

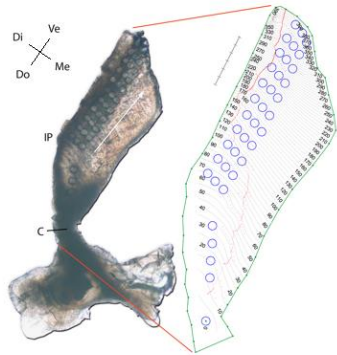
# NMFS Report SWFSC Activities Highly Migratory Species

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# NOAA FISHERIES

Southwest Fisheries  
Science Center



# Presentation Outline

## Bluefin

- Recreational size sampling
- Reproductive Biology



## Albacore

- Foraging Ecology
- Foraging Success
- MSE Economic Analyses



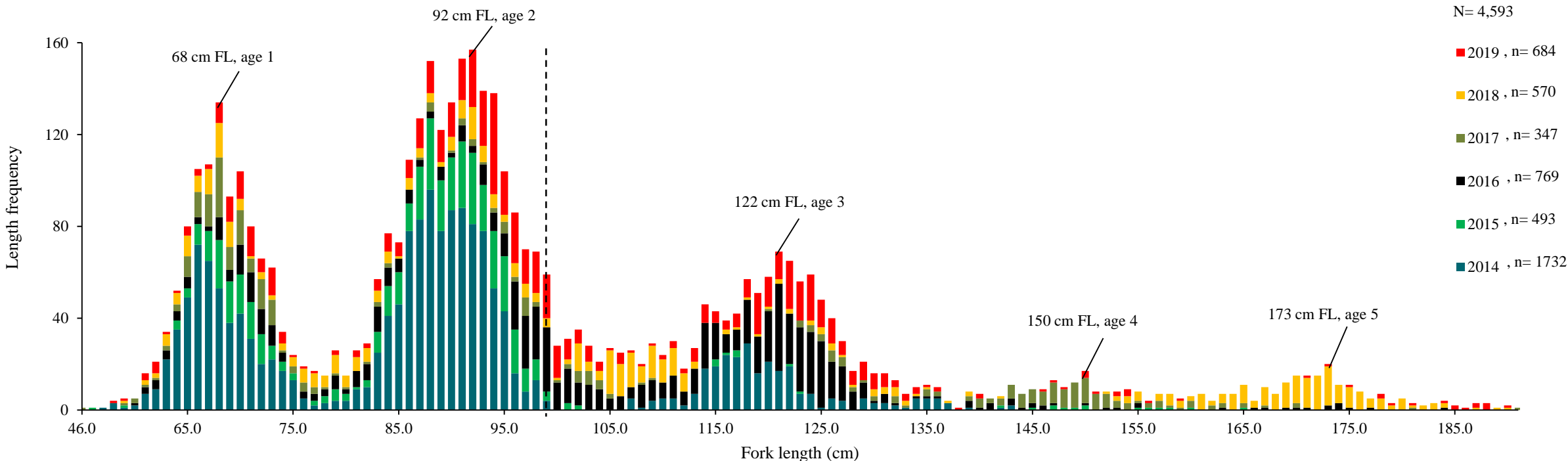
## ISC/IATTC Management efforts

## Culinary Engineering



# Bluefin tuna (*Thunnus orientalis*) Size Composition Sampling, 2014-2019

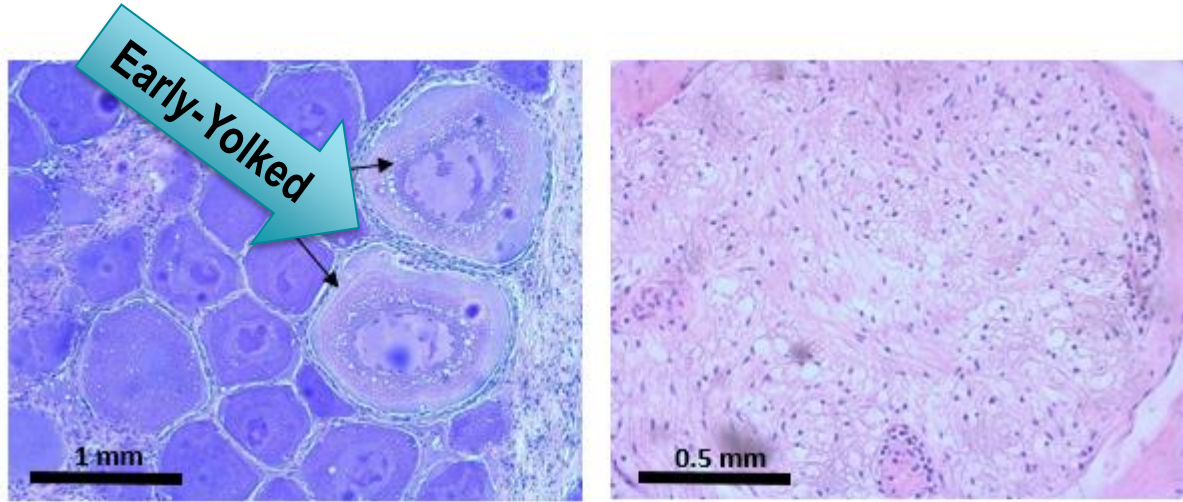
- Recreational vessels in San Diego, California
- Represents 2.0% of California catch totals (range 0.9- 3.3%)
- Best available size data for Eastern Pacific Ocean Sport Fisheries in ISC Stock Assessment
  - Larger fish caught in recent years (2018 yellow and 2019 red)
  - 4,593 total lengths
  - 46.1- 210.2 cm FL (age 0- 9 years)
  - Average bluefin in EPO: 98.7 ± 26.8 cm FL (age 2 years)



