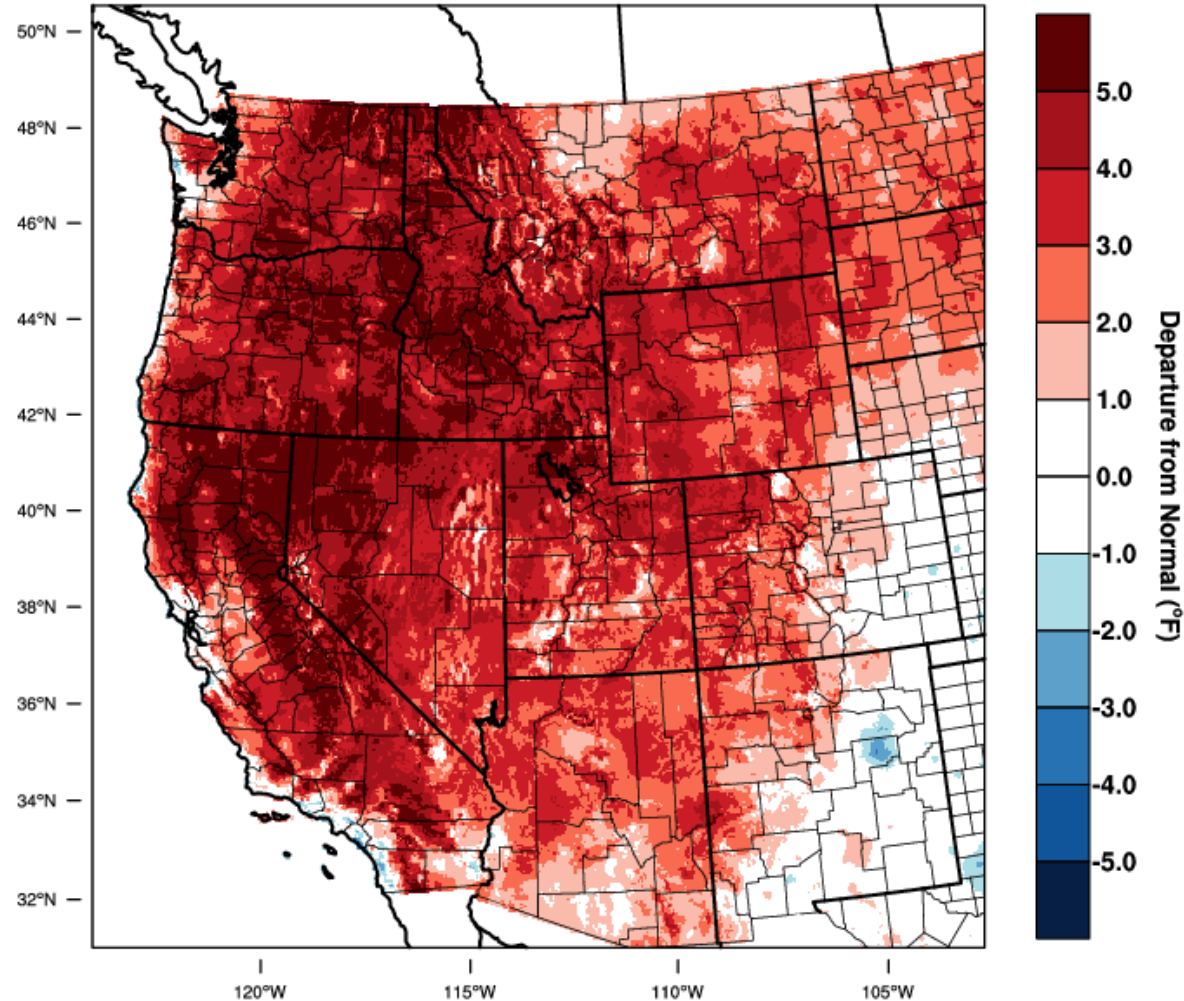
1. A goal is transitioning from “once a year” delivery to automatic updates for more timely information. First step is a funded retroactive analyses of existing data.

