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# Southwest Fisheries Science Center Highly Migratory Species Research Update

## ***Presenter***

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## ***Contributing researchers***

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1=CIMEAS, 2=NRC additional affiliation





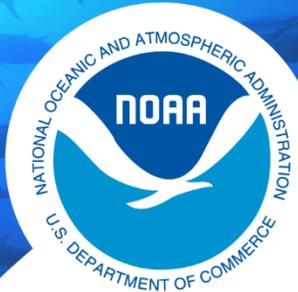
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# Outline

## HMS Research Update

- 2023 HMS assessment schedule
- Collaborative Research Overview
- Life History Research
  - Albacore
  - Bluefin
  - Opah
- Broad Application of Foraging Ecology
- Movements and Habitat Use





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## 2023 HMS assessment schedule

### ISC

- North Pacific Albacore (benchmark)
- Pacific Bluefin tuna MSE (beginning)
- Striped marlin (PIFSC lead)
- WCNPO swordfish (PIFSC lead)

### IATTC

- EPO Skipjack Tuna
- Indicators: EPO Yellowfin Tuna, EPO Bigeye Tuna, Silky shark

# Collaborative Research Overview

## Leveraging Resources to expand Utility and Impact

**Partners:** CDFW, SAC, AFRF, PSMFC, CIMEAS, PIER, Fishers, WCR, PIFSC, PIRO, Texas A&M, AFRF, AAFA, WFOA, NRIFSF/Japan, Fish Processors, COP, and CICESE Mexico

### Research:

- 1) Size composition of Bluefin landings in the CPFV fleet (SAC, Pacific States)
- 2) Length-Weight relationship Bluefin (CDFW, SAC, Processors)
- 3) Biosampling of Albacore, Bluefin and Swordfish (SAC, AFRF, AAFA, CDFW, Processors, Fishers)
  - 1) Archival tag deployments and recovery on Albacore (AFRF)
  - 2) Foraging ecology on Albacore, Bluefin and Swordfish (SAC, PIER, AFRF, WCR)
  - 3) Habitat use and life history of Opah (PIER, PIFSC, WCR, CICESE Mexico)
  - 4) Albacore Sex Ratios and sex-specific length at age (PIFSC, Processors, AFRF)
  - 5) Migratory dynamics/ stock structure of Bluefin (Texas A&M, NRIFSF/Japan)
  - 6) Add value and reduce waste across the seafood supply chain (COP, Processors, Distributors, Chefs)





# Life History Research

**Albacore Tuna: (AFRF, AAFA, Processors, PIFSC, PIRO)**

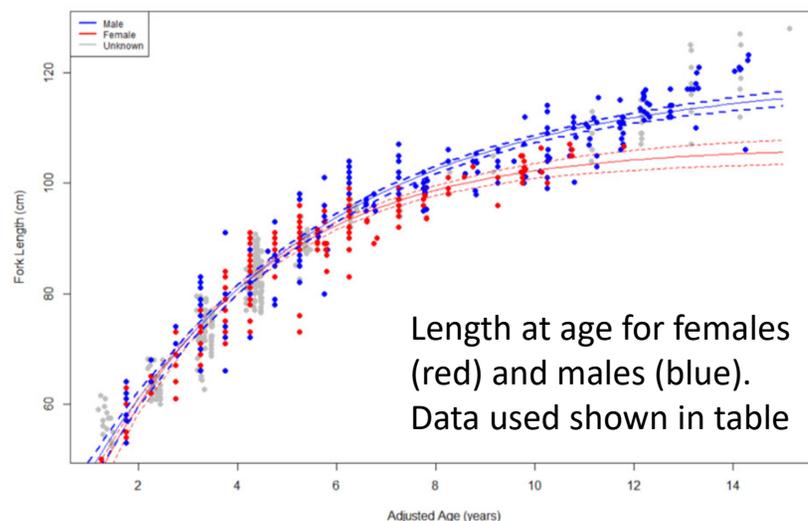
**-Length-at-Age Data Important for Age-Structured Stock Assessments**

## Adult Albacore Tuna

- Length at age is sex specific (see figure)
- Majority of data from the WPO (see table)
- Collecting otoliths and tissues from central Pacific to improve estimations of age
- Additional data on sex ratios also being collected

