



Southwest Fisheries Science Center

Opah Science Summary and Research Activities

Presenter

Annie Yau, Fisheries Resources Division Director





Opah Science Outline

West Coast Fisheries

- Landings
- CPUE

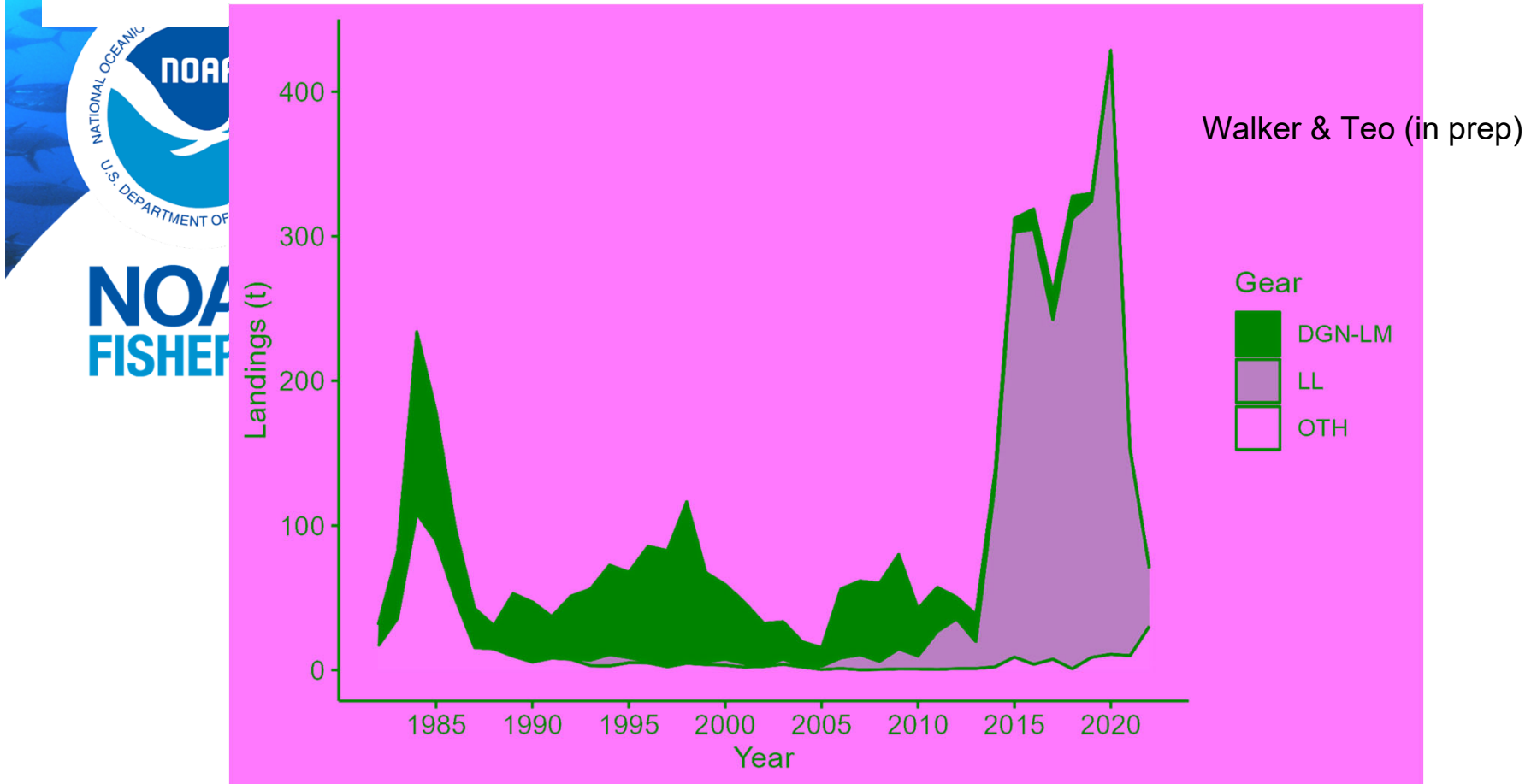
Species from Genetics

Life History

- Age and Growth
- Reproduction
- Modeled Distribution
- Species ID efforts
- Endothermy



