Age and growth of striped marlin (*Kajikia audax*) caught in the Hawaii-based longline fishery

Photograph by: William Boyce

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Striped marlin, *Kajikia audax*

- Most widely distributed species of istiophorid billfish
- Most commercially valuable species of istiophorid billfish caught in longline fisheries
- Life history information lacking for the North Pacific
- Biomass of striped in the North Pacific has declined significantly from 1952 levels (Piner et al. 2007; Brodziak and Piner 2010)
- ISC is currently conducting a North Pacific stock assessment
Age and growth:

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

**Central North Pacific – HI**
- PFRP funded in 2010 with sample collections by NOAA PIRO-PIFSC
- Completion due September 2012.
OBSERVER SAMPLING
Hawaii-based longline fleet (2009-2011)
**Methods**

**Dorsal Spines**
4\(^{th}\) dorsal fin spines (cleaned, dried, and embedded in resin. Sections made relative to max. condyle width (Kopf et al. 2010)

**Sagittal Otoliths**
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.
Spine Radius vs Body Length Relationship
Striped Marlin – Hawaii

\[ y = 49.033x^{0.531} \]

\[ R^2 = 0.8343 \]
HAWAII FISHERY

- Modes in length frequency aged by otolith daily microincrements
- Confirms rapid growth to ~103 EFL by 6 months old and 135 EFL by 12 months
- Progression of age-class modes from 6 months old to 2.0 years with strong cohort
Preliminary von Bertalanffy Growth Model (Sexes Combined)

**$L_\infty$ Unconstrained**

$\begin{align*}
L_\infty & = 160 \\
k & = 1.82 \\
t_0 & = -0.012
\end{align*}$

**$L_\infty$ Constrained**

$\begin{align*}
L_\infty & = 210 \\
k & = 0.60 \\
t_0 & = -0.55
\end{align*}$
Growth Curves (Pacific Ocean)

- Present study Linf. Min 210 EFL
- Kopf et al. 2011, female, observed
- Kopf et al. 2011, male, observed
- Melo-Barrera et al. (2003), both sexes
- Skillman and Yong (1976), female, model 1
- Skillman and Yong (1976), male, model 1
Hawaii and Australia Striped Marlin Catches
Length Frequency Distributions

- **HA. COMM. LL**: Mean=1776 mm LJFL, ~35 kg whole weight
- **AUS. COMM. LL**: Mean=2229 mm LJFL, ~78 kg whole weight
Are these differences real?

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

South Pacific - Australia/NZ
2551 mm LJFL
Age: 8 years
Kopf et al. (2011)
## 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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Preliminary Conclusions

1. 3-4 age-classes of striped marlin present in the Hawaii-based commercial longline fishery

2. Sexual growth dimorphism is minor but females usually larger than males

3. Large difference in size structure of striped marlin between Hawaii and Australia longline fisheries due to differences in age structure and growth rate
Future Efforts

- Finish processing 2011 dorsal spines and otoliths
- Fill gaps from previous years:
  - Marginal increment analysis (indirect validation)
  - Matching fin-spines and otoliths from striped marlin less than 120 EFL (corroboration)
  - Sample larger fish?
- Re-evaluate $L_\infty$ constraint on vonB growth model
- Intercalibration study between regions
Acknowledgements

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- NOAA, Pacific Islands Fisheries Science Center, Aiea Heights Research Facility