## Juvenile Albacore Tuna

- Collecting tissues and otoliths to determine if the current length-at-age curve still represents landings in the EPO



Region	Female	Male	Unknown
Eastern	0	0	295
Central	26	79	65
Western	114	131	0



# Life History Research

## **Bluefin Tuna: (SAC, Pacific States, CDFW, Processors, Texas A&M, NRIFSF/Japan)**

### **Size composition of Bluefin Tuna landings by the CPFV fleet**

- Key input to stock assessment
- Analyses showed SAC and NOAA sampling programs similar and more appropriate to use SAC data than commercial landings data (James et al. 2021, Lee 2021)
- 2022 Bluefin Tuna assessment used data collected by SAC (ISC 2022)

### **EPO Length-Weight (L-W) relationship Bluefin Tuna**

- Total landed weight estimated using L-W relationship
- Current L-W relationship from the WPO and included larger fish
- Collecting additional L-W data to estimate an EPO relationship

### **Migratory dynamics of Bluefin Tuna**

- Using microchemistry to quantify movements W-E and E-W (Mohan et al. 2022)

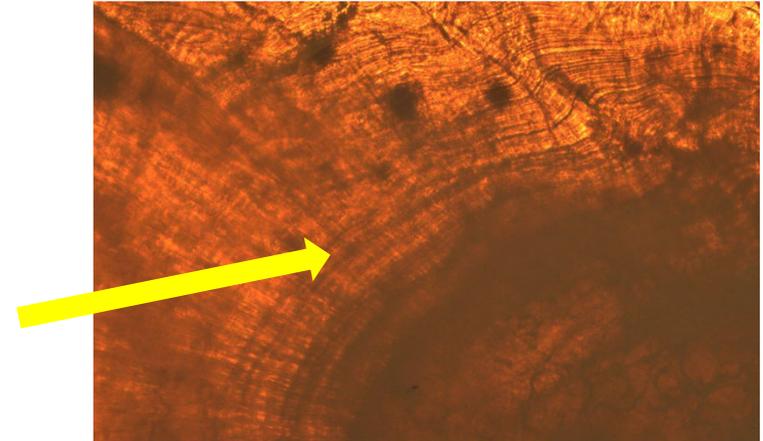


# Life History Research

**Opah: (CICESE, PIER, PIFSC, PIRO, WCR)**

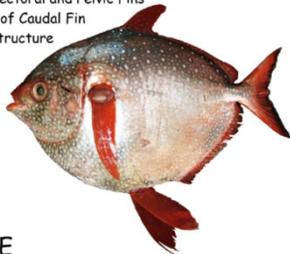
## Age and Growth

- Developing method to age Opah
- Will compare across hard parts including otoliths
- The Lapillus otolith shows some banding patterns



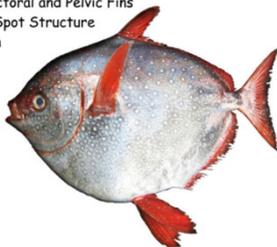
### **BIG-EYE**

Big Eye Relative to Body Size  
Opalescent Posterior and Ventral Skin Coloration  
Longer Dorsal, Pectoral and Pelvic Fins  
Scalloped Shape of Caudal Fin  
Pin-Point Spot Structure  
Purplish Tongue



### **SMALL-EYE**

Smaller Eye Relative to Body Size  
Silvery Skin Coloration across Entire Torso  
Shorter Dorsal, Pectoral and Pelvic Fins  
Fried Egg Shaped Spot Structure  
Truncate Caudal Fin  
Pink Tongue