Opah West Coast Landings by US fisheries

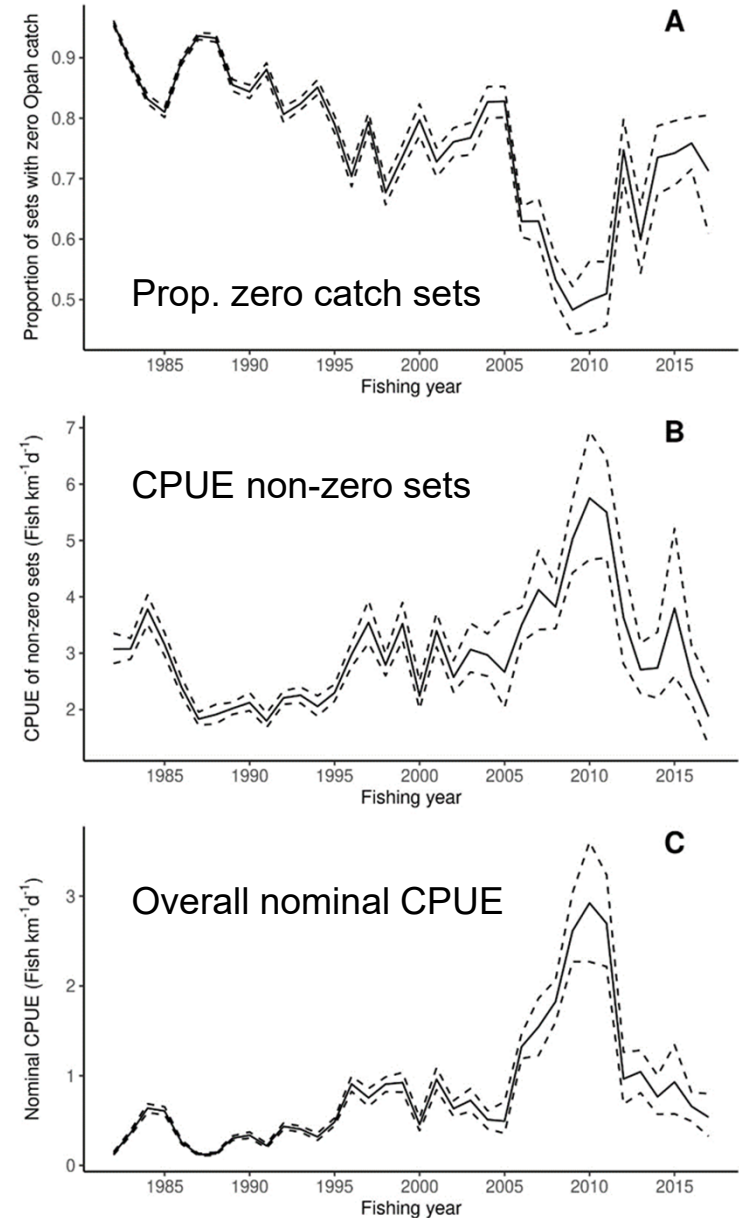


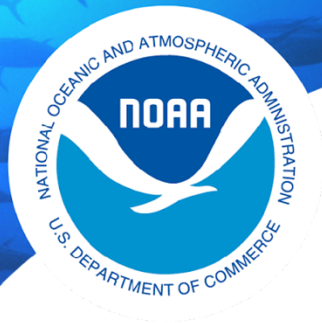
- PacFIN (1982 - 2022)
- Primarily large-mesh DGN (1982 - 2011), longline (2012-2022)
- Large declines in catch in 2021 - 2022
- Longline landings include both Smalleye and Bigeye Opah
- Large mesh DGN landings likely primarily Smalleye Opah