# It is hot!

## PRISM > Temperature Anomaly 3 Month > Western US

Western United States - Mean Temperature

May-July 2021 Departure from 1981-2010 Normal

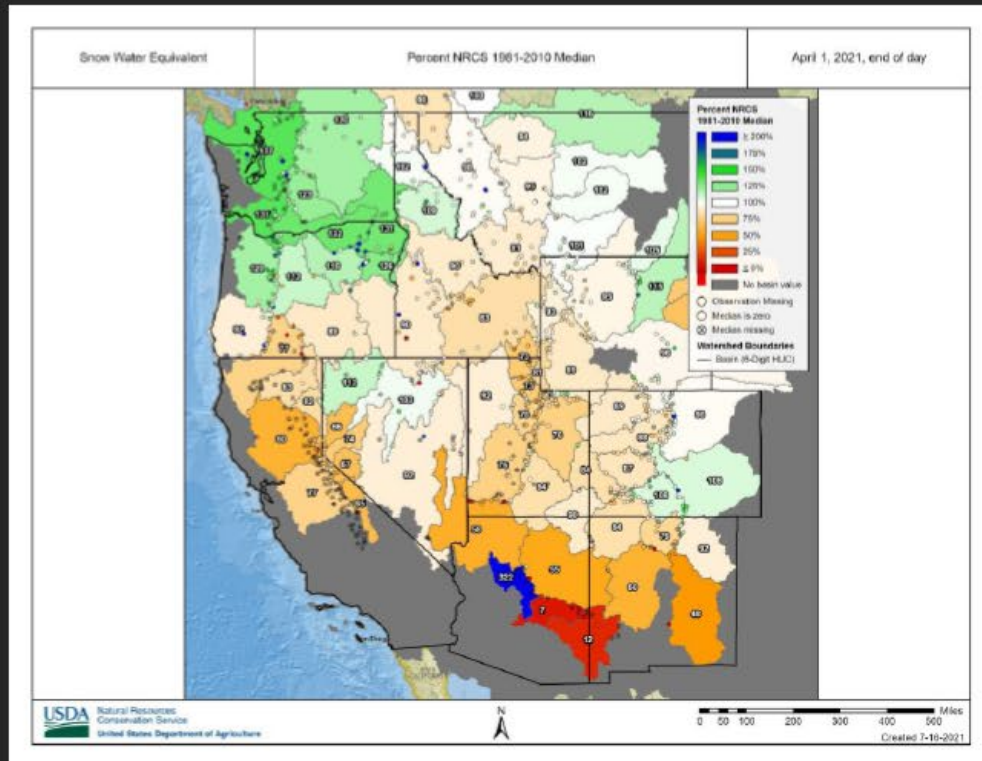


WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 11 AUG 2021

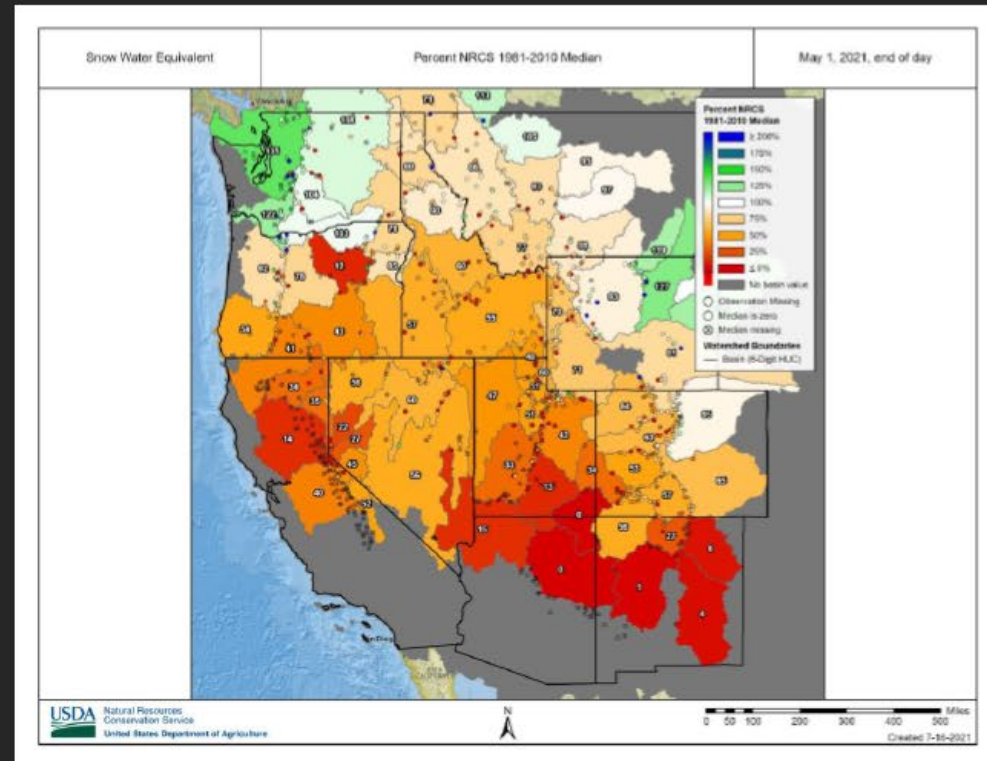
# The heat sped up the spring snowmelt

## Drought Expands and Intensifies – Rapid Spring Snowmelt

April 1 Snow Water Equivalent % of normal



May 1 Snow Water Equivalent % of normal



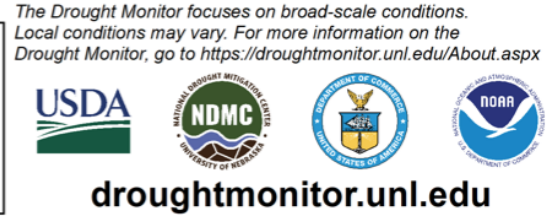
100

**Western United States - Precipitation**  
May-July 2021 Percent of 1981-2010 Normal

50°N  
48°N  
46°N  
44°N  
42°N  
40°N  
38°N  
36°N  
34°N  
32°N

120°W 115°W 110°W 105°W

WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 11 AUG 2021