## Species-Specific Range

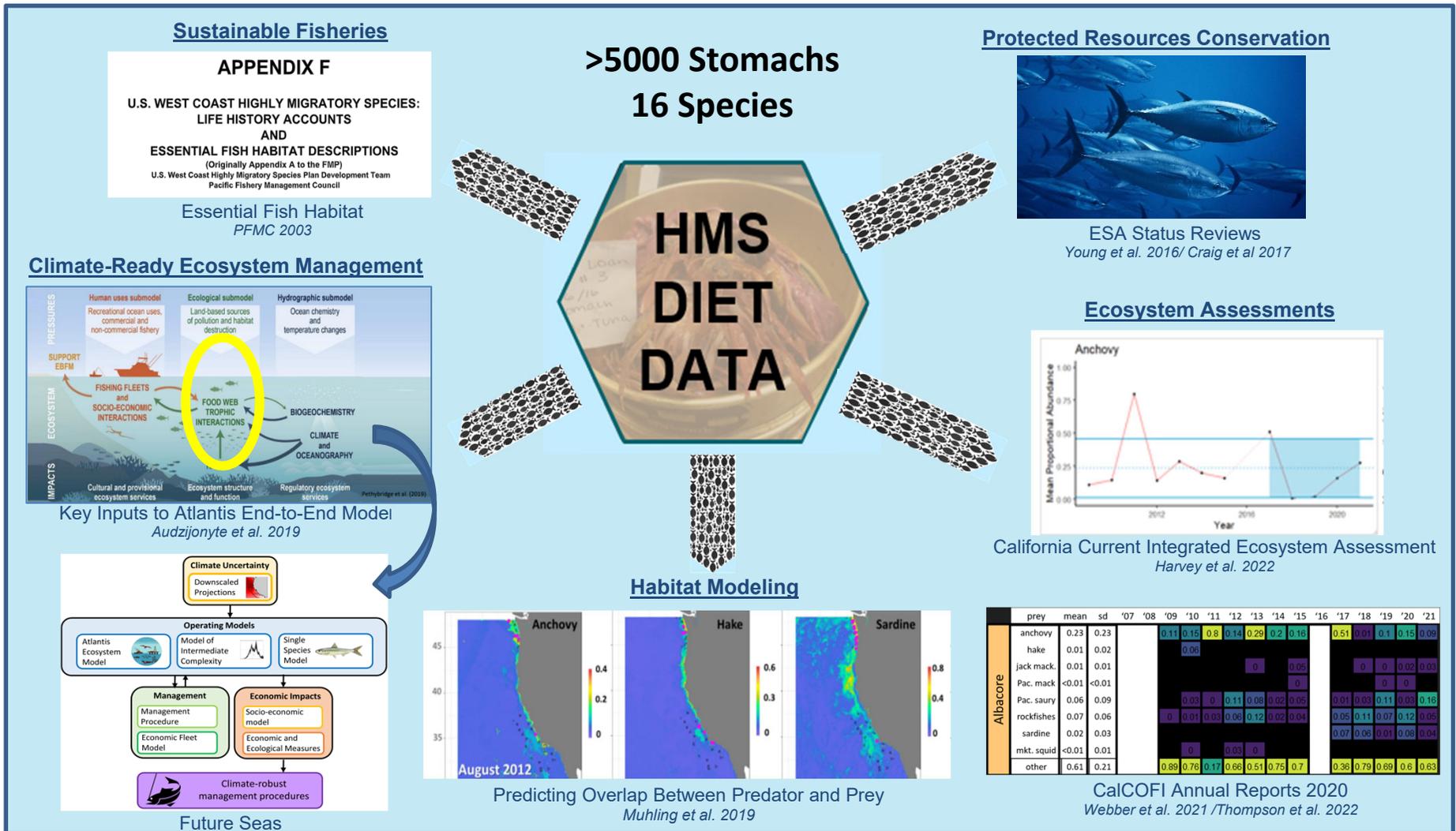
- Two species are not systematically identified in landings and observer data
- Working with PIRO and WCR to develop species ID protocols for observers
- Matching photos to genetic ID to validate characteristics (left)

## Habitat use

- Using satellite tags to understand large-scale movements and habitat use
- Will inform vulnerability to gear, stock structure and migratory dynamics

