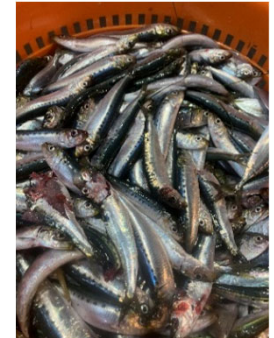
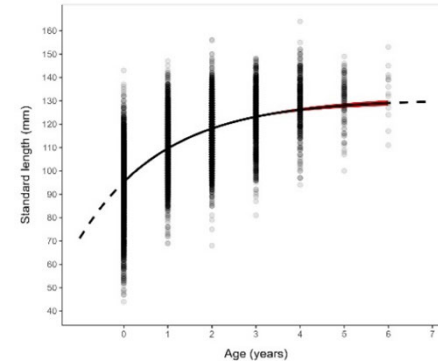


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# Southwest Fisheries Science Center Coastal Pelagic Species Research Update



## ***Presenter***

*Annie Yau, Fisheries Resources Division Director*

## Outline



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- CPS Assessment Schedule
- Sardine stock structure workshop report
- Survey Updates
  - CalCOFI
  - Summer CPS Survey 2023
  - Integrated Survey 2025
- Life History Activities
- FUTURE SEAS update



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## CPS Assessment Schedule

### Pacific Mackerel Benchmark (May 2023)

- STAR panel April 11-13, 2023 @ SWFSC La Jolla
- Presentation to June Council meeting



### Sardine Northern stock

- Report available for Stock Structure workshop (Nov 2022)
- SSC CPS subcommittee review (Mar 2023)
- Benchmark Assessment (STAR panel ~Feb 2024)





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# Sardine Stock Structure Workshop Report

Nov 15-17, 2022

At the SWFSC and virtually, open to the public  
~60 participants from NMFS, PFMC, industry,  
non profits, state agencies

Yau, Annie (ed.). 2023. Report from the Pacific  
Sardine Stock Structure Workshop, November  
2022. Southwest Fisheries Science Center  
(U.S.). DOI : <https://doi.org/10.25923/er7r-b228>

# Sardine Stock Structure Workshop Report



## Motivation:

Comments received from the PFMC SSC about the 2021 catch-only assessment update of Pacific sardine northern stock

- 1) Use recent years of data to update the habitat model (Zwolinski et al. 2011) used to delineate northern stock sardine from CPS survey data
- 2) Revisit the method used to delineate northern stock landings (Demer and Zwolinski 2014) given recent years of high catches from the Baja CA fleet being included in the stock assessment