Frequency distribution (1-cm bins), average (dashed line), modes, and corresponding age classes (ISC, 2018) of the 4,593 lengths measured from PBF between July 2014 and October 2019 NOAA Sampling Program.

# Reproductive condition of Large Pacific Bluefin tuna in the Eastern Pacific Ocean, 2015-2019

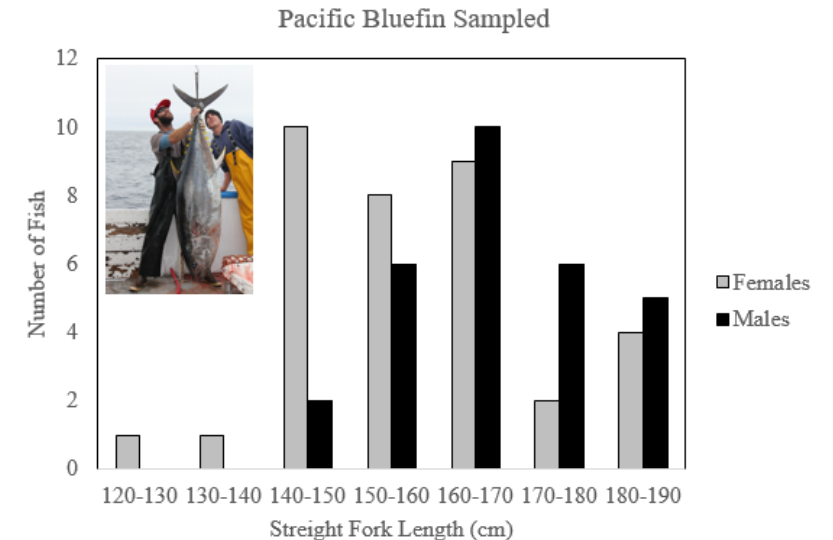
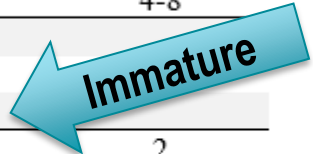
Presented to ISC Bluefin Tuna Working Group, La Jolla CA. 18-23 November 2019 La Jolla, USA



**Figure 4:** Left: Histological section at 20x magnification from female FL 160, estimated age 5. Note the two early-yolked oocytes indicated by the arrows. Scale bar = 1 mm. Right: Histological section at 40 X magnification from male 179 FL, estimated age 8. Note the presence of spermatozoa (stained purple): classified as developmental stage D. Scale bar = 0.5 mm. Despite absence of spermatozoa in the vas deferens (not shown), milt was observed in this fish with the naked eye during sampling.

**Table 1:** Sample sizes, length (cm) and age (years) ranges, and number of fish classified by developmental stage for females and males.