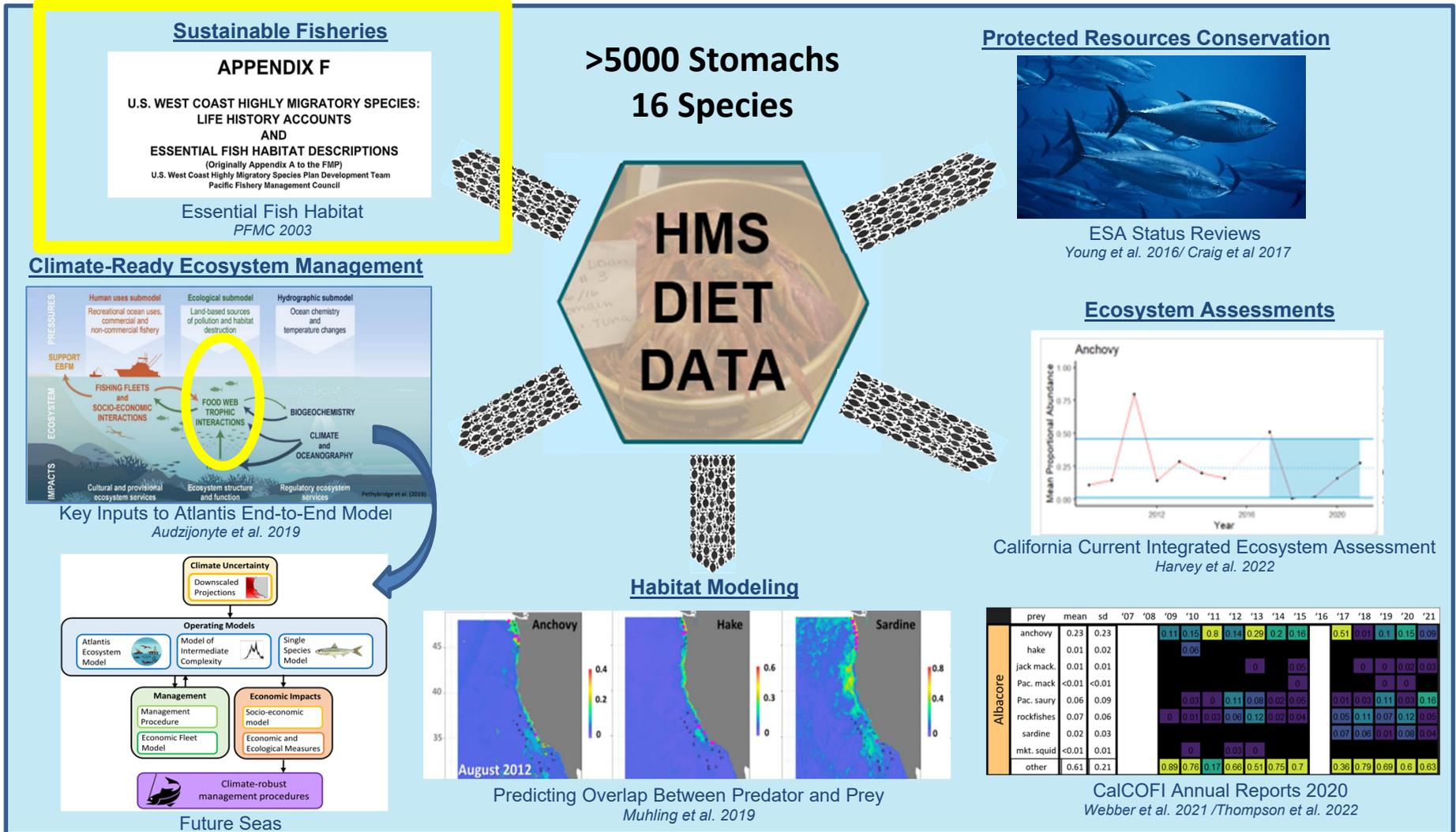
# Foraging Ecology:

Leveraging Decades of Diet Data to Inform Single Species and Ecosystem Management