# Sardine Stock Structure Workshop Report



## Outcomes:

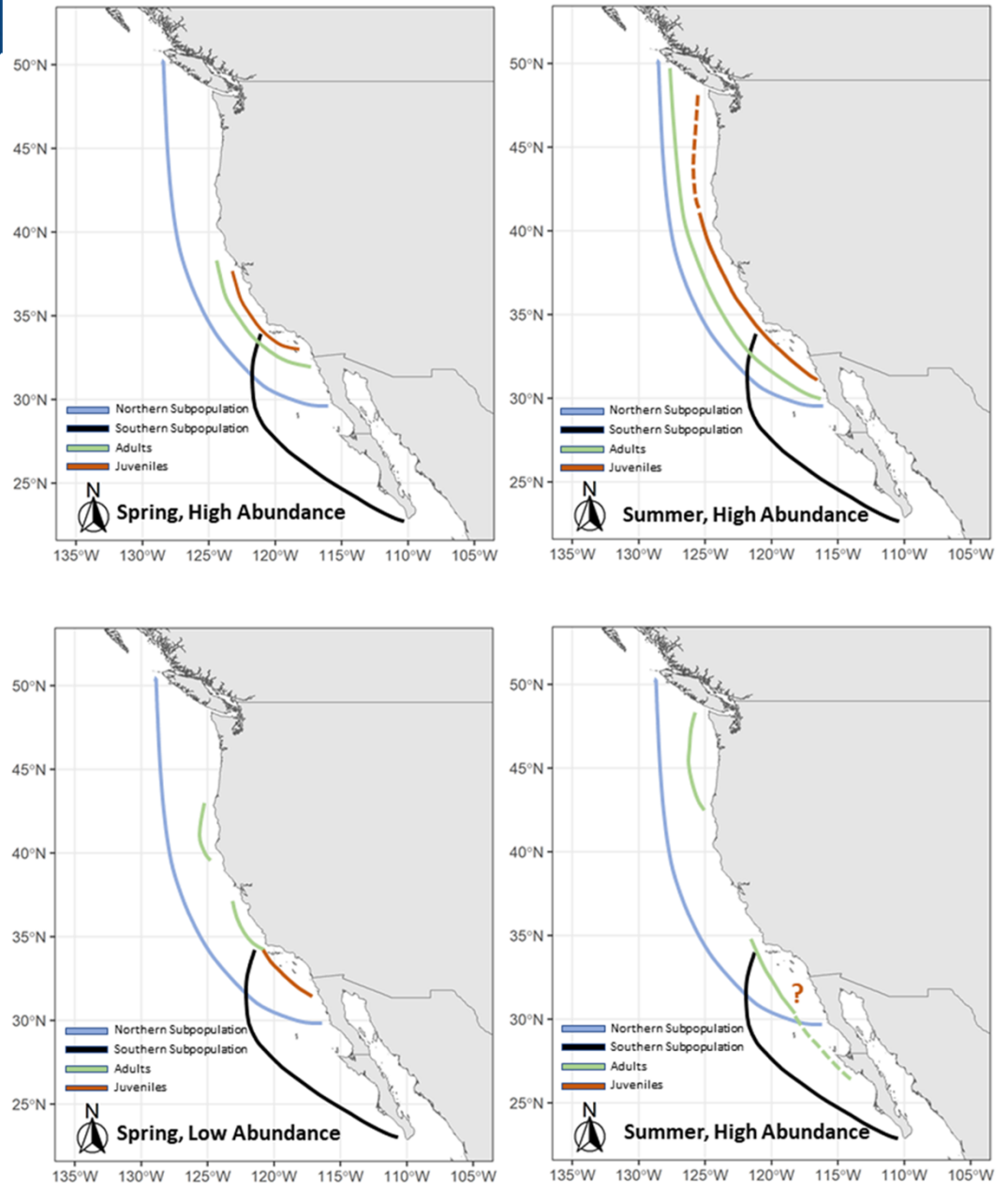
Two-stock structure remains the working hypothesis- no new scientific studies supporting an alternate stock structure hypothesis.

Reviewed by the SSC CPS subcommittee:

- 1) Habitat model was updated with minimal impacts to CPS survey biomass time series
- 2) Landings data separation using updated habitat model reduces assumed Baja CA landings attributed to northern stock

SWFSC has ongoing stock structure research

# Sardine Stock Structure Workshop Report



Archetype  
(operational  
definition) of  
northern stock

Fig 1 from report

# Survey Updates

## CalCOFI Surveys



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Fall CalCOFI (R/V Sally Ride - SIO hosted)

- Nov 5-20, 2022

Winter CalCOFI (R/V Lasker)

