Southwest Fisheries Science Center

Highly Migratory Species: Research Update

Presenter

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Contributing researchers

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Presentation to PFMC March 9,2023

Outline

HMS Research Update

2023 HMS assessment activities
Genetics
Life History
- 73rd Tuna Conference: In person
  - *"The Diet Renaissance: Shedding Light on Ecosystem Function."*
- Essential Fish Habitat Update
- Life History: Albacore, Bluefin and Opah
- HMS Foraging Ecology/ Ecosystem Management

2023 HMS Assessment Activities

ISC

- North Pacific Albacore (benchmark – SWFSC lead)
- North Pacific Bluefin tuna MSE (multi-year process - SWFSC lead)
  - Development of an operating model
  - Development of an uncertainty grid for key productivity parameters
- WCNPO Swordfish (benchmark - PIFSC lead)

IATTC (SAC meeting May 15-19, 2023)

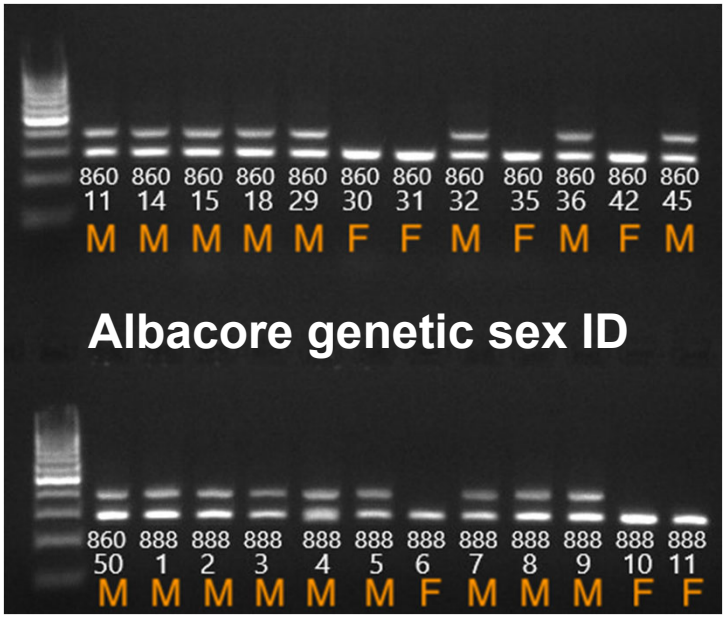
- EPO Yellowfin tuna (benchmark)
- EPO Bigeye tuna (benchmark)
- Skipjack tuna (benchmark)

Genetics

Ongoing projects:

Testing new genetic sex markers for tunas and applying to north Pacific Albacore samples

Species-ID for Opah life history studies (separating Bigeye and Smalleye Opah)



Life History Program Update: EFH

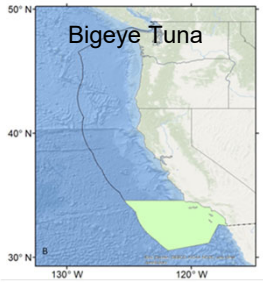
1) First draft completed tool

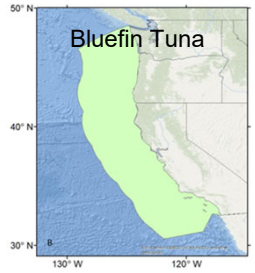
LHP Data Included:
Diet Data
Tagging
Species Distribution Models
Life History Data

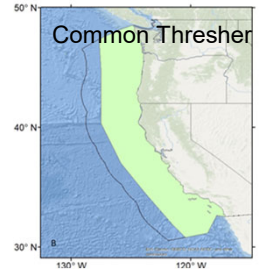
APPENDIX F

U.S. WEST COAST HIGHLY MIGRATORY SPECIES: LIFE HISTORY ACCOUNTS AND ESSENTIAL FISH HABITAT DESCRIPTIONS
(Originally Appendix A to the FMP)
U.S. West Coast Highly Migratory Species Plan Development Team
Pacific Fishery Management Council