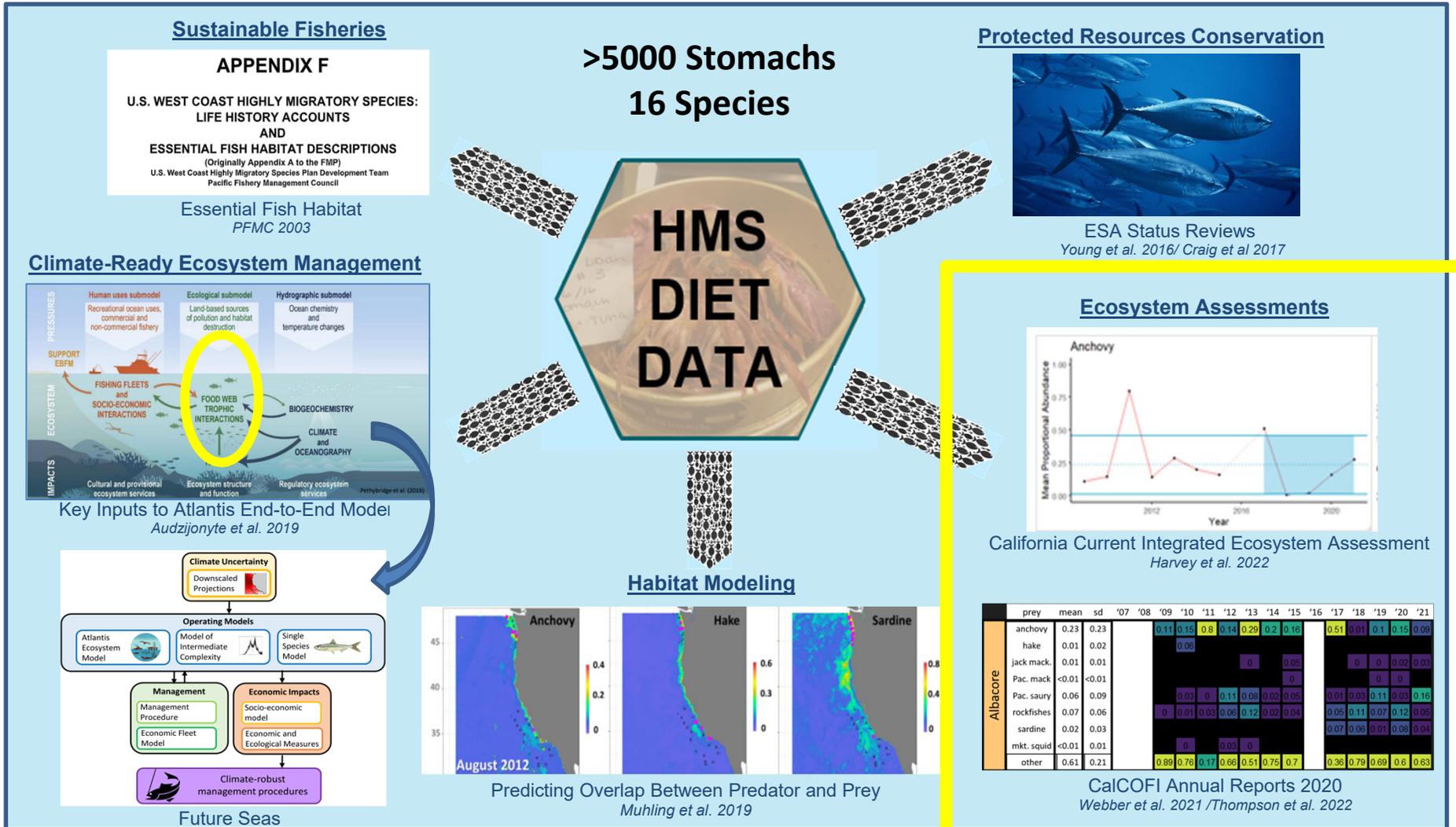
# Foraging Ecology:

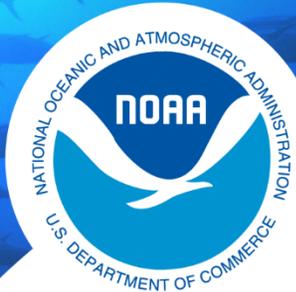
Leveraging Decades of Diet Data to Inform Single Species and Ecosystem Management



# Foraging Ecology:

Leveraging Decades of Diet Data to Inform Single Species and Ecosystem Management