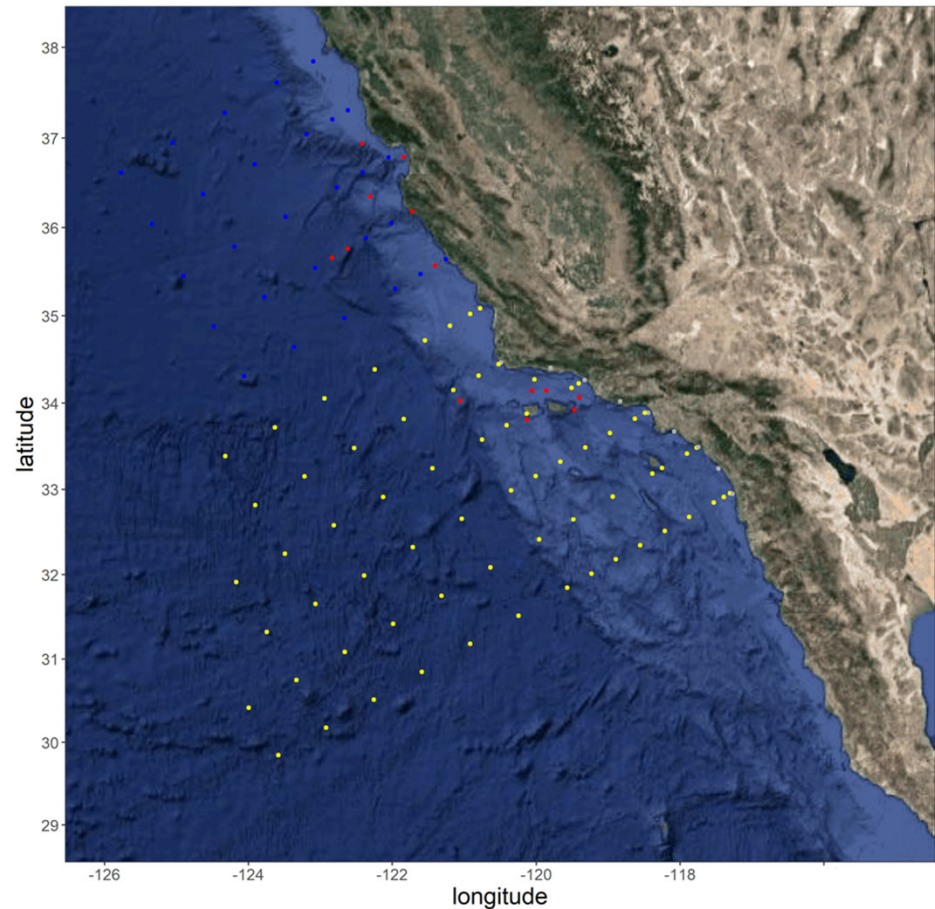
- January 6-26, 2023

Spring CalCOFI (R/V Shimada)

- March 25-April 26, 2023
- Incorporates Enhanced CalCOFI project collaboration with NOS Channel Islands and Monterey Bay Sanctuaries

Summer CalCOFI (R/V Sally Ride - SIO hosted)

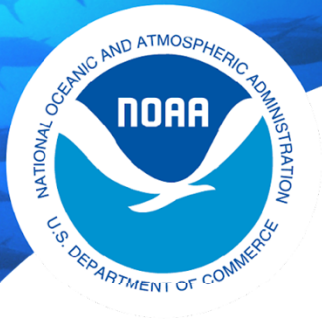
- July 3-18, 2023



Category

- Core (all seasons)
- Enhanced (all seasons)
- North (winter/spring)
- SCCOOS (all seasons)





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## CPS Survey Summer 2023

Baja California, MX to West Coast Vancouver Island, CAN

82 DAS - NOAA Ship *Reuben Lasker*, (Jul-Oct)

50 DAS - *FV Lisa Marie* (Jul-Sep)

30 DAS - *FV Long Beach Carnage* (Jul-Aug)

80 DAS - three *Saildrones* (Aug-Sep)

35 DAS - *RV Dr Jorge Carranza Frazer* (Jun-Jul)

100 DAS – *RV BIP XII* (Apr-Aug)

### Daytime Sampling

Echosounders (18, 38, 70, 120, 200 & 333 kHz)

10- to 20-nmi spaced transects, 5-1829 m or 35 nmi offshore

Continuous Underway Fish Egg Sampler (CPS eggs)