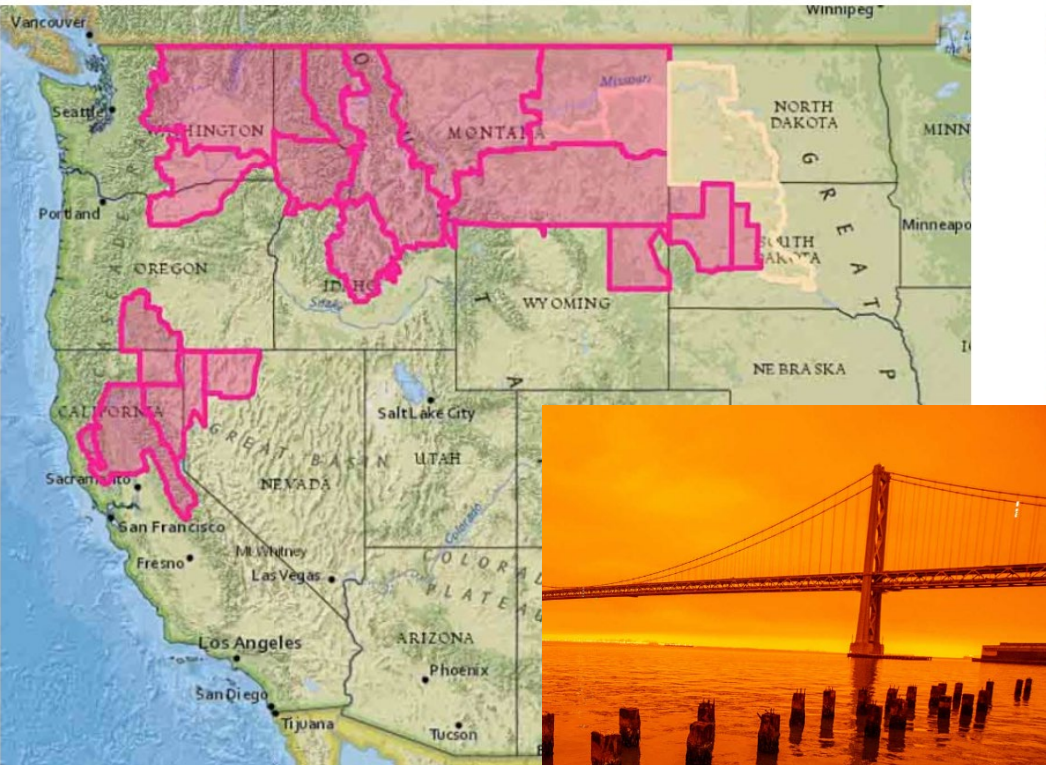


# The fire danger has expanded with the drought

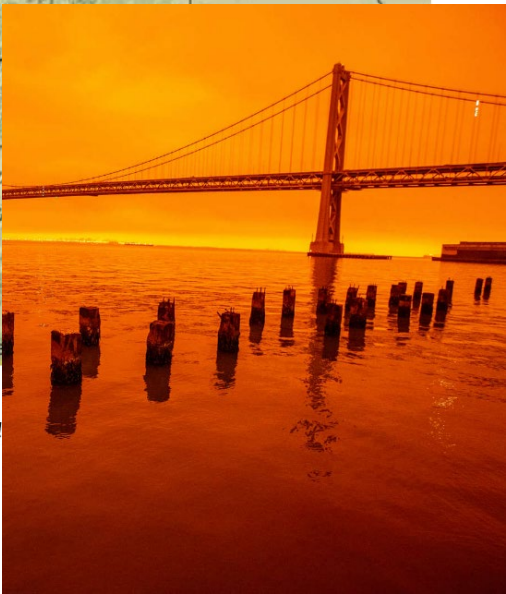
## Fire weather watches and warnings in 9 states, August 11, 2018

Bill Gabbert August 11, 2018 Uncategorized Red Flag Warning

And, 9 states will have areas of dense wildfire smoke Saturday

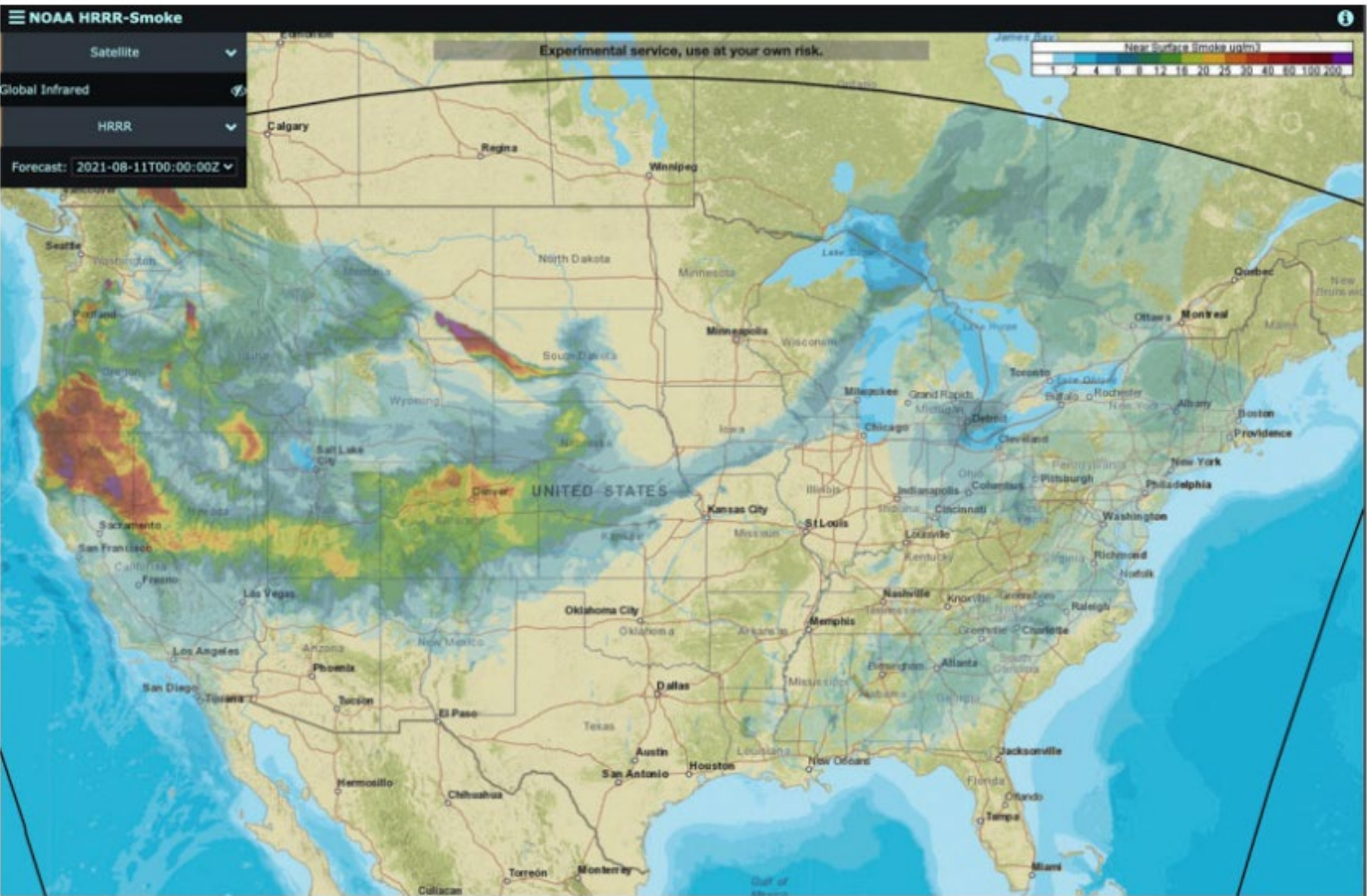


Above: Red Flag Warnings (red) and Fire Weather Watches (yellow)



## Smoke forecast, August 11, 2021

Bill Gabbert August 10, 2021 Uncategorized smoke



Smoke Forecast for 6 p.m. PDT Aug 11, 2021.

Above is the forecast for the distribution of smoke from wildfires at 6 p.m. PDT August 11, 2021.

# COVID still reigns, but adaptations are developing

COVID-19 is still impacting laboratory, field, and at sea operations.

