Southwest Fisheries Science Center
Highly Migratory Species Research Update

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Outline

HMS Research Update

• Collaborative Research
• Albacore
• Pacific Bluefin tuna
• Billfish
• Opah
• ISC Upcoming Activities
• Fishful Future
Collaborative Research

Partners: CDFW, SAC, AFRF, PSMFC, CIMEAS, PIER, Fishers, WCR, U.S. Coast Guard, PIFSC, Texas A&M, AFRF, AAFA, WFOA, NRIFSF/Japan, Catalina Offshore Products, Fish Processors, WCR, and CPFV’s

Research:

1) Size composition of bluefin tuna landings in the CPFV fleet (SAC, Pacific States)
2) Length-Weight relationship bluefin tuna (CDFW, SAC)
3) Tuna Biosampling (SAC, AFRF, AAFA, CDFW, Processors, Fishers, WCR)
4) Archival tag deployments (AFRF)
5) Foraging ecology (SAC, PIER, AFRF)
6) Habitat use and life history of opah (PIER, PIFSC, WCR)
7) Opah, species-specific distribution and basic biology (PIER, PIFSC, Fishers, WCR)
8) Reducing waste and adding value across the seafood supply chain (COP)
• Albacore Foraging Ecology:
  • Juvenile Albacore are in the CCLME to Forage

• Critical to characterize trophic connections for:
  1) Essential Habitat
  2) Quantify connections to CPS
  3) Ecosystem management and modeling
  4) Examine shifts in habitat quality
  5) Understand shifts in prey abundance and distribution
    1) Project shifts with climate change
    2) Will inform movement models in MSE

• Current Data Products
  1) Data incorporated into Atlantis
  2) Included in CalCOFI Report
     a) 2020 Albacore
     b) 2021 Albacore and Swordfish
     c) 2022 Bluefin, Albacore and Swordfish (across regions and vertical habitat)
  3) Data included in the CCIEA database
  4) Current plan to include HMS diet data in the 2021 CCIEA report

**KEY:** Long-term time series, as called out in PFMC research and data needs, are critical to understanding shifts in diet and their associated forcing mechanisms.
Albacore Archival Tagging Efforts (AFRF, WFOA):

- Deployed final 78 archival tags with AFRF captain as surgeon:

Archival tags provide insight into:

1) Foraging ecology: When and where they forage
2) Essential Habitat: Project shifts associated with short and long-term climate variability
3) Gear vulnerability: Geographic and vertical
4) And many more .....
Albacore:

- Foraging Migrations Inferred from Archival Tags
  - *Energy intake estimated from Heat Increment of Feeding (HIF)*
  - *Juvenile albacore may migrate offshore in anticipation of favorable spring foraging conditions*

Heat Increment of Feeding for a 90cm albacore in April 2004

Muhling et al. in review
North Pacific IUU

- **Build distribution models for juvenile and adult albacore**
- **Examine pelagic longline fleet dynamics from RFMO and AIS data (Frawley et al. in prep)**
- **Examine reported catch versus predicted species ranges**
- **Collaboration with OLE, USCG and industry**

**Distribution model for adult albacore**

OLE-funded project: “Dynamic decision-support tools to counter IUU fishing for North Pacific albacore”, M Jacox, T Frawley, B Muhling, S Brodie, J Smith, D Tommasi, H Welch
North Pacific Albacore MSE

- Results of the ISC NPALB MSE were presented to US and Canadian managers and stakeholders on March 22-25, 2021 during a virtual workshop. Similar stakeholder workshops were also held in Japan (March 17-19) and Taiwan (April 7-8)

- The ISC NPALB MSE report was reviewed at the virtual ISC21 Plenary Meeting on July 12-15, 2021

- The ISC Plenary endorsed the MSE results and reiterated that no additional NPALB MSE work is anticipated at this time

- NPALB MSE Report and recorded video presentation provided to SC17

- Results from the ISC NPALB MSE report were presented to the Northern Committee on October 4, 2021

- D. Tommasi advising Kit Dhal and Jessica Watson of the HMSMT on development of a Shiny app to present MSE results to stakeholders
Bluefin Research:

- **Length-Weight Curve for EPO: CDFW/ SAC/ NOAA**
  - First step: compiling data and identifying data gaps