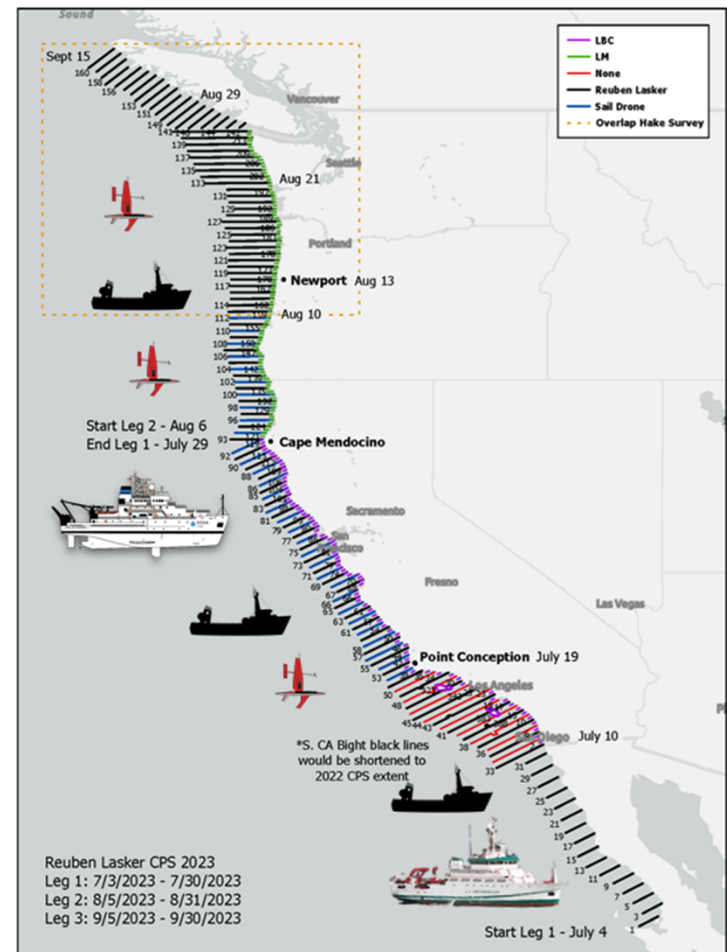
UCTDs and Continuous Surface Conditions (T, S, DO, Chl)

### Nighttime Sampling

Surface trawling (CPS)

Bongo nets (krill and larval fish)

CTDs (T, S, DO, Chl)





## Integrated West Coast Pelagics Survey

By 2025 and beyond, NMFS will integrate NWFSC and SWFSC west coast surveys of hake and coastal pelagic species

- Optimizing resources and ensuring continuity of data collected for stock assessments, management strategy evaluations, and ecosystem research and modeling
- Continuing NWFSC and SWFSC internal planning meetings
- Acting in 2023 to :
  - Hold stakeholder meetings
  - Compare catches: midwater & surface trawls & purse-seines
  - Design and test a net for midwater and surface trawling
  - Engineer AI/ML for echo classifications of hake, CPS & krill
  - Develop eDNA techniques for estimations of species present