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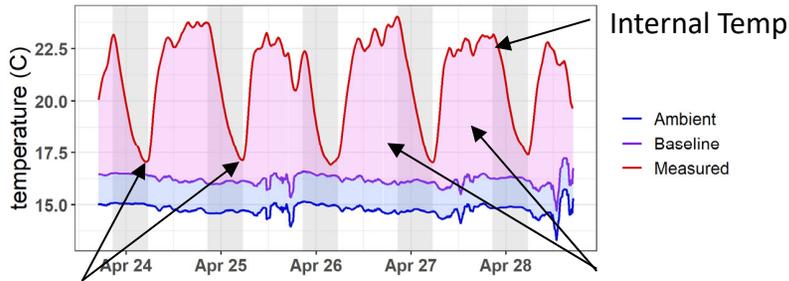
# Diets database

The SWFSC has published an online database of diets, to be updated periodically:

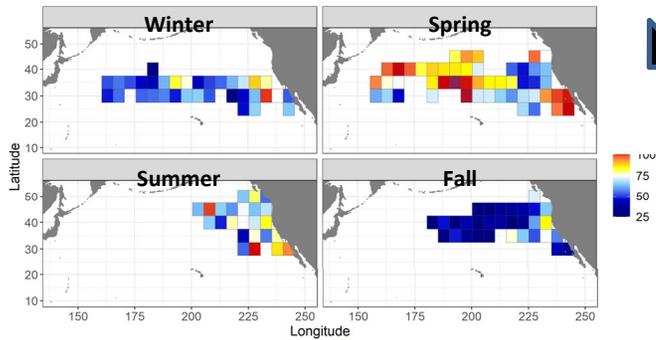
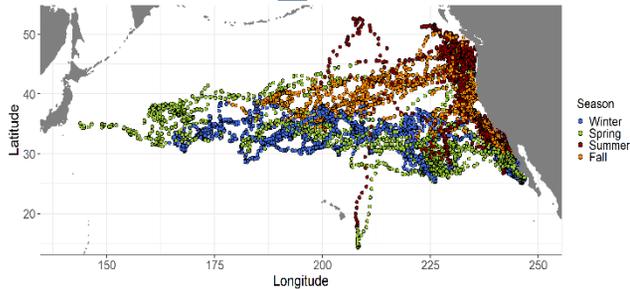
<https://oceanview.pfeg.noaa.gov/cctd/>

# Albacore Tuna

When, how much eaten + Where they go = -EFH in time: space  
 -Risk/Reward migration



Feeding Events + Caloric Intake



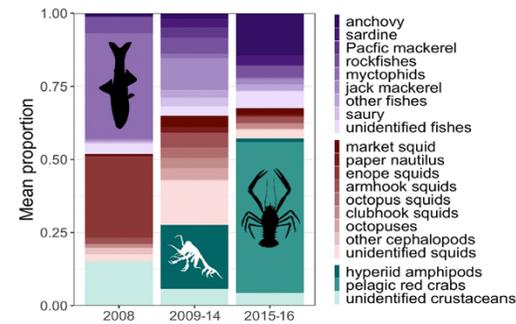
Muhling et. al. 2022 Frontiers in Marine Science, 343.

# Bluefin Tuna

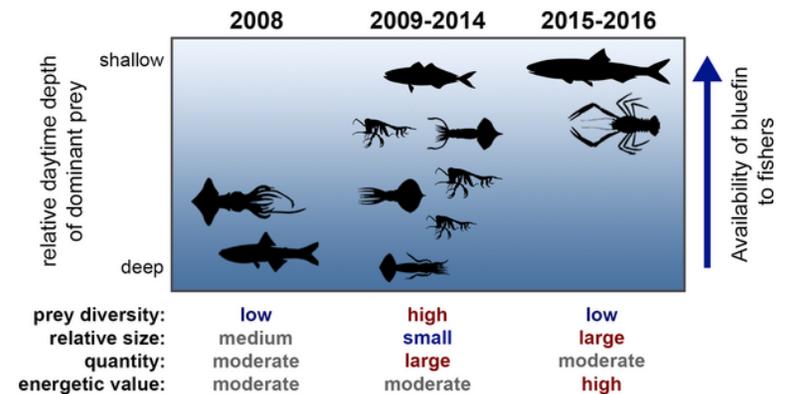
Diets over Time + Prey habitat = -Shifts in EFH & Foraging  
 -Availability to Fishers