- **Close Kin: Will provide a fisheries independent estimate of biomass**
  - Have been collecting samples since 2015
  - Identifying both genetic technique and sample

- **Foraging Ecology: Again, in the CCLME to Forage**
  - *Range of epi- and mesopelagic fish + squid*
  - *Opportunists predators can forage across taxa and habitats.*
  - *Distinct shifts in diet over time*
  - *Testament to the need for long-term studies*

- **Movement Dynamics/Otolith Microchemistry:**
  - *Use unique signature in the core to identify spawning ground.*
  - *Next step to link patterns over a decade environmental variability.*
Bluefin: Comparison of NOAA and SAC Length Sampling Programs

The NOAA Port Sampling Program and Sportfishing Association of California (SAC) sampled PBF lengths from (2014-2020) from the CPFV fleet.

• Comparison
  – % of fish sampled: NOAA 4.5%/ SAC 3.8%
  – Length compositions were similar overall
  – NOAA size composition was larger in some years/ may be linked to only sampling at the dock
  – SAC sampled fewer vessels, but this had a minor effect the length compositions
  – SAC able to sample in 2020 where as NOAA was not
  – Both sampling programs sample main body of fish

Continued annual sampling is imperative to provide robust length distributions to the ISC stock assessment. Going forward SAC will be the primary source of the length composition data.

Billfish: Also in the CCLME to Forage

- **Sunset Conventional Tagging Program.** *Database publically available*
- **Movement Dynamics Using Otolith Microchemistry:**
  - Compared signature of core in adults to that of nursery grounds.
  - Adults in CA, HI and Mexico recruit from multiple nursery grounds

Relative contribution of nursery grounds to adult foraging ground. Black= CA, Red = Mexico and Blue=HI. Drawn from data presented in Wells et al. 2021

- **Foraging Ecology: Swordfish**
  - Range of epi- and mesopelagic fish + squid
  - High variability over time
  - Opportunists
  - Most similar to bigeye thresher sharks

Percent GII (geometric index of importance) 2007-2014 (Preti et al. 2020).
Opah: Landed in both coastal and high-seas fisheries

- Species Specific Range and Gear Vulnerability (SWFSC/PIFSC)
  - Combining catch data and genetic analyses (Cooper et al. in prep)
  - Using satellite telemetry to examine vertical habitat use

- Working with PIRO to Collect Species-Specific Catch Data
  - Waiting on new species specific code for small- and bigeye opah
  - Collecting genetic samples

Average CPUE (fish / 1000 hooks) for U.S. deep-set longline fishery from 2014 to 2018 from blocks w > 3 vessels. Cooper et al. in prep

- Basic Biology
  - Reproductive Biology:
    - Evidence of spawning off-shore
  - Age and Growth: Best Hard-Part?
Upcoming ISC Activities

- November 9-19, 2021  SharkWG, Blue Shark Data Prep Mtg
- December, 14-21, 2021 PBFTWG, Bluefin Tuna Data Prep Mtg
- February, 2022  Bluefin Tuna Assessment, TBD
- April, 2022  Blue Shark Assessment, TBD
- July 13-18, 2022  ISC22 Plenary Meeting - Hawaii, USA
Fishful Future:
fostering culinary and non-culinary solutions to undervalued or discarded products. SWFSC/ COP/ Saltonstall-Kennedy

Reducing Waste/ End Goal is ZERO waste:
• Organic Fertilizer
• High end pet food from low grade tuna
• Lobster and crab bait
• Jewelry

Adding Value $$$:
• Minced fish products
  • (burger, sausage, spam)
• Smoked fish
• Dry aging

Feasibility Studies
• Fish Leather
• Fish skin bandages
• Biopharmaceuticals: Fish oil, tunas good candidate
• Collagen
• Fish Silage (animal feed)

Will be posted on https://www.fishfulfuture.com
References:


Cooper, R., Dewar, H., Muhling, B., Teo, S., Hyde, J. and Bigelow, K. Spatiotemporal catch patterns and population distributions of bigeye Pacific opah (Lampris megalopsis) and smalleye Pacific opah (L. incognitus) in the eastern North Pacific. In prep.