Originally Available
January 16, 2003







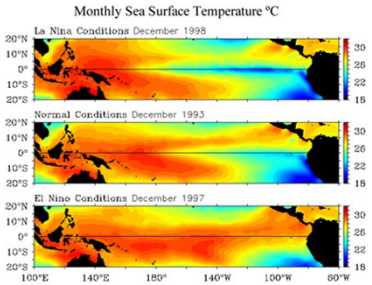
2) Dynamic mapping

Example Data Inputs:
1) Fisheries
2) Tracking
3) Survey
4) Environmental

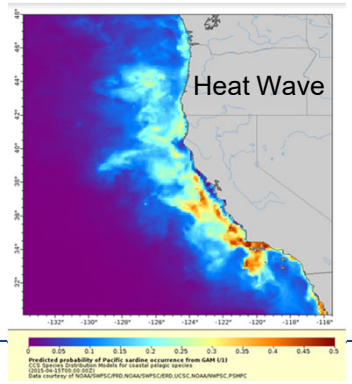
Species Distribution Models

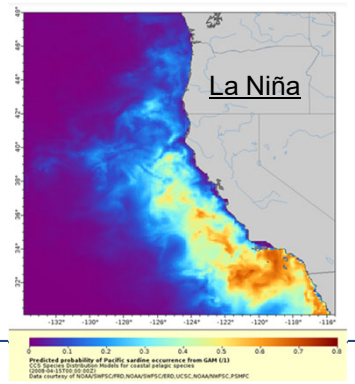
Hindcast: 1980-2018 CCLME

Post Process for
1) average,
2) El Niño,
3) La Niña, and
4) marine heatwave climatologies.



Output: E.G. Predicted Sardine Distributions

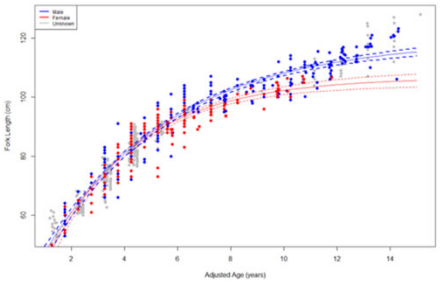




Life History Program Update: Albacore

Sex specific length-at-age and sex ratios: AFRF, HI Processors

- >100 Albacore Tuna heads (otoliths) from Central Pacific to determine sex ratios and sex-specific age and growth.
- Key data gaps in the stock assessment



Growth in males (blue) vs. females (red)

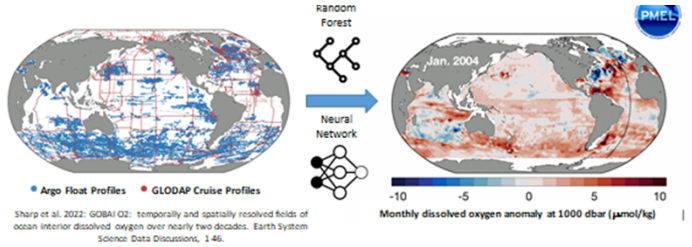
Time consuming task of extracting otoliths and tissues from 50 heads

Juvenile data: 180 juvenile albacore tuna: AFRF

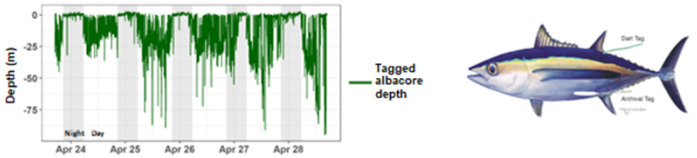
- Foraging ecology: 2022 showing lots of anchovy
- Validate length-at-age relationship

3D-Species Distribution Models: SIO, OAR

Collaborative project using Argo float data to improve understanding of drivers of HMS distribution in 3D



How does dissolved oxygen drive species distributions in 3D?