However, laboratories are lightly staffed, ships are going to sea and field programs are happening, all with enforced protocols

| Facility Staffing levels | AK | WA | OR | CA |
|--------------------------|----|----|----|----|
| Phase 0 (critical)       | 4  | 2  | 0  | 1  |
| Phase 1 (<25%)           | 1  | 4  | 2  | 2  |
| Phase 2 (<50%)           | 0  | 0  | 0  | 0  |
| Phase 3 (open)           | 0  | 0  | 0  | 0  |



A. Klemmedson

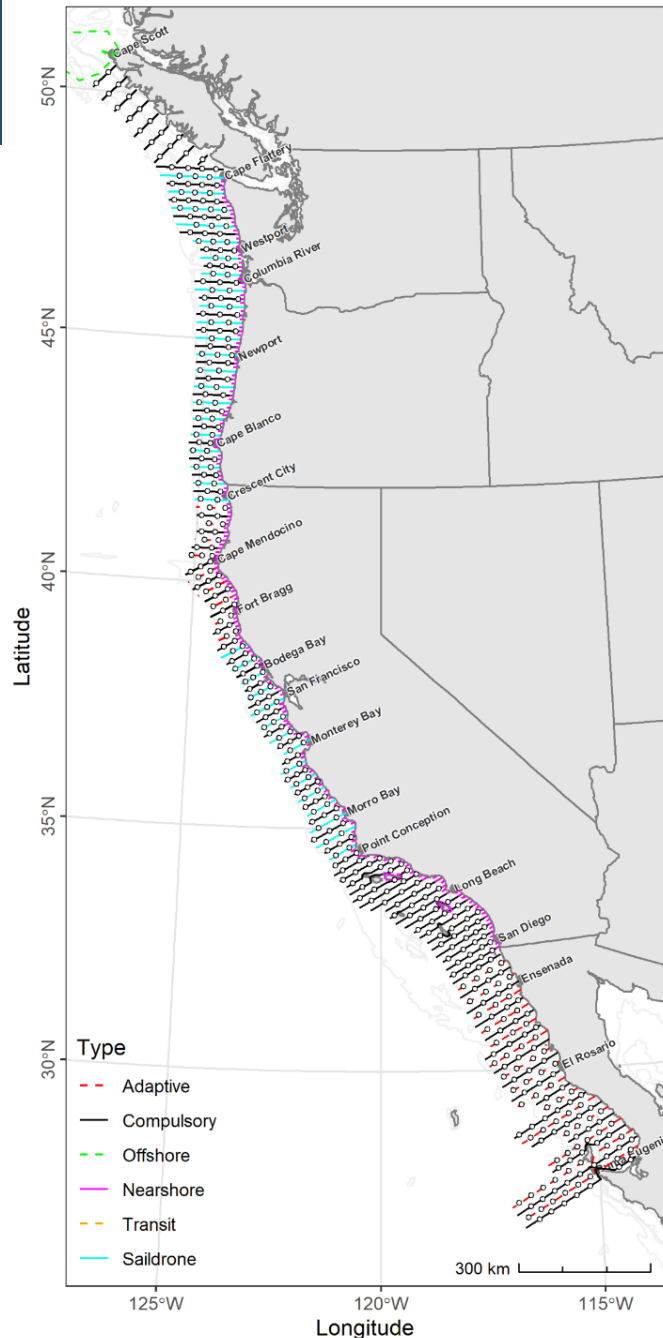


# 2021 Cruises that have occurred

Almost all cruises were cancelled in 2020.

Thanks to a large effort by many people, including OAMO, most cruises have occurred this year:

- Winter, spring and summer CalCOFI cruises
- W. coast groundfish bottom trawl survey (WWCGBTS)
- Juvenile Salmon and ocean ecosystems survey (JSOES)
- Hake Survey
- Northern California Current Survey (NCCS)
- Hook and Line rockfish survey
- Rockfish Recruitment and Ecosystem Assessment Survey (RREAS)
- Spring and summer California Current Ecosystem Survey (cps)
- Newport line
- Trinidad line
- Pinniped breeding grounds aerial survey