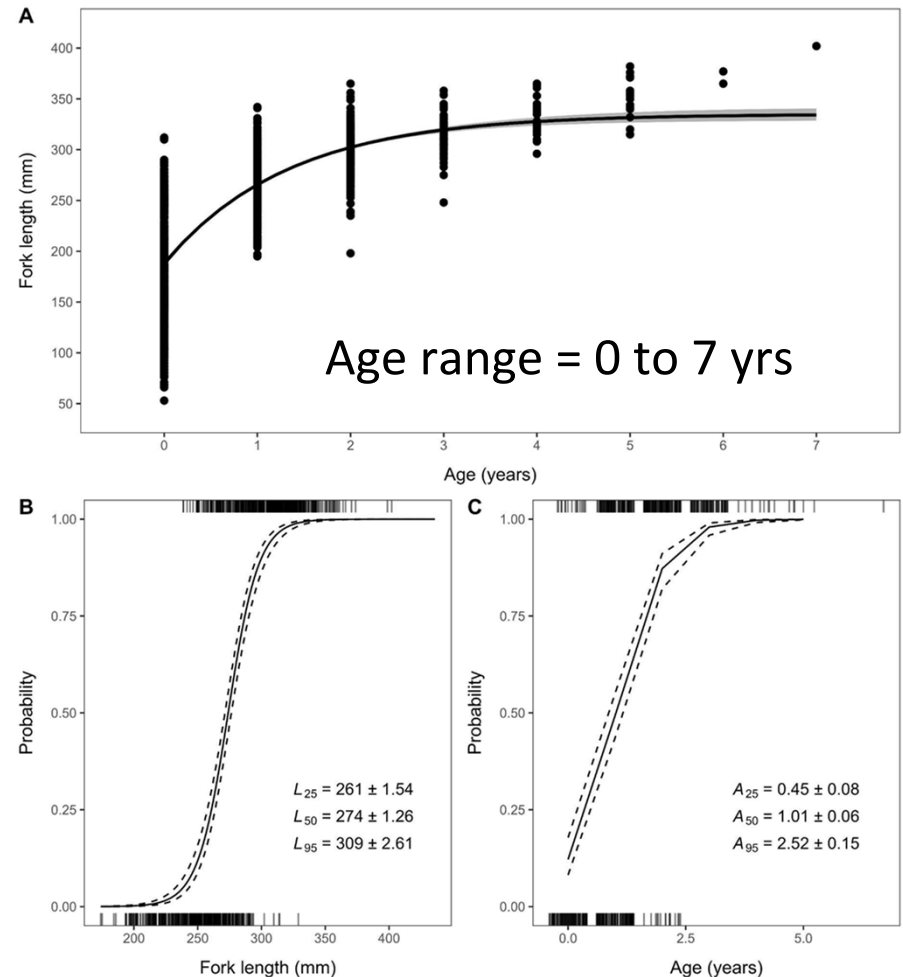
## Integrated West Coast Pelagics Survey

- Anticipated integration in 2025.
- [Request For Information](#) - input opportunity open to all, closed March 17, 2023 (SAM.gov Notice ID: WAD-SRW-23-0001)
- First of several opportunities for input.
- Industry/stakeholder engagement events are being planned - will try to hold several hybrid ones across the region
- Suggestions for other engagement activities welcomed.

# Life History Activities: 2023 Pacific Mackerel Benchmark Assessment



- Life history update included in assessment report
  - 1,762 fish aged by multiple readers from otoliths collected from CPS surveys (2012-2022)
  - Updated estimates of length and age at maturity from 911 samples collected from 2010 to 2021
- NOAA Tech Memo *in prep.*

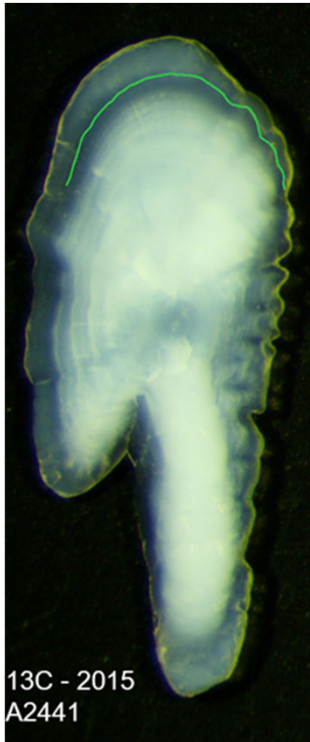




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# Ongoing Research on Somatic Growth Patterns in CPS

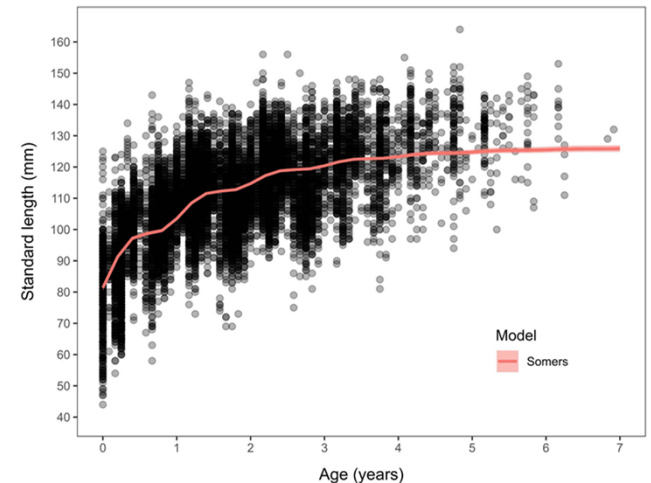
1. Modeling somatic and otolith growth of the central subpopulation of Northern Anchovy (*Engraulis mordax*) by incorporating seasonality
2. Validation of Pacific Sardine (*Sardinops sagax*) annuli in a captive growth experiment