Opah CPUE

Walker & Teo (in prep)

- Large-mesh DGN logbook data used to study changes in Opah CPUE along California coast
- 1982 - 2017 (DGN effort too low after 2017)
- ~4-fold increase in CPUE from 1982 to 2017
- Peak CPUE in 2010 was ~22-fold higher than 1982
- DGN CPUE trends not considered representative of population trends due to very small spatial coverage relative to stock distribution
- Drivers of CPUE trends unclear; Potentially due to long term shifts in distribution?





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FISHERIES**

Opah Species from Genetics

DNA barcoding provides support for a cryptic species complex within the globally distributed and fishery important opah (*Lampris guttatus*)

JOHN R. HYDE,* KAREN E. UNDERKOFFLER† and MEAGAN A. SUNDBERG†

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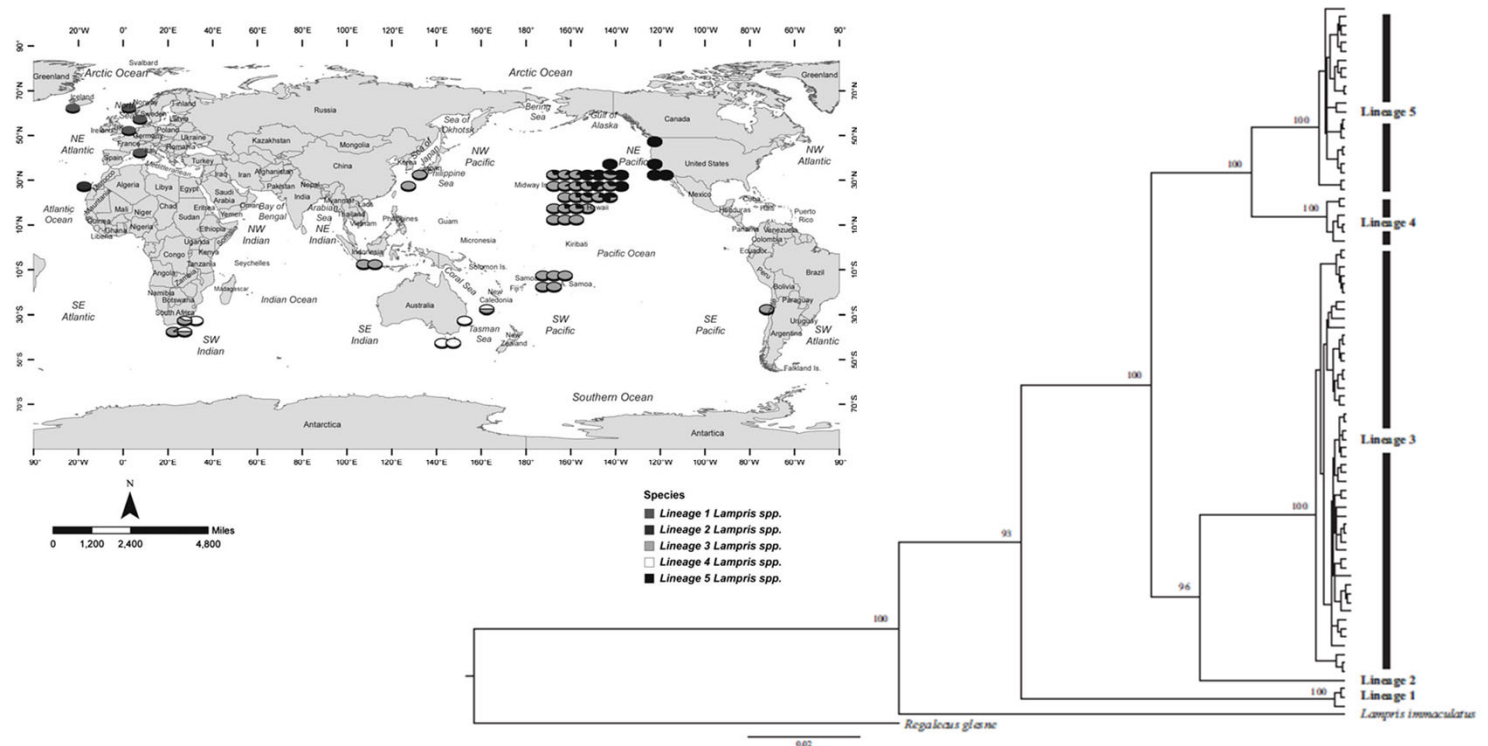
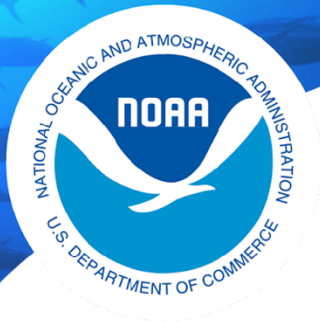