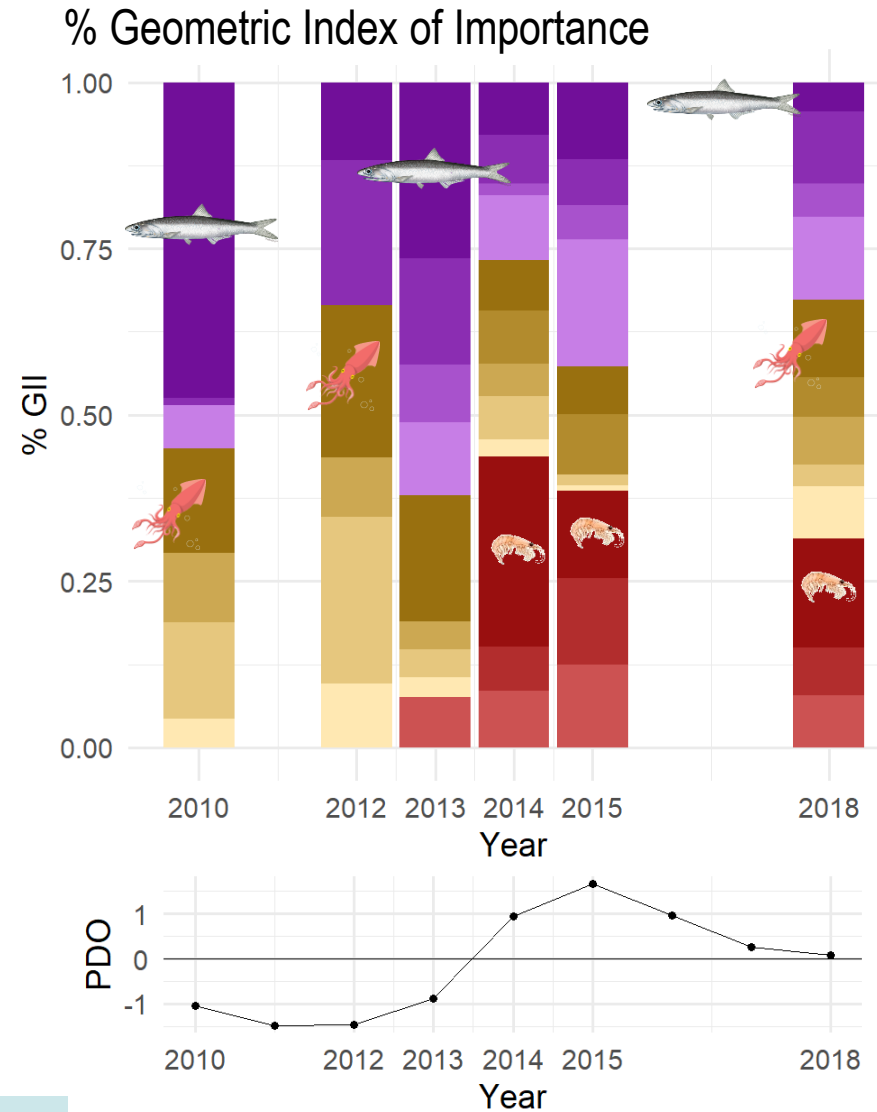
	Female	Male
<i>Size Range cm (mean)</i>	125-188 (158)	142-183 (167)
<i>Age Range</i>	3-8	4-8
<i>Unvolved</i>	34	
<i>Early-Yolked</i>	2	
<i>Atresia</i>	0	
<i>Primary Spermatogonia</i>		2
<i>Primary Spermatoocytes</i>		14
<i>Spermatis Present</i>		10
<i>Spermatozoa Present</i>		1
<i>Spermatozoa in Vas Deferens</i>		1
<i>Milt Present</i>		7
<i>Total</i>	36	28



# Juvenile Albacore Diet offshore of Oregon and Washington

Nickels, Snodgrass, Dewar, Muhling, 2020. *Albacore Tuna Diet and Foraging Ecology in the Northern California Current*. Poster at OSM 2020

- Anchovy, euphausiids, and *Onychoteuthis* squid dominate juvenile albacore tuna prey offshore of OR and WA, USA
- Negative Pacific Decadal Oscillation (PDO) is associated with more anchovy in the diet, while positive PDO includes higher abundances of multiple other prey groups
- Cephalopods were more important in cooler years, consistent with recruitment models



## Prey Category

- Anchovy
- Rockfish
- Saury
- Unknown/Other Fish
- Onychoteuthis
- Larval Squid
- Gonatus
- Unknown/Other Squid
- Octopus
- Euphausiid
- Amphipod
- Unknown/Other Invertebrate

Percent numeric abundance (%N):  

$$\frac{\text{count of individuals in prey category in albacore stomachs}}{\text{count of all organisms in albacore stomachs}}$$