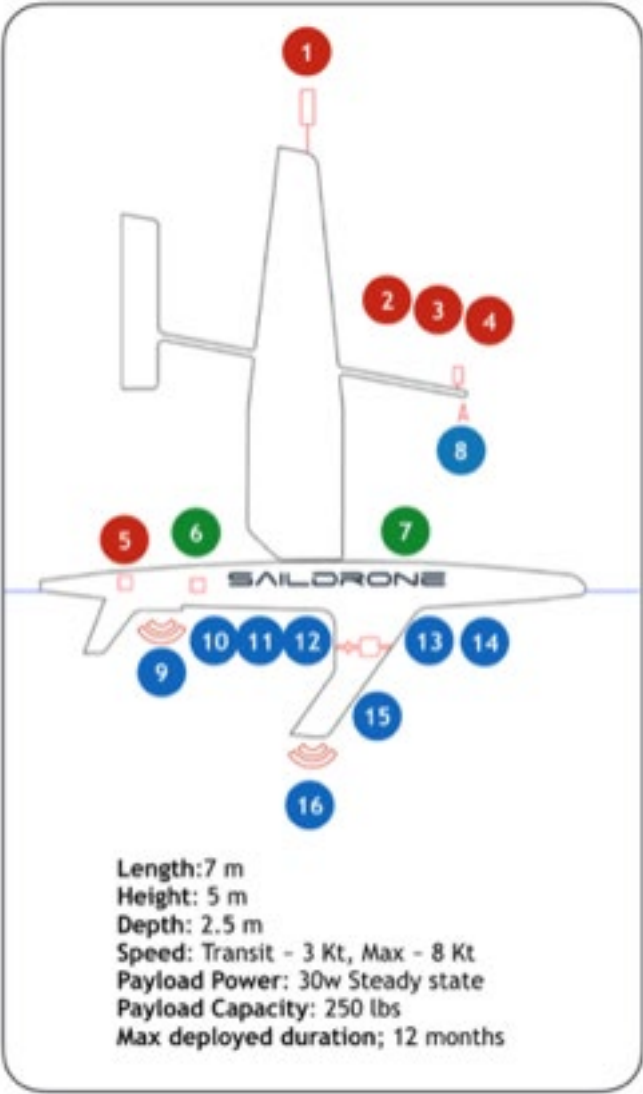


# Saildrone (left) and Wave Glider (right) are the two surface uncrewed vehicles

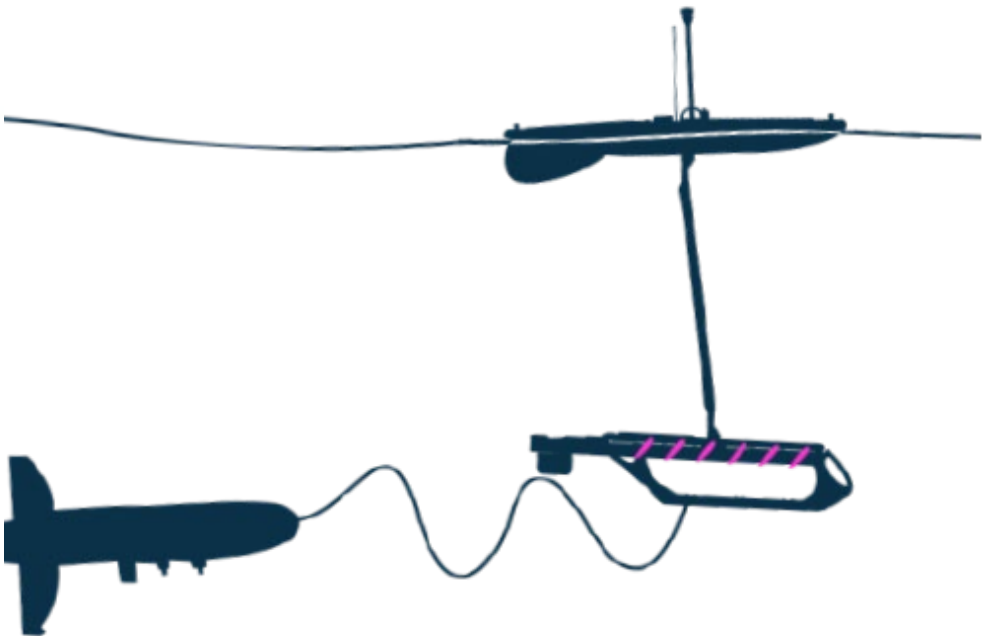
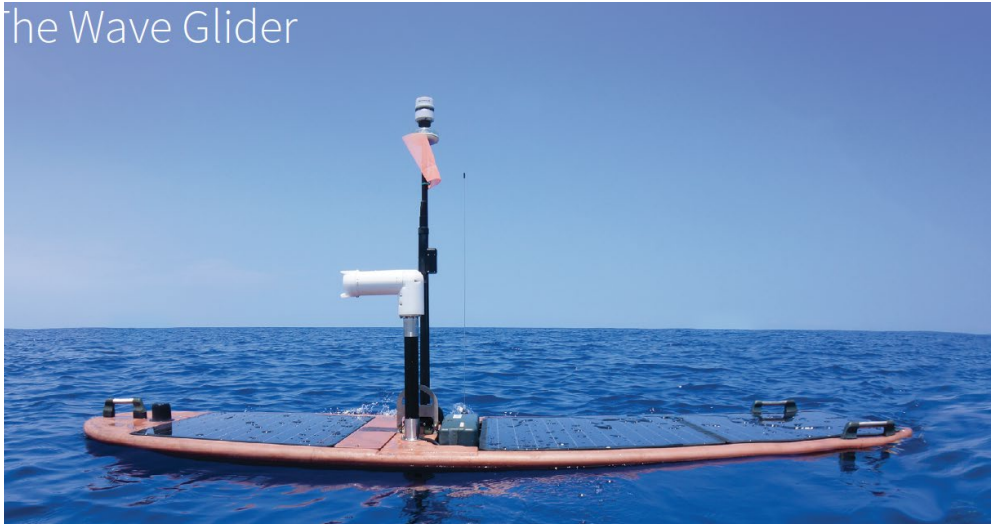