*Pacific Sardine otolith with the oxytetracycline mark in green.*

13C - 2015  
A2441

3. Variability in age and growth of Pacific Sardine (*Sardinops sagax*) in US waters during the recent period of low population biomass, 2012-2021



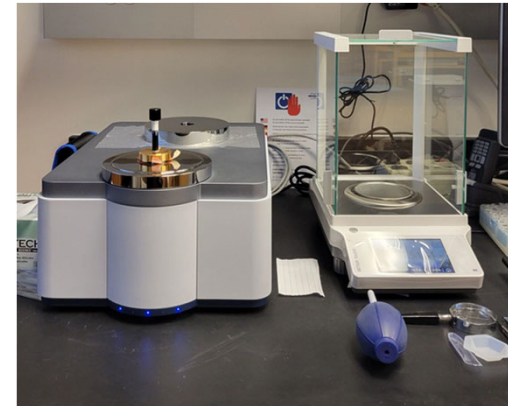
*Length at fractional age data of Northern Anchovy; seasonal growth model (Somers) shown by red line.*

# CPS Automated Ageing Efforts



## Purpose:

Scanning otoliths using Fourier Transform Near-Infrared Spectroscopy (FT-NIRS) to determine if this method would permit rapid and automated ageing of CPS.



*FT-NIRS machine (TANGO)*

## Deliverable:

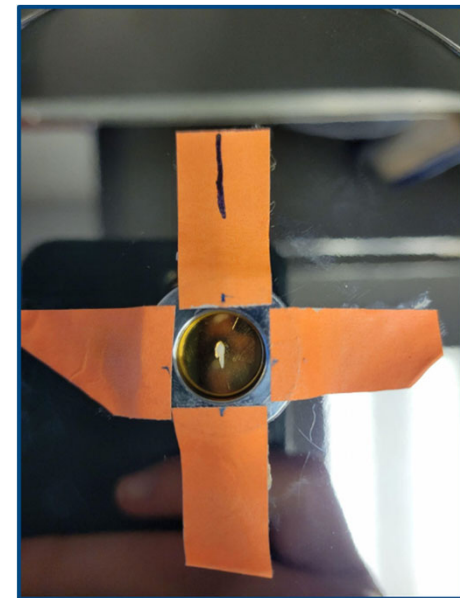
- Determined best method to scan Pacific Sardine otoliths
  - Chrome ring to reduce window size and no stamp
  - Clean and whole otoliths with consistent placement

## Product:

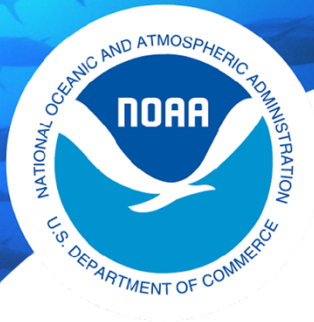
- Presentation to be given at the 2023 FT-NIRS workshop in April hosted by the AFSC

## In progress:

- Method development for Pacific Mackerel otoliths
- NOAA Tech Memo on scanning methods for CPS
- Model development for ageing predictions



*Pacific Sardine otolith placement on TANGO window with chrome ring*



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# Investigations of Life History Traits Relevant to Pacific Sardine Population Structure

1. Critical review of selected foundational studies of population structure in Pacific Sardine (*Sardinops sagax*)
2. A preliminary review of spatio-temporal patterns of spawning in the Pacific Sardine (*Sardinops sagax*) along the Pacific coast of North America in relation to population structure
3. Exploration of variations in length-at-age to inform stock structure of Pacific Sardine (*Sardinops sagax*) off the U.S. West Coast.