+ Time



Prey Habitat Info



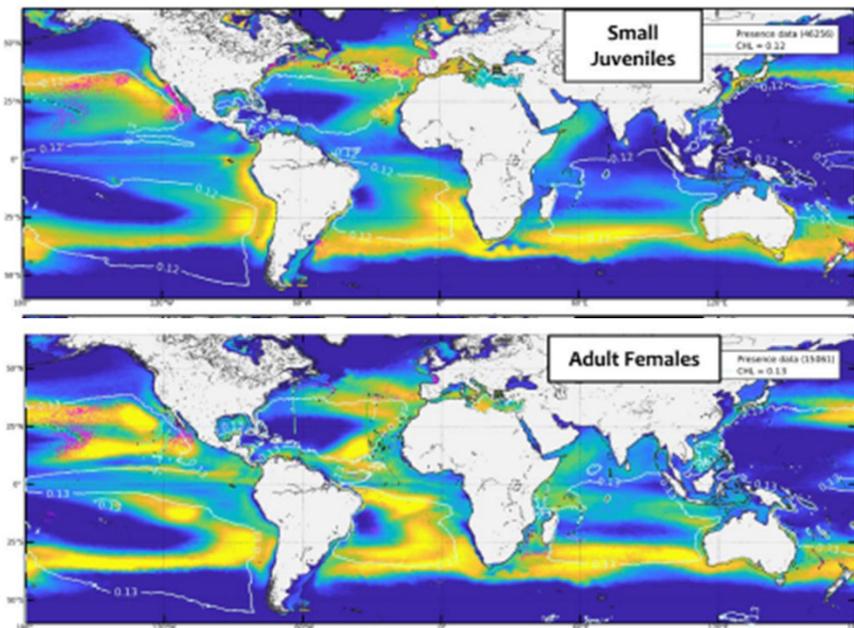
Portner, Snodgrass and Dewar 2022 Plos1, 17(8).

# Shark Movements and Habitat Use:

Leveraging Decades of Electronic Tagging Data to Inform Single Species and Ecosystem Management

## Global analysis of habitat preferences for five size and sex classes:

- NOAA provided most data for ENP (n=95)
- will allow for spatially explicit management across sex and size classes



Druon, J. N., et al. (2022). **Global-scale environmental niche and habitat of blue shark (*Prionace glauca*) by size and sex: a pivotal step to improving stock management.** *Frontiers in Marine Science*, 9.

## Global Comparison of Vertical Habitat Use:

NOAA provided

- 48 out of 202 Blue Sharks
- 53 out of 114 Shortfin Mako Shark

Provide insight into

- Niche separation
- Exposure to climate variability
- Vulnerability to fisheries
- Bycatch mitigation

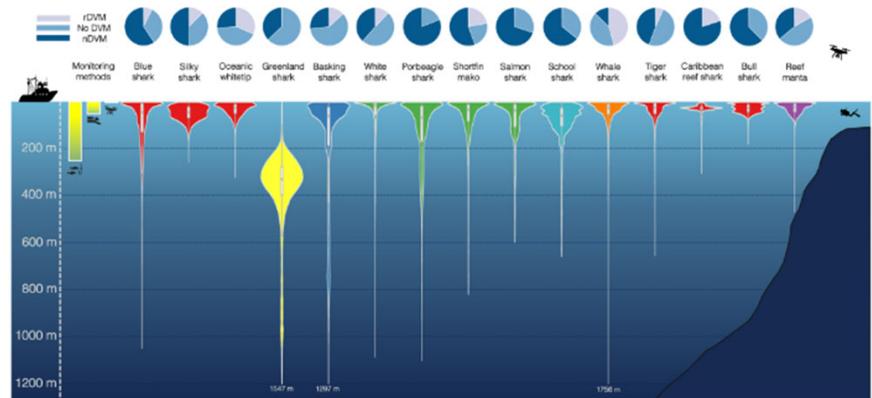


Fig. 3. Vertical distributions and diel behavior of 15 elasmobranch species.

Andrzejczek, S., et al (2022). **Diving into the vertical dimension of elasmobranch movement ecology** *Science advances*, 8(33), eabo1754.



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Questions?

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