Life History Program Update: Bluefin

Foraging Ecology: Fishers, Processors, Texas A&M, UCSC, SAC

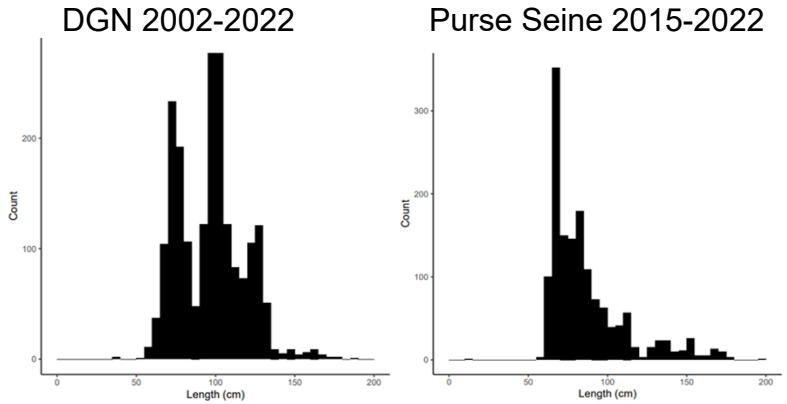
Dr. Travis Richards (postdoc) started WRAP/EBFM funded project "Using predator -prey dynamics to understand the high local abundance of an overfished tuna species."

1) Stomach contents: Extend the time series to present (2016-2022), examine environmental drivers
2) Stable Isotope Analyses: Integrated view over time and insight into trophic level
3) Condition: Determine health impacts of varying diets

Pic 2. Remains of 100+ anchovy found in the stomach of a Pacific bluefin tuna.

Commercially Landed Length-Weight Data: CDFW, SAC, WCR

- ISC PBFWG request: Working group paper on commercial length and weight data in the eastern Pacific
- A similar analyses of the recreational data shows that larger size classes are being landed than observed historically
- Same pattern apparent in the commercial data?
- Analyses underway

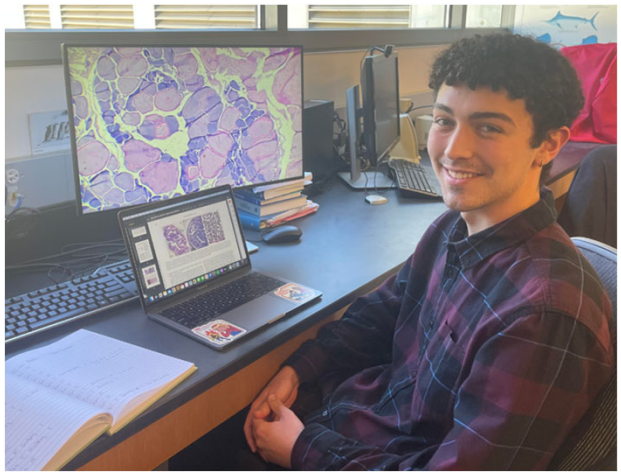


Length distributions over the years shown

Life History Program Update: Opah

Opah reproductive biology: COP

- Currently no information on size at reproduction or spatio-temporal spawning patterns for either opah spp.
- LHP has been collecting gonads opportunistically for years
- Undergrad staging backlog of ~200 histology samples
- Preliminary results indicate that the majority of females are mature and/or spawning
- Analyses ongoing



Sammy Duke staging ovaries

Dr. Oscar Sosa dissecting out the clavicle for examination

The saccule containing the otoliths (circled)