Fig. 3 Bayesian-derived tree with maximum posterior probability for cytochrome c oxidase I gene haplotypes found in this study. Values above nodes represent posterior support values. Lineage names for each of the clades present in this figure are referred to in Figs 4 and 5. Sequence data from *Lampris immaculatus* (GenBank DQ108066) and *Regalecus glesne* (SIO 97-226) are used as out-groups.

Opah Species from Genetics Continued



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A taxonomic review of *Lampris guttatus* (Brünnich 1788) (Lampridiformes; Lampridae) with descriptions of three new species

KAREN E. UNDERKOFFLER^{1†}, MEAGAN A. LUERS^{1‡}, JOHN R. HYDE² & MATTHEW T. CRAIG^{2,3}

A. *Lampris immaculatus*

A. *Lampris guttatus*

A. *Lampris australensis*

A. *Lampris Lauti*

Bigeye opah

A. *Lampris megalopsis**

Smalleye opah

A. *Lampris incognitus**

*Central and Eastern Pacific

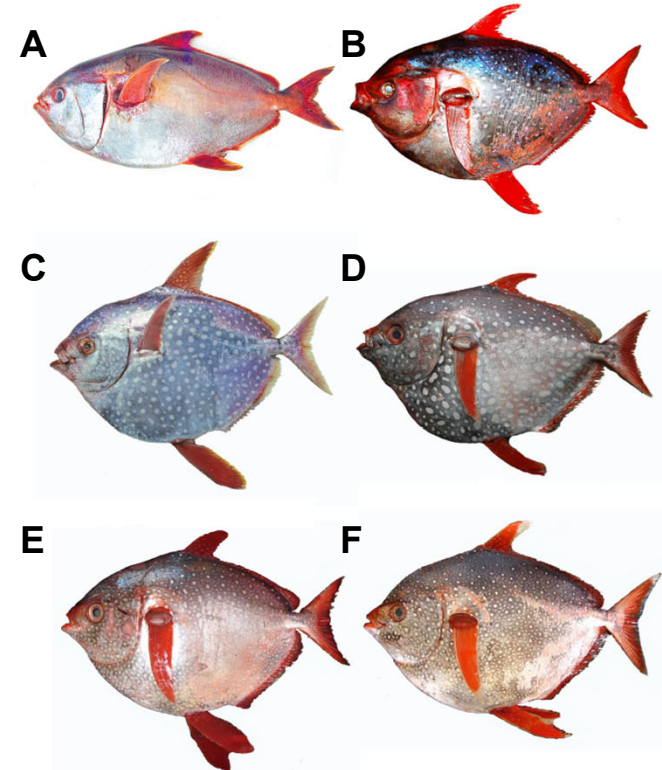


FIGURE 4. Species of the genus *Lampris*. A) *Lampris immaculatus**, B) *Lampris guttatus*, uncatalogued, 118 cm TL*, C) AM 124492-001, holotype, *Lampris australensis* n. sp., 67.3 cm SL, D) MMF 42253, *Lampris lauta*, 90.5 cm SL, E) USNM 402733, holotype, *Lampris megalopsis* n. sp., 85.3 cm SL, F) USNM 402731, holotype, *Lampris incognitus* n. sp., 82.8 cm SL. (*Photograph by Dianne J. Bray, *Lampris immaculatus* in Fishes of Australia, accessed 17 Feb 2018, <http://fishesofaustralia.net.au/home/species/1503>) (†Photograph courtesy of Patrice Francour).