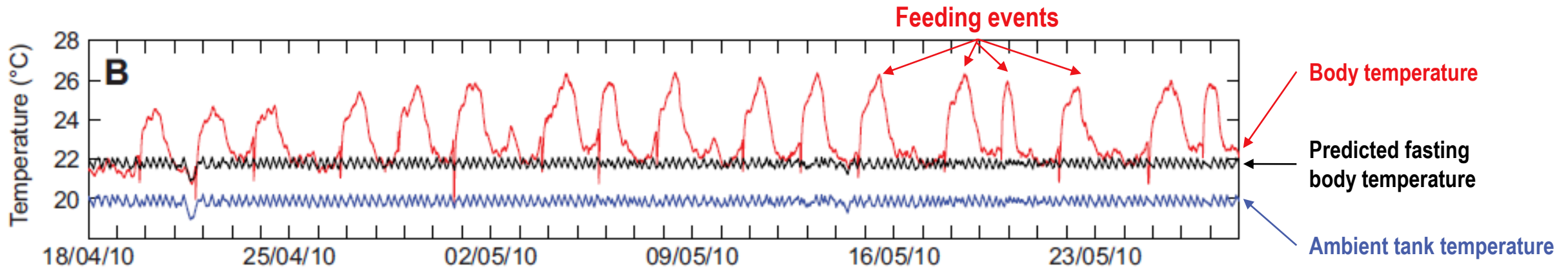
Percent frequency of occurrence (%FO):  

$$\frac{\text{count of albacore stomachs in which prey occurred}}{\text{count of all albacore stomachs}}$$

Percent Geometric index of importance (%GII):  

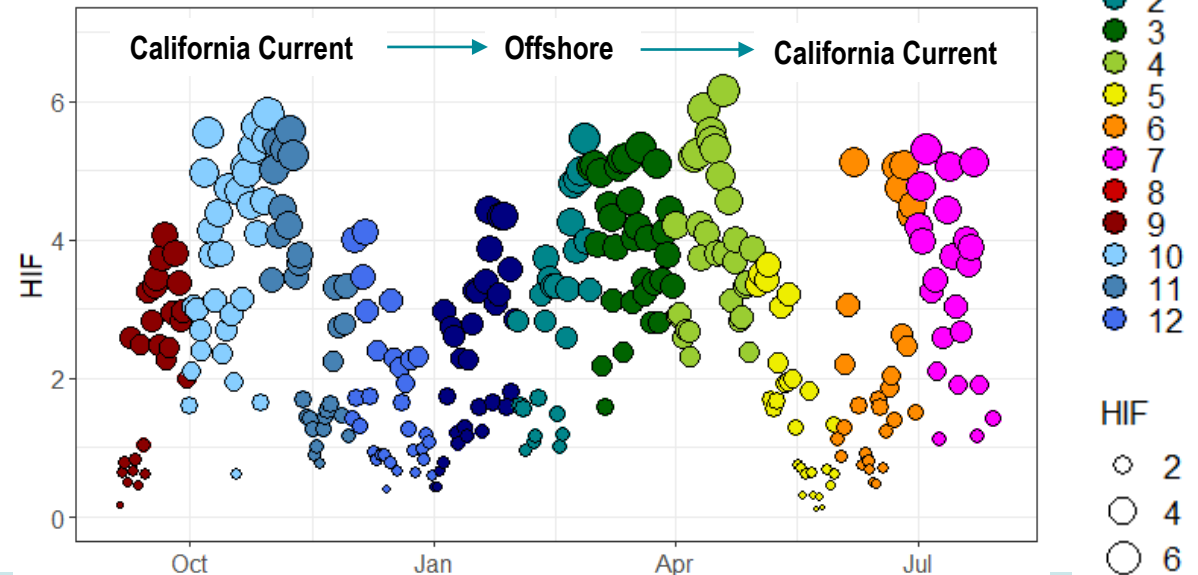
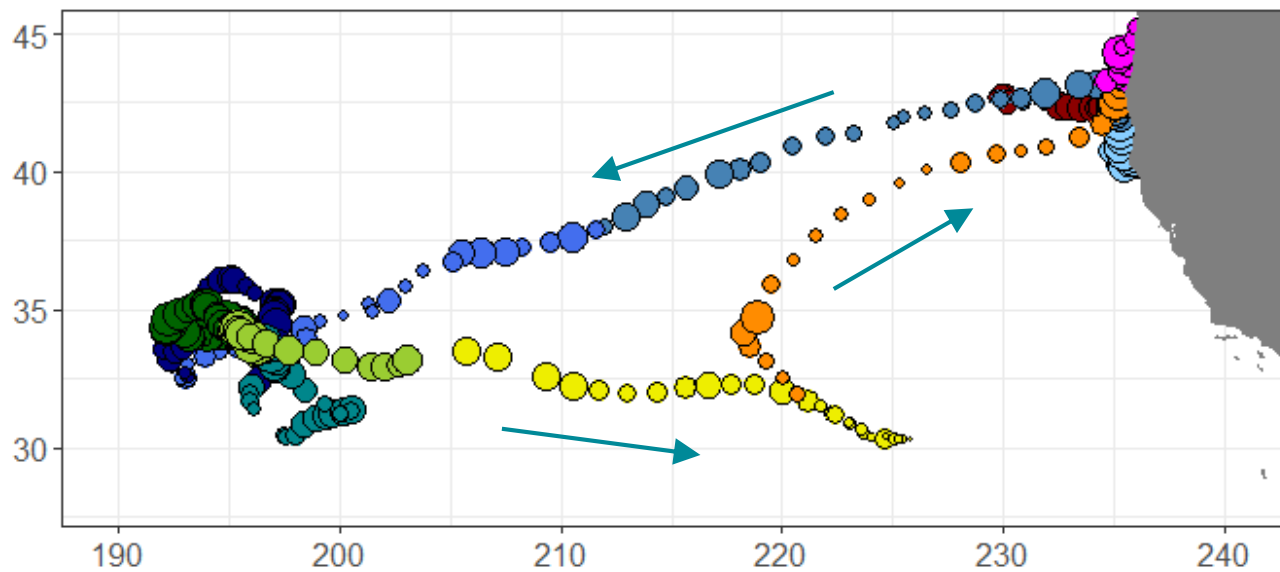
$$\frac{\frac{\%N + \%FO}{\sqrt{2}} \text{ for prey category}}{\sum \frac{\%N + \%FO}{\sqrt{2}} \text{ for all prey categories}}$$

