Projecting U.S. west coast sablefish (Anoplopoma fimbria) recruitment under global climate change scenarios

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Background

- Widely distributed across the NE Pacific
- US west coast treated as a single stock
- Winter deep water spawners
- Pelagic larvae inhabit offshore waters before migrating inshore to settle as demersal juveniles

Photo: Wade D. Smith
Environmental Drivers of Recruitment

- Zooplankton abundance
  (Schirripa and Colbert, 2006)

Mechanism:
- Sablefish recruitment is driven by feeding conditions during the pelagic life stages.
- Feeding conditions can be indexed by sea level.
Environmental Drivers of Recruitment

- July sea level in Crescent City, CA (Schirripa and Colbert, 2006)
  — Tide Gauge
- Sea level integrates regional wind forcing, temperature anomalies, and coastally trapped phenomena
Stock Assessment Applications

- Continuing validation
  - Bootstrap, jackknife, and removal of recent values (Schirripa and Colbert 2006, Schirripa 2007).
  - Randomization tests (Stewart et al., 2011).
- 2007, 2011 stock assessments considered the April-June average sea level between Newport, OR and Neah Bay, WA.
- ~35% of the variance in recruitment explained
2011 Stock Assessment Results: Sea level as a Survey Index of Recruitment
Motivation

- Uncertainty in future environmental conditions of the California current ecosystem should be considered a significant source of uncertainty in all projections of stock status.
- IPCC GCMs can provide projections of future environmental conditions that are relevant to sablefish.
- Identifying changes in productivity before they occur can allow for improved management/industry planning.
Goals

1. Investigate the ability to move from the currently used local environmental covariate and larger scale sources of sea level information such as those produced by SODA for past conditions and IPCC-class climate models for future conditions.

2. Produce long term projections of the sablefish population under alternative global climate change scenarios using the 2011 stock assessment to assess possible directional changes in sablefish recruitment on multi-decadal time scales.
Modeling stock-recruitment-sea level: Population dynamics
Local v. large scale sea level

Historical Time Series

![Graph showing standardized SSH over time for TideGauge and SODA](image-url)
GCMs with Monthly Sea Level

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IPCC sea level: A1B
Projections of Recruitment

Age-0 recruits (millions)

Year

- 1900
- 1950
- 2000
- 2050

Dynamics
MIROCM
MIROCH
NCAR
CCCP
GFDL2.1
GFDL2.0
HADGEM
Conclusions

• Projections assumption of stationary in sea level-recruitment relationship

• Single species stock assessments have the ability to incorporate environmental relationships.

• Utility of the relationship is in the application to long term strategic projections

• Sablefish recruitment under a1b scenario likely to be variable but does not generally show strong trends