Opah Age and Growth

Heidi Dewar, Chugey Sepulveda (PIER) and Oscar Sosa (CICESE), Ensenada, Mexico



Problem: No method to estimate age for opah

Method:

Working with CICESE and PIER we are comparing age estimates across hard parts

Results:

Banding in vertebrae clear/ shows promise

Reabsorption at center/ less useful

Vertebrae



Otoliths/



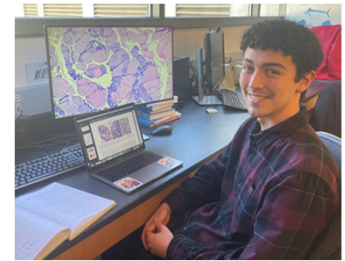
Spine

Funded by:

Office of Science and Technology/ International Science

Opah Reproduction

Samuel Duke (UCSD Student), Brad Erisman and Heidi Dewar



Problem: No data on opah reproduction available in the North Pacific

Approach: From 2014-2020, 327 opah examined (23-177 kg)

Results

Histology analyses conducted on 128 females

Coastal (n=49): No spawning and 5 immature

Offshore (n=63 Smalleye and 16 Bigeye): 1 immature

- Smalleye: Majority in spawning condition; spawning evident in all quarters
- Bigeye: Spawning also observed (low n)

Implications:

- Both species spawning in offshore fishing grounds
- No spawning in the CCLME, consistent with other HMS
- Size at first reproduction occurs in fish smaller than 23 kg
- Additional sample collection needed

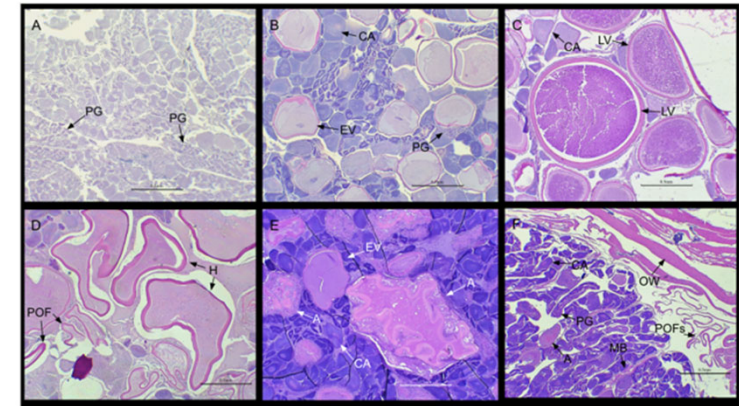


Figure 1. Photomicrographs of ovarian histology, illustrating the reproductive phases of the opah. (A) Immature Phase (PG = Primary Growth oocyte); (B) Developing Phase (EV = Early Vitellogenic oocyte, CA = Cortical alveolar oocyte); (C) Spawning Capable Phase (LV = Late Vitellogenic Oocyte, POF = Post-ovulatory follicle); (D) Actively Spawning subphase of Spawning Capable Phase (H = Hydrated oocyte); (E) Regressing Phase (A = Atresia); (F) Regenerating Phase (OW = Ovarian Wall, MB = Muscular Bundle).