# Albacore: Estimating foraging success



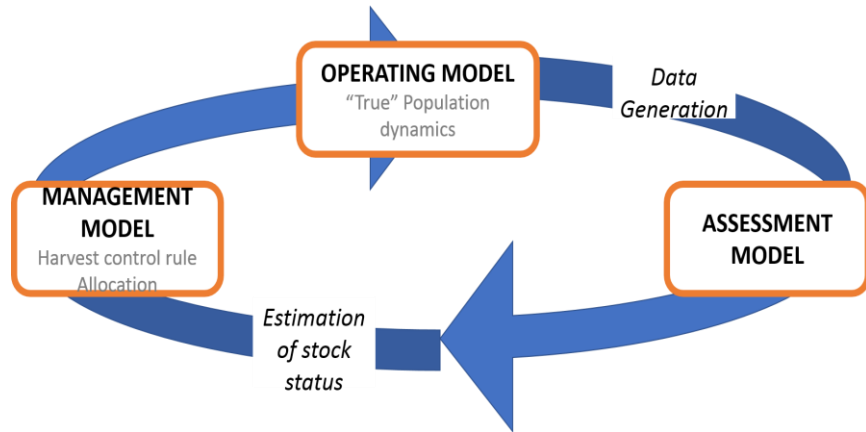
Heat increment of feeding (HIF) in a captive Pacific bluefin tuna (Whitlock et al. 2013)

## Albacore tag 1045: Sept. 5<sup>th</sup> 2006 to July 30<sup>th</sup> 2007

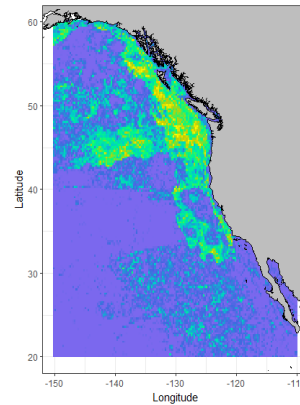


# Albacore MSE Economic Analyses: Drivers of Albacore Port Level Landings

Tommasi, Muhling, Smith, Sweeney, 2020. Policy and environmental constraints on the profitability of the albacore fleet. Poster at OSM 2020



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Landings by port and vessel type (<45 ft, 45-60 ft, >60 ft) as a function of patterns in albacore distribution, vulnerable biomass, economic factors (e.g. costs, fleet capacity, salmon, crab landings)

Vulnerable Biomass to US surface fleet from Large Scale Population Dynamics Model

Environmentally Informed Albacore Distribution Model

- Fuel prices and distance from center of fishing grounds are a strong determinant of a port being active.
- Communities largely dependent on landings from small vessels may be more vulnerable to changes in distribution.
- Overall vulnerable biomass was a significant driver of landings for large vessels, while medium and small vessels were more constrained by the spatial patterns of biomass distribution.
- Fleet capacity, and port effects were also significant covariates for all vessel types, implying that regulatory and infrastructure differences across ports also affect landings.
- This methodology appears useful to derive local socio-economic performance metrics from a large scale MSE.