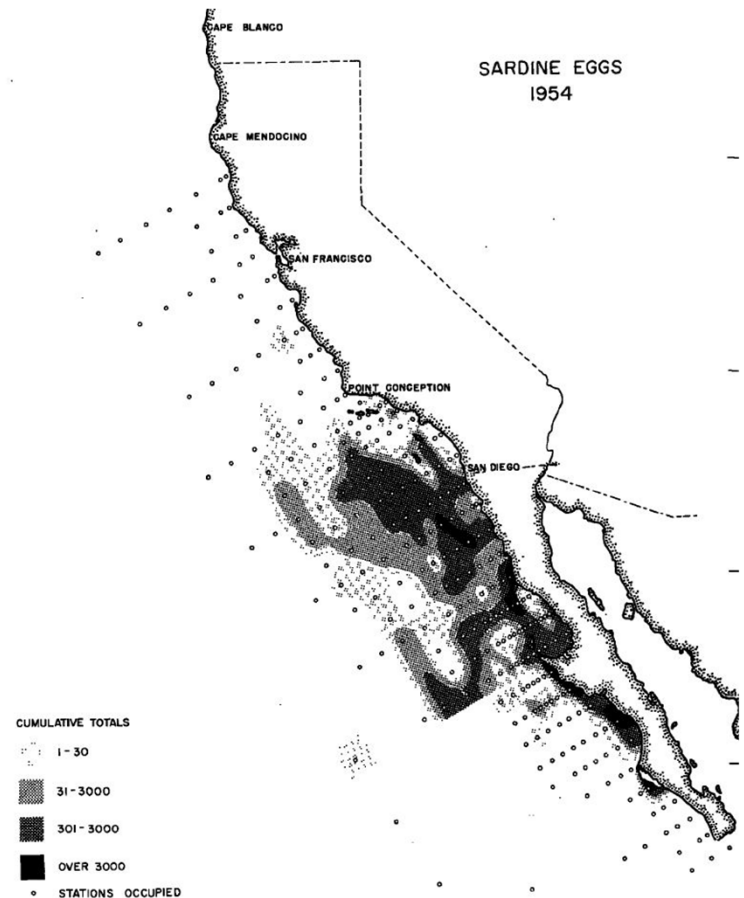


Figure 5 from Ahlstrom 1959 showing distribution and abundance of Sardine eggs in 1954.



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# Future Seas Update

[future-seas.com](https://future-seas.com)

## Future Seas Stakeholder Engagement Workshop

Nov 28-29, 2022

Virtual workshop

~30 participants from NMFS, industry, non profits, state agencies, and Quinault Indian Nation



# Future Seas Stakeholder Engagement Workshop



## Motivation:

1. Improve stakeholder understanding and awareness of Future Seas Project results to date on climate change impacts on the California current ecosystem, with a particular focus on CPS fishery performance
2. Engage CPS fishery stakeholders to help Future Seas team better understand the fleet dynamics and fisheries operations, with the aim of improving socio-economic models used in the project
3. Engage CPS fishery stakeholders to identify perceived climate-driven challenges in the fishery, the fishery's ability to adapt, and limitations on adaptation and flexibility
4. Engage CPS fishery stakeholders to help us advance the development of climate-informed ecosystem management strategy evaluation via a discussion of management strategies and performance metrics.

# Future Seas Stakeholder Engagement Workshop



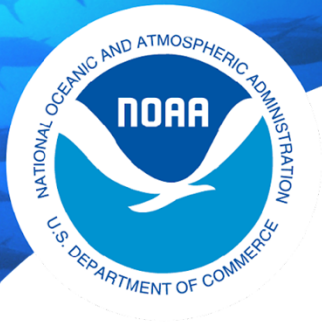
## Outcome:

With input from all represented stakeholders, we were able to synthesize for the CPS fishery:

- Key drivers that affect fishing operations, species portfolio and switching behavior
- Decisions on harvest location and port of landings
- Key climate vulnerabilities and performance metrics for management strategy evaluation.
- Findings will guide the development and execution of the models elaborated for the project and ensure that they address the concerns and ideas of stakeholders.

