

North Pacific Swordfish Stock Status and Trends

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Western Pacific Regional
Fishery Management Council

ECOSYSTEM-BASED MANAGEMENT OF FISHERIES
IN THE U.S. PACIFIC ISLANDS



Western and
Central Pacific
Fisheries
Commission