Teams ready a Saildrone for launch from Neah Bay, Wash. NOAA Fisheries/NWFSC

## DATA CAPABILITIES

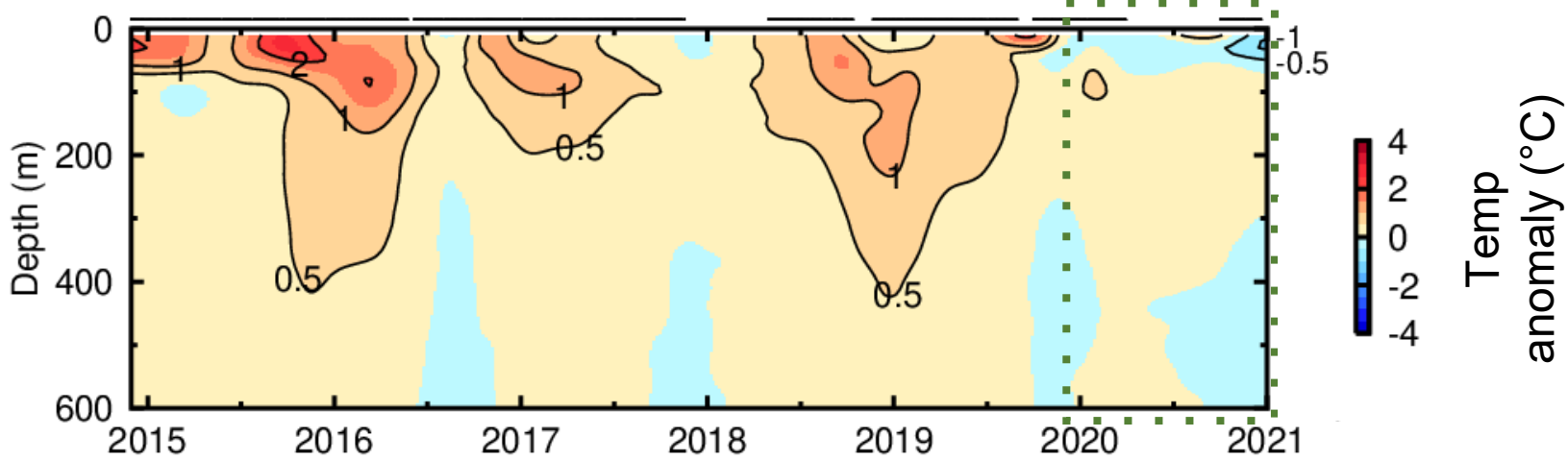


## The Wave Glider

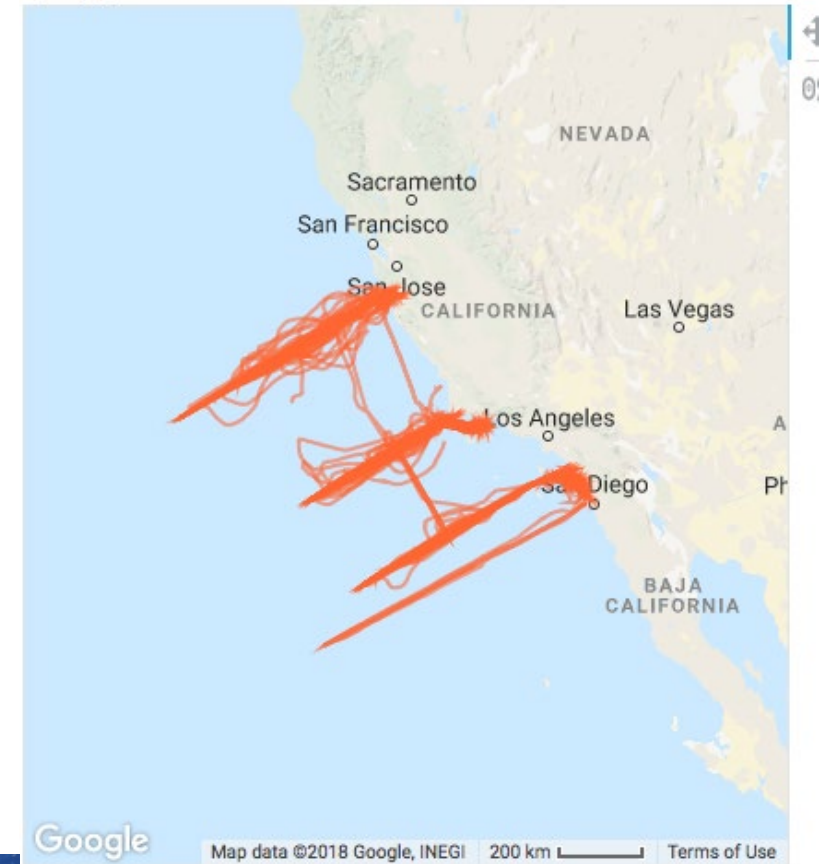


# There are three types of subsurface gliders

Trinidad Head temperature anomaly  
averaged over inshore 200 km



Spray glider tracks



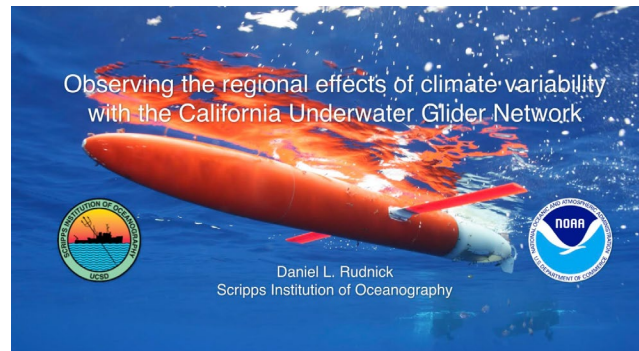
Sea Glider



Slocum Glider



Observing the regional effects of climate variability  
with the California Underwater Glider Network



Spray Glider

# New IEA and WRAP 3-year plans for climate assessment

Both the CCIEA and WRAP programs underwent review and development of new three-year plans for extending climate and ecosystem information into Assessment and Council processes.

Both programs plan to continue ongoing efforts to bring more climate science into the Council process. The two programs work together closely; the WRAP activities to date have included working with both Centers on developing ocean, fisheries and human dimension indices that are used in the annual IEA Ecosystem Status Report (ESR) given to the PFMCI.

The California Current Integrated Ecosystem Assessment (CCIEA) team has six goals for the next three years, intended to support ecosystem-scale decision-making related to marine species, habitats, coastal communities and ecosystem services along the West Coast of the US.

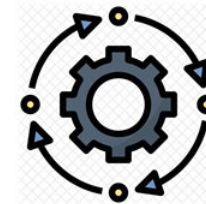
Expansion of climate services reporting will depend on availability of increased funding. At present, hopes are on the CFI