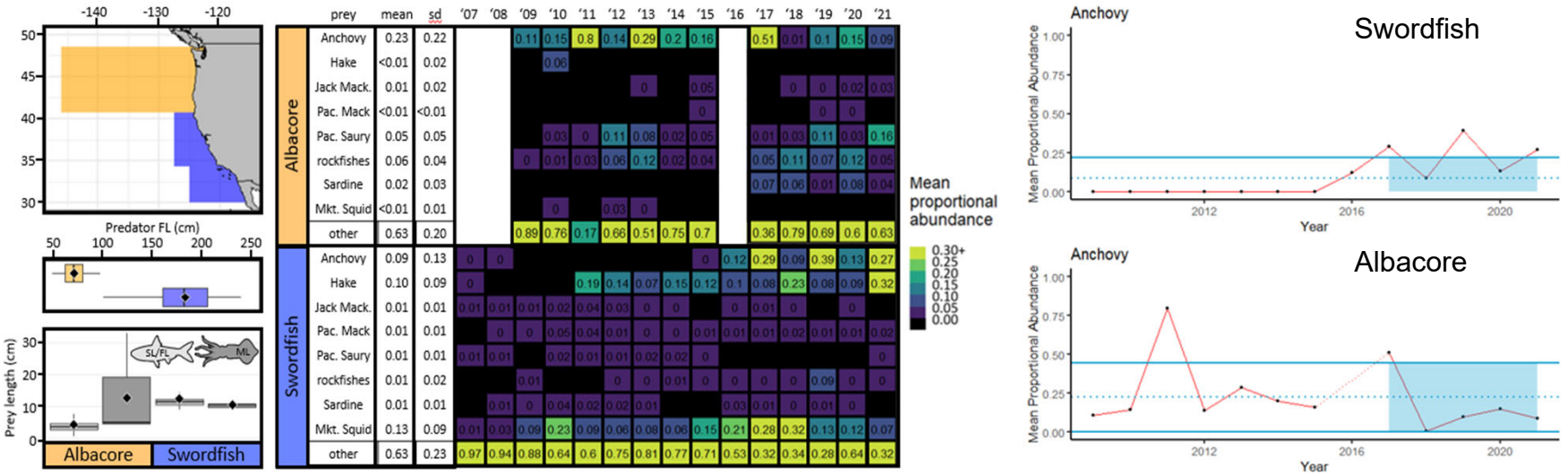
Opah age and growth: PIER, CICESE

- Currently no information on longevity or growth rate of opah; critical LH parameters
- Collaboration with PIER and CICESE to develop methods by comparing across hard parts
- Comparing fin spines, clavicle, otoliths and vertebrae
- Funded in part by S&T, EBFM

Life History Program Update: Foraging Ecology

Diet data, condition and growth information for ecosystem monitoring and management: Texas A&M, SAC, AFRF, Processors, Fishers, WCR

- Brought time series current for Albacore and Swordfish to allow incorporation into annual metrics of California Current Conditions (CalCOFI, CCIEA)[1, 2, 3]
- Bluefin will be current by the end of 2023
- Data also being used in Atlantic Ecosystem Models[4], EFH habitat designations[5], species distribution models[6], ESA status reviews[7, 8], etc.
- Multiple publications recently accepted or published on Albacore and Swordfish diets.
  Preti, A., et al. 2023, *PloS one*, *18*(2), e0258011. / Nickels et al in press. FIsheries Oceanography



Life History Program Update: References

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2) Weber, E. D., Auth, T. D., Baumann-Pickering, S., Baumgartner, T. R., Bjorkstedt, E. P., Bograd, S. J., ... & Zeman, S. M. (2021). State of the California Current 2019–2020: Back to the Future With Marine Heatwaves?. Front. Mar. Sci., 1081.
3) Harvey, C., Garfield, T. Williams, G. and N. Tolimieri, et al. (2022). 2021-2022 CALIFORNIA CURRENT ECOSYSTEM STATUS REPORT: A report of the NOAA California Current Integrated Ecosystem Assessment Team (CCIEA) to the Pacific Fishery Management Council, March 13, 2022: Agenda Item H.2.a CCIEA Team Report 1 (Electronic Only) https://www.pcouncil.org/documents/2022/02/h-ISC 2022
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5) Pacific Fishery Management Council (2003) U.S. WEST COAST HIGHLY MIGRATORY SPECIES: LIFE HISTORY ACCOUNTS AND ESSENTIAL FISH HABITAT DESCRIPTIONS (Originally Appendix A to the FMP) Pacific Fishery Management Council. https://www.pcouncil.org/documents/2007/06/hms-fmp-appendix-f-u-s-west-coast-highly-migratory-species-life-history-accounts-and-essential-fish-habitat-feis-appendix-a.pdf/
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7) Craig, M.T., Bograd, S.J., Dewar, H., Kinney, M.J., Lee, H.H., Muhling, B.A. and Taylor, B.L. (2017). Status review report of Pacific bluefin tuna (Thunnus orientalis). NOAA technical memorandum NMFS;NOAA-TM-NMFS-SWFSC ; 587; http://doi.org/10.7289/V5/TM-SWFSC-587
8) Young, C.N., Carlson, J., Hutchinson, M., Kobayashi, D., McCandless, C., Miller, M.H., Teo, S., and T. Warren (2016). Status review report: common thresher shark (Alopias vulpinus) and bigeye thresher https://repository.library.noaa.gov › noaa_17698_DS1

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Questions?