# Future Seas Phase I Summary Paper

## Sardine northern subpopulation landings projections across three model ensemble

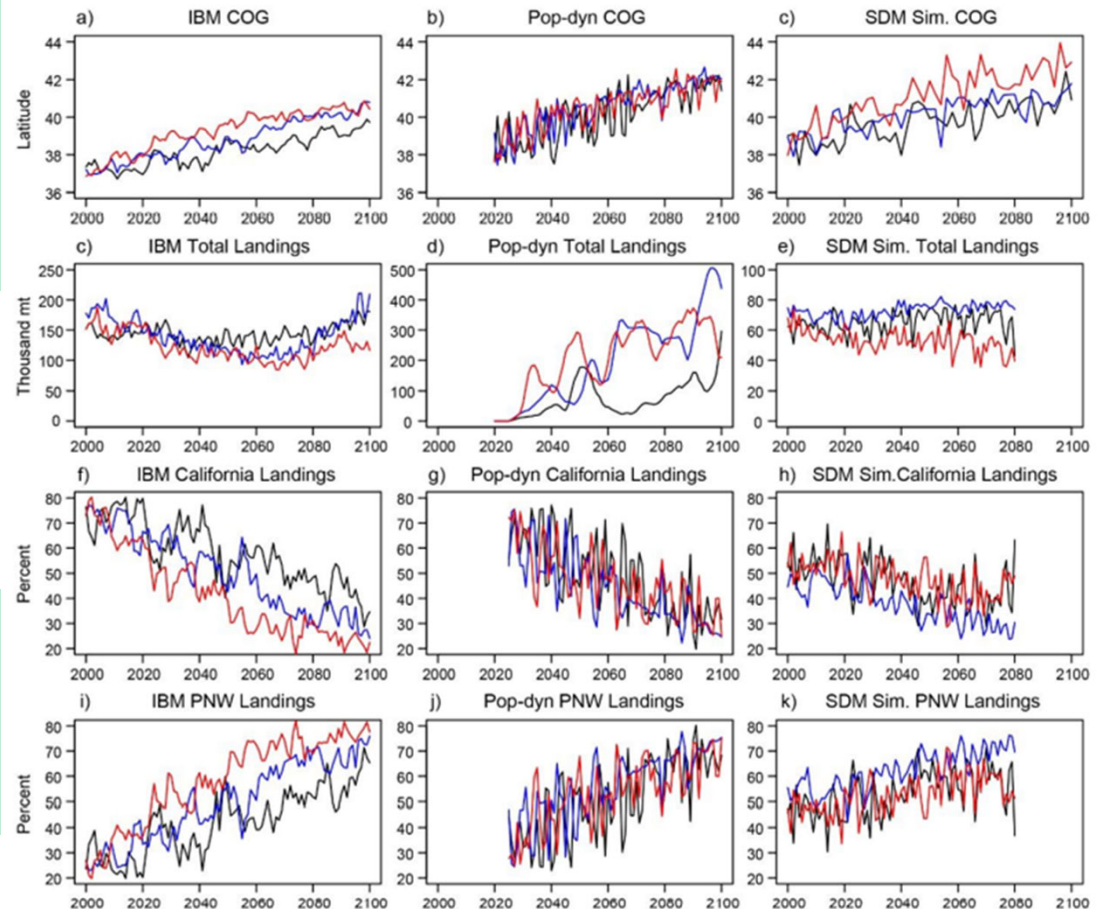


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*High confidence* across models in northern shift of habitat for northern sardine subpopulation

*Low confidence* in future sardine landings amount – high uncertainty

*High confidence* that the CA contribution to total landings of northern sardine will decline and the PNW contribution will increase



[Smith et al. 2023](#)

<https://doi.org/10.1016/j.pocean.2023.102973>

Questions?