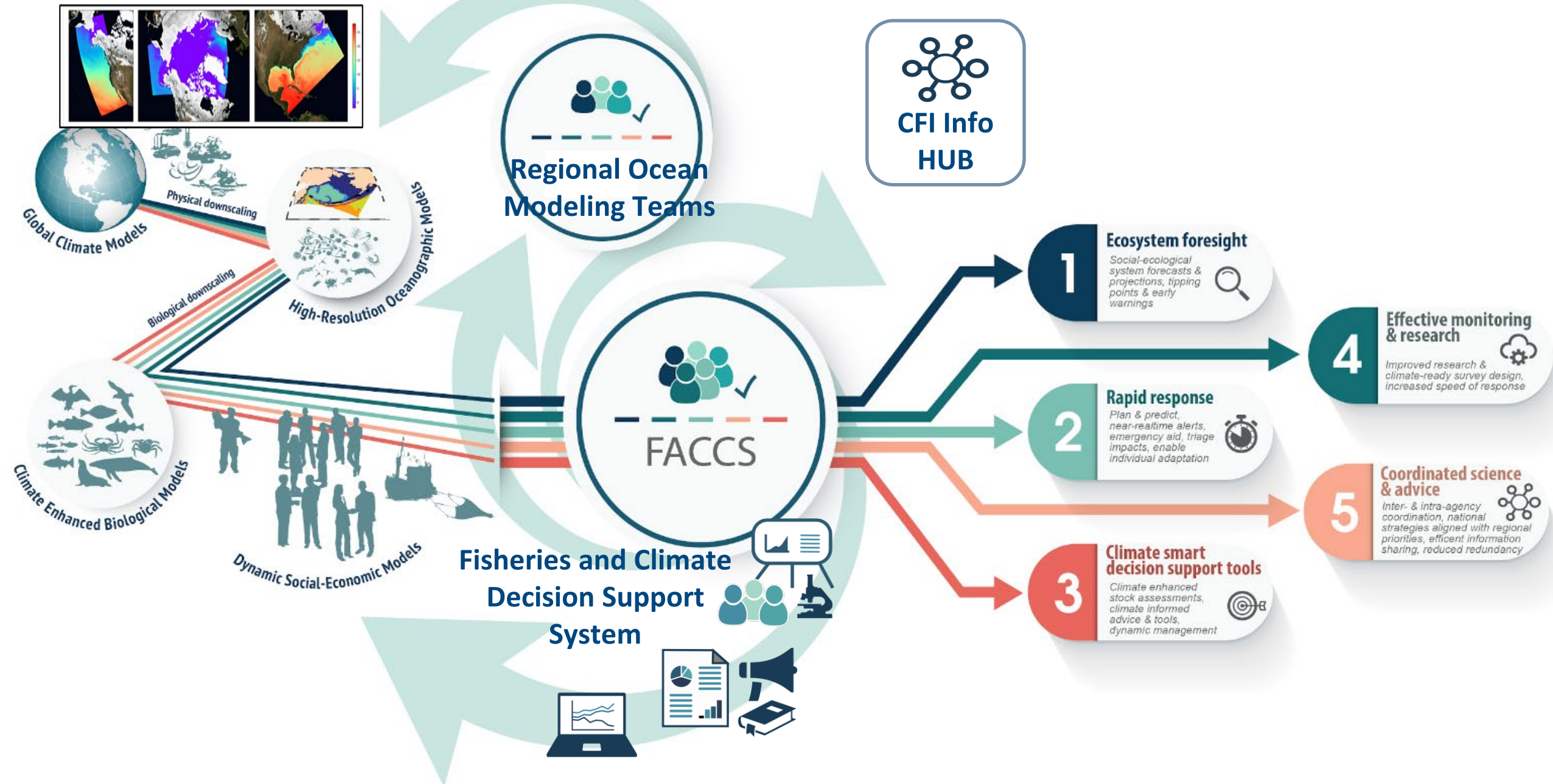
*Matthew Savoca*

# CFI is a foundation of Climate Ready NMFS

- **ONE-NOAA** *nation-wide system implemented regionally.*
- **RELIABLE** *delivery of ocean forecasts and projections needed by NMFS and other ocean users.*
- **OPERATIONAL** *capability to turn ocean forecasts into climate-informed management advice.*
- **CONTINUOUS** *innovation and validation through observations, research & end-to-end feedback.*
- **ROBUST NMFS** *capability to deliver climate-informed advice.*
- **INCREASED** *management capability to use climate-informed advice to reduce risks and increase resilience.*



# CFI Ocean Modeling and Decision Support System

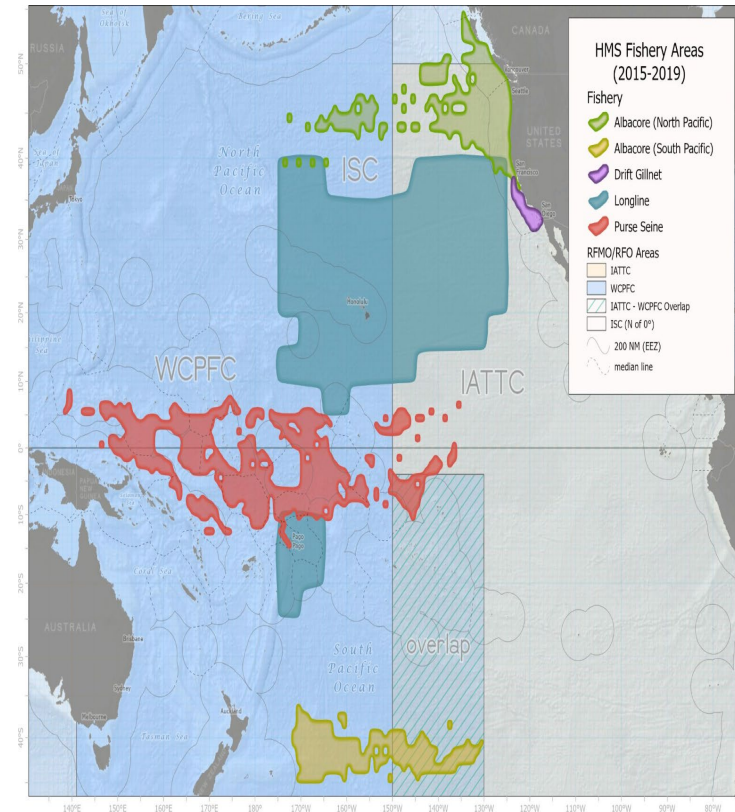


# West Coast HMS Data and PSMFC

- HMS data management and reporting efforts at the SWFSC and the WCR have increasingly relied on data sets stored in PacFIN and external data sets, e.g. Coast Guard Data, VMS, National Permitting System and State Vessel Registration.
- PacFIN has integrated all of the external data sets into a single, centralized data warehouse which resulted in a more streamlined and timely reporting of high quality data.
- PSMFC continuously provides HMS data managers and data users with database administration, programming, web applications, reporting software and a variety of other services.
- Data integration efforts have led to improved communication and sharing of resources between West Coast offices. This has in turn led to improved data accessibility and data products which ultimately increases fisheries management effectiveness.

# Expand Collaboration

- An increased collaboration between the West Coast Regional Office, PSFMC, Pacific Islands Regional Office and State partners.
- The creation Eastern Pacific and a Hawaiian data group, i.e. the Eastern Pacific Professional Specialty Group (EP PSG) and the Pacific Islands Group (PIG) that focus on West Coast HMS and Hawaii HMS data issues respectively.
- The unification of two groups led to the development of the national HMS Professional Specialty Group which is sponsored by the Fisheries Information System at NOAA Fisheries Headquarters.



# Centralized HMS Data and PacFIN Report System



Pacific Fisheries Information Network



## Reports Dashboard

Locate and execute reports from the available list.

