AGE AND GROWTH OF STRIPED MARLIN (KAJIKIA AUDAX) CAUGHT IN THE HAWAIIAN-BASED LONGLINE FISHERY
Striped marlin, *Kajikia audax*

- Most widely distributed species of marlin, sailfish, and spearfish (Istiophoridae)
- Two - five semi-independent stocks in the Pacific Ocean
- Most commercially valuable species of Istiophorid billfish caught in longline fisheries
- ~4000 mt harvested per year in US Western and Central Pacific
- Biomass of striped in the north Pacific has declined to approximately 6% -16% of 1952 levels (Piner et al. 2007; Brodziak and Piner 2010)
Age and growth of striped marlin:

- PFRP funded in 2010 with sample collections by NOAA PIFSC

North and South Pacific stocks of striped marlin with potential for more sub-structure in eastern Pacific (McDowell & Graves 2008; Purcell et al. 2011)

Southwest Pacific Ocean
- Age and growth of striped marlin in the SWPO (Kopf et al. 2011; ICES J. Mar. Sci.)

Primary distribution (dark blue), Occasional distribution (light blue) Study regions (red circles)
Do North and South Pacific Striped Marlin Stocks Exhibit Different Growth Rates?

- **HA. COMM. LL**
  - Mean = 1776 mm LJFL
  - Approximately 35 kg whole weight

- **AUS. COMM. LL**
  - Mean = 2229 mm LJFL
  - Approximately 78 kg whole weight
**Methods**

**Hawaii striped marlin:**


First dorsal and anal fin spines (cleaned, dried, and embedded in polyester resin. Sections made relative to maximum condyle width (Kopf et al. 2010)

Transverse sections of otoliths from juveniles ground and polished by hand. Daily micro-increments viewed at ~1500X magnification and counted on digital images made along the counting path.
Validation and Precision

- **Edge type and Marginal Increment Analysis**
  - Peaked in summer for females and males and was lowest Autumn or winter.
  - Age classes 1-2 only

- **Daily Otolith Age estimates corroborated against first annulus**
  - Daily age estimates up to 499 day but average precision decreased significantly after 389 days
    - +/- 8 days up to 389 days

- **Coefficient of Variation in dorsal fin spine age estimates**
  - Ranged from a median of 8% within the principal reader to 14% between readers.
  - 16% of spines considered unreadable
Age composition of striped marlin based on fin spine age estimates

![Age composition of striped marlin based on fin spine age estimates](image-url)
Daily otolith age estimates

$R^2 = 0.6675$

$N=44$
- Modes in length frequency corroborated by otolith daily micro-increments up to 1 year

- Confirm rapid growth to approx. 103 EFL by 6 months old and 135 EFL by 12 months old

- Follow age-classes from 6 months old to 2.0 years given a strong cohort.
Length modes corroborate fin-spine and otolith daily age estimates up to age 1

1432 mm LJFL –
Median length-at-age one estimated from fin spines

1533 mm LJFL –
Modal length-at-age one corroborated by otolith daily micro-increments. Pooled across years.
Are regional differences in size-at-age real?

North Pacific
1967mm LJFL
Age 8 years
Melo-Barrera et al. (2003)

Southwest Pacific Ocean
2587 mm LJFL
Age 8 years
Kopf et al (2011)
## Median size-at-age (LJFL, mm)

<table>
<thead>
<tr>
<th>Age</th>
<th>Hawaii Present study combined</th>
<th>Hawaii Skillman and Yong (1976) female</th>
<th>Mexico Melo-Barerra et al. (2003) combined</th>
<th>Southwest Pacific Ocean Kopf et al. (2011) female</th>
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</table>
Conclusions

- Three to four age-classes of striped marlin present in the Hawaii-based commercial longline fishery

- Sexual growth dimorphism is minor but females usually larger and older than males

- Differences in size structure of striped marlin in the Pacific Ocean appear largely due to spatial differences in age structure but may be differences in asymptotic size or maximum age/longevity.
  - Compensatory growth response?
  - Food quality or availability?
  - History of exploitation
Acknowledgements

- Pelagic Fisheries Research Program
- NOAA, Pacific Islands Fisheries Science Center
- Pacific Island Regional Observer Program