# HMS Stock Assessments – ISC

## 2020

- Pacific Bluefin Tuna Benchmark Assessment March 2-12, 2020 (Webinar Only). Preliminary results will be presented to the IATTC Science Advisory Committee (SAC), May 11-15, 2020 in La Jolla, CA. Final results ratified at ISC Plenary Meeting
- North Pacific Albacore Tuna Benchmark Assessment, April 5-14, 2020 (Webinar Only). Preliminary results will be presented to the IATTC Science Advisory Committee (SAC), May 11-15, 2020 in La Jolla, CA. Final results ratified at ISC Plenary Meeting
- U.S. will host ISC2020 Plenary Meeting in Kona, HI, July 15-20, 2020

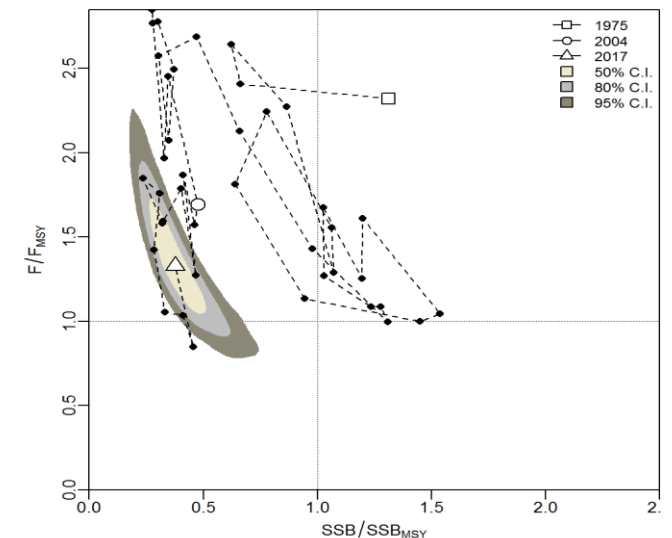
## 2021

- Pacific Blue Marlin (Benchmark)

## 2022

- North Pacific Blue Shark

Striped Marlin Kobe Plot





# HMS Stock Assessments - IATTC

**2020**

- Bigeye Tuna (Benchmark with updates thereafter)
- Yellowfin Tuna (Benchmark with updates thereafter)
- Skipjack Tuna (Indicators annually until 2023)
- Silky Shark (Indicators annually until 2023)

**2021**

- Bigeye Tuna, Pacific-wide (Exploratory)
- Swordfish, South EPO (Benchmark)

**2022**

- South Pacific Albacore Tuna (Benchmark)



# Management Strategy Evaluations (MSE)

- **North Pacific Albacore Tuna MSE Workshop – Final workshop in late 2020 – Location TBD but likely in US**
- **Pacific Bluefin Tuna – MSE process to scale up after 2020 Stock Assessment completed - Will be discussed further at Joint NC/IATTC WG meeting July 28-31, 2020 Fukuoka, Japan**
  - **U.S. Stakeholder Meeting on Management Objectives and Management Framework April 23, 2020, from 9 a.m. to 4:30 p.m. PST, NMFS West Coast Regional Office, Long Beach, CA**
- **Tropical Tuna MSE workshop hosted by the IATTC May 8-9, 2020 in La Jolla, CA. *Stakeholders and managers are encouraged to attend.***

# Culinary Engineering: Reducing waste and adding value across the seafood supply chain

In collaboration with Catalina Offshore Products, Chef, and local Fishers:

- Completed SK project to reduce waste and add value to local fisheries.
- Hosted multiple outreach events with a range of stakeholder groups.
- At Town Hall at Ocean Science meeting Feb 20, Chef Christina Ng served:
  - *Meatball Bolognese from opah adductor muscle*
  - *Smoked, low-grade bigeye tuna with artichoke tapenade*
  - *Blue shark confit with lemon, fennel and parsley*



# Thank You

# Questions?