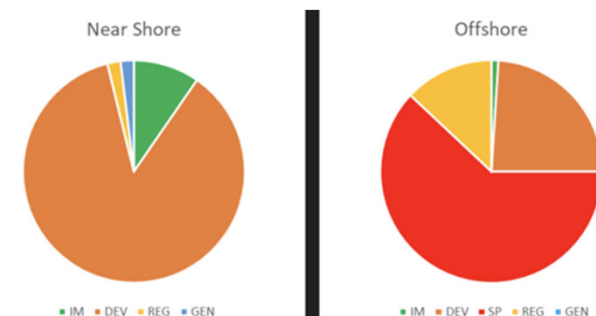


Figure 2. The proportion of opah in each developmental phase that were sampled from

Unpublished Data/ Manuscript in prep

Modeling Distributions



Spatiotemporal catch patterns and population distributions of bigeye Pacific opah (*Lampris megalopsis*) and smalleye Pacific opah (*L. incognitus*) in the eastern North Pacific Ocean.

Cooper, R., Dewar, H., Muhling, B. A., Teo, S. L., Hyde, J., & Bigelow, K. (2022). Fish. Bull. 120:138–149 (2022)

Combined CPUE from longline logbook and observer data with some genetically IDed species samples to model distribution of 2 opah species in Central and North Pacific

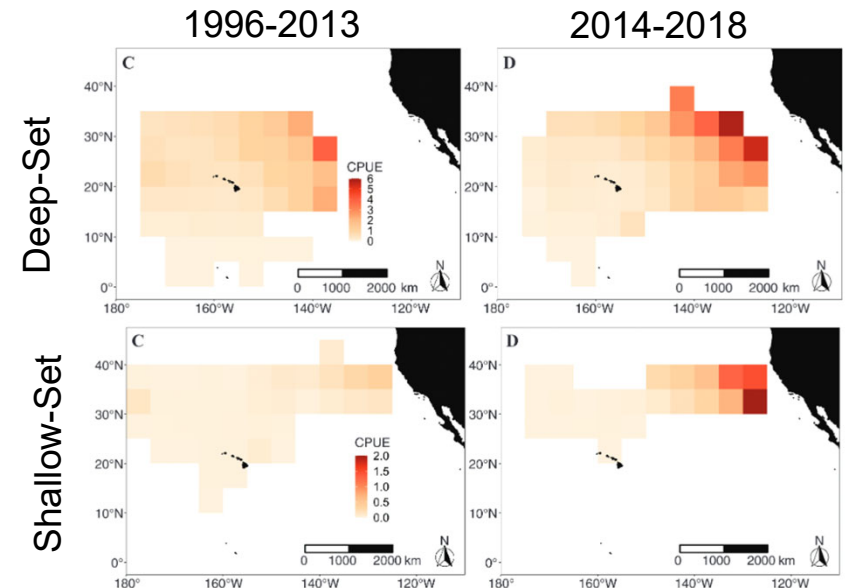
Model results:

- Bigeye Pacific Opah is generally west of 140°W
- Smalleye Pacific Opah is generally east of 130°W
- Opah CPUE deep-set fishery > shallow-set
- Opah CPUE increased as fishery moved east on both gears
- Higher CPUE where Smalleye Opah dominate (~10 fold).

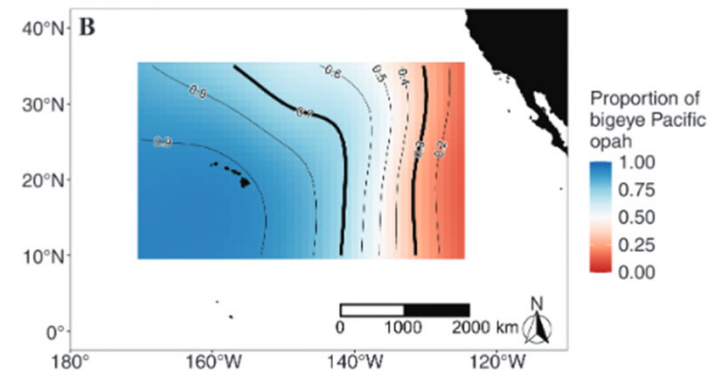
Implications:

- The catch of Smalleye Opah has increased offshore
- Study highlights the need for species specific information

SWFSC & WCR developing key for visual ID



Modeled CPUE deep (top) and shallow –set (bottom) LL fisheries



Relative abundance of the two species

Observer Identification Key

Problem: Two opah species look very similar and can be difficult to distinguish visually. Genetic ID at large scale is labor intensive and expensive

Poses challenges for collecting species specific catch data

Approach:

1. With WCR observer program, matching visual and genetic IDs to develop key
2. Key will be shared with HI observer program
3. Continued genetic validation of a subset necessary

Results:

Relative eye size, tail shape and tongue color show promise

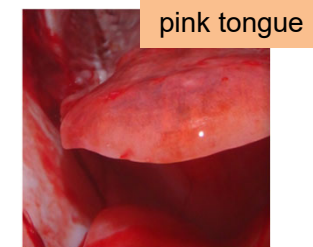
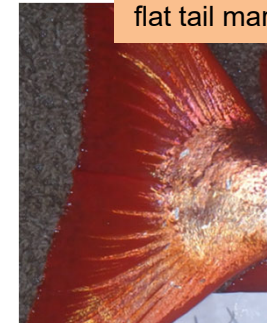
Goal:

Species specific catch data throughout U.S. Pacific longline fisheries

Smalleye Opah



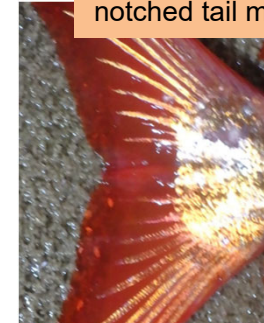
flat tail margin



Bigeye Opah

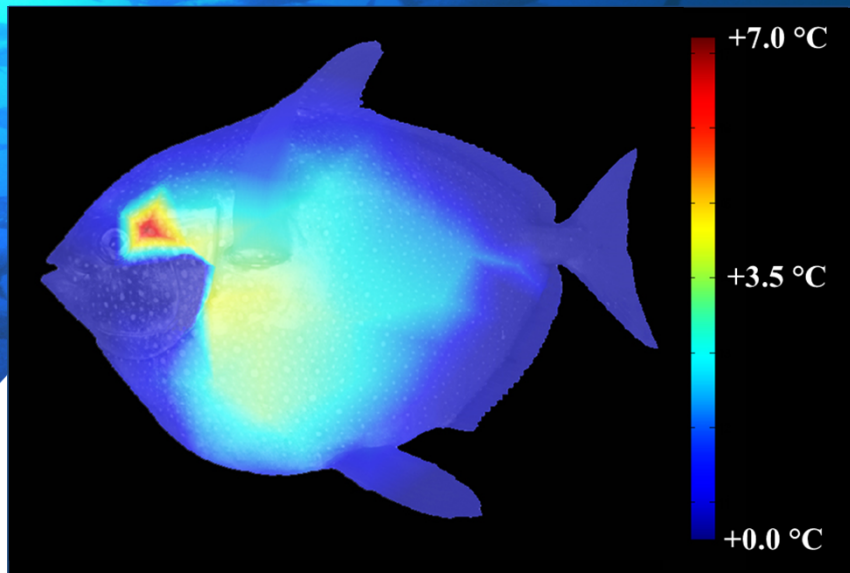


notched tail margin



Opah Endothermy

- Warm body core and eye/brain region
- Increases metabolic rate, digestion, swimming speed, and likely growth rates
- Allows opah to maintain physiological performance at depth and remain below the thermocline



Opah internal body temperature profile

Depth distribution of an opah in comparison to that of the regional-endothermic albacore tuna. Circulation of warm blood throughout the entire body (including the heart) allows opah to spend more time at depth affecting catchability and targeting gear.

Wegner et al. (2015)