### Enforcement (ENF) Reports

- ENF501 Enforcement Vessel Data
- ENF502 OLE Port Summary Report
- ENF503 Enforcement Dealer Report
- ENF504 Enforcement Port and Species Report
- ENF505 Enforcement Species Report
- ENF506 OLE Sablefish Primary Fishery Tracking Report

### ▼ HMS RFMO and International Reports

#### ▼ IATTC

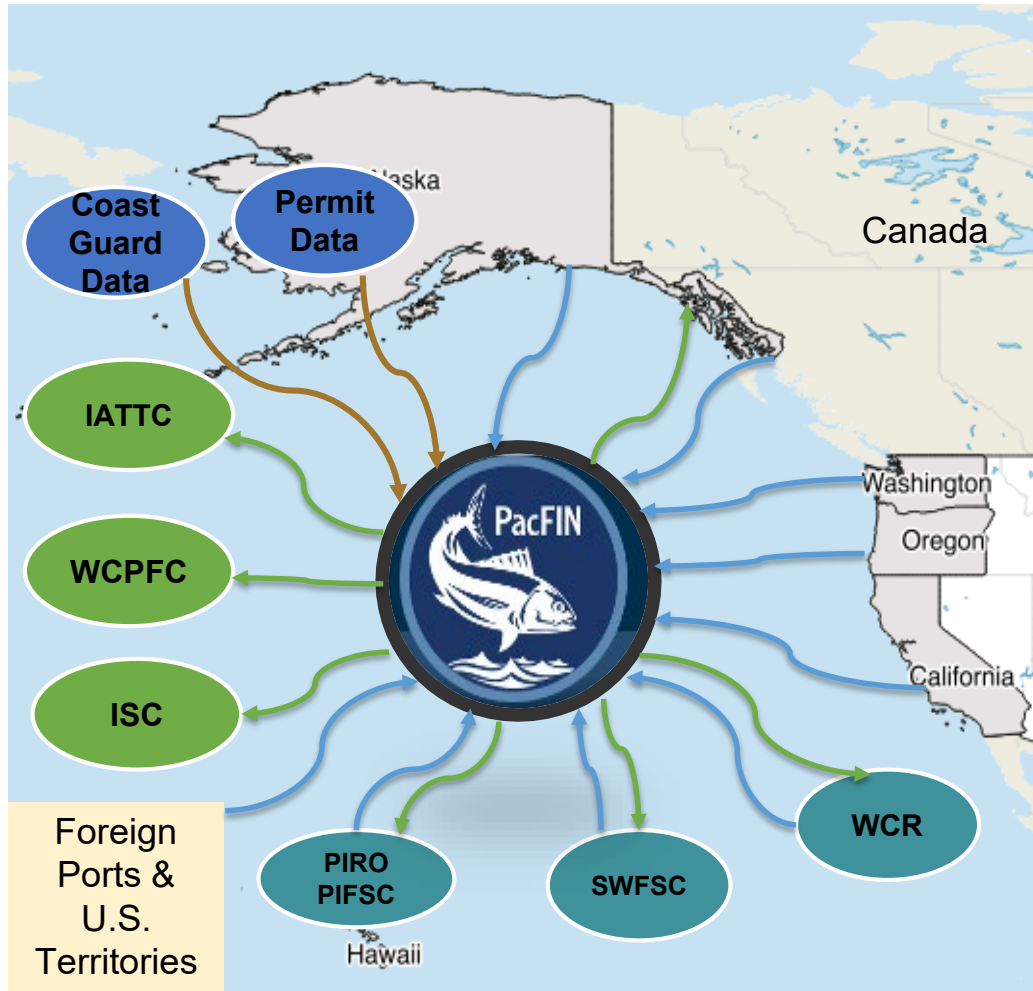
- IATTC501 HMS Permit Report

#### ▼ WCPFC

- WCPFC501 Active Vessel List
- WCPFC502 WCPFC Annual Total Catch (Category 1)

#### ▼ US/CAN Treaty

- USCAN001 - HMS US Canada Albacore Treaty Effort



# NWFSC Updates

- Good News: Surveys on the water in 2021!
- NWFSC ran \$4.8m through PSFMC in 2021
- PSMFC supports project management around salmon population data and freshwater habitat project data. We also are expanding on this with the newly launched "Salmon Dashboard" project. We plan to support PSMFC development of a west coast data portal to illustrate salmon population data and population process determinants.
- The PSMFC manages StreamNet and the PTAGIS databases accessed by staff in FE. PTAGIS is a fundamental tool / database for the region, any NWFSC project that uses PIT-tag data from PTAGIS is a kind of collaboration with the PSMFC. PTAGIS has become so essential to salmon science in the PNW that it's often taken for granted.
- The PSMFC folks that maintain the PIT-tag detection systems in the Columbia Basin worked with FE staff, for example, the new LGR RSW detector as it was developed/constructed in collaboration with the Kennewick office staff.



**NOAA**  
**FISHERIES**

# Collaborative Efforts with NWFSC

- PSMFC is a key partner in our fishery- dependent and independent data collections and analyses. PSMFC bycatch engineering activities funded by BREP provide additional collaboration opportunities with NWFSC/FRAM.
- There is ongoing FRS collaboration with PSMFC for the annual Hook and Line Survey via a Cooperative Research Grant with RTOW approved for the 2021 survey
- FRS collaboration on a funded SK project to separate the vermilion-sunset rockfish cryptic species pair along the US west coast using DNA analysis is ongoing with the biggest challenge being the preparation of 25,000 fin clips for analysis



# Data sharing between N/SWFSCs and the States

- NMFS relies on the DFWs for information about fisheries, fishing dynamics, fleets, and fishing communities
- PacFIN is a directly accessible and highly functional database in which much of these data are stored
- Huge potential, realized and yet-to-be-realized, from these data



# Improvement Requests

- Incorporate states catch reconstructions back to 1900 or before.
- PacFIN/RecFIN should include info on where age structures are available from each state in addition to age data.
- PacFIN support for an analytical database that allows all users access to the same QA/QCed data.
- States to provide access to permits databases to support fishery participation analyses.

# Improvement Requests

- We support continued investment in PSMFC becoming a one-stop shop for all data for assessments and related research.
- We still need improvements to be made through long-term agreements and solutions.
- Concerns of Confidentiality: We request a process that doesn't require confidentiality requests each time for recreational data not already in PacFIN.
- Need update on the new MOA with NOAA-State of CA to share confidential data with all science Centers and WCRO.



# Questions

## Acknowledgments:

All the many NWFSC & SWFSC personnel who contribute to the effort

WRO partners, state, academic and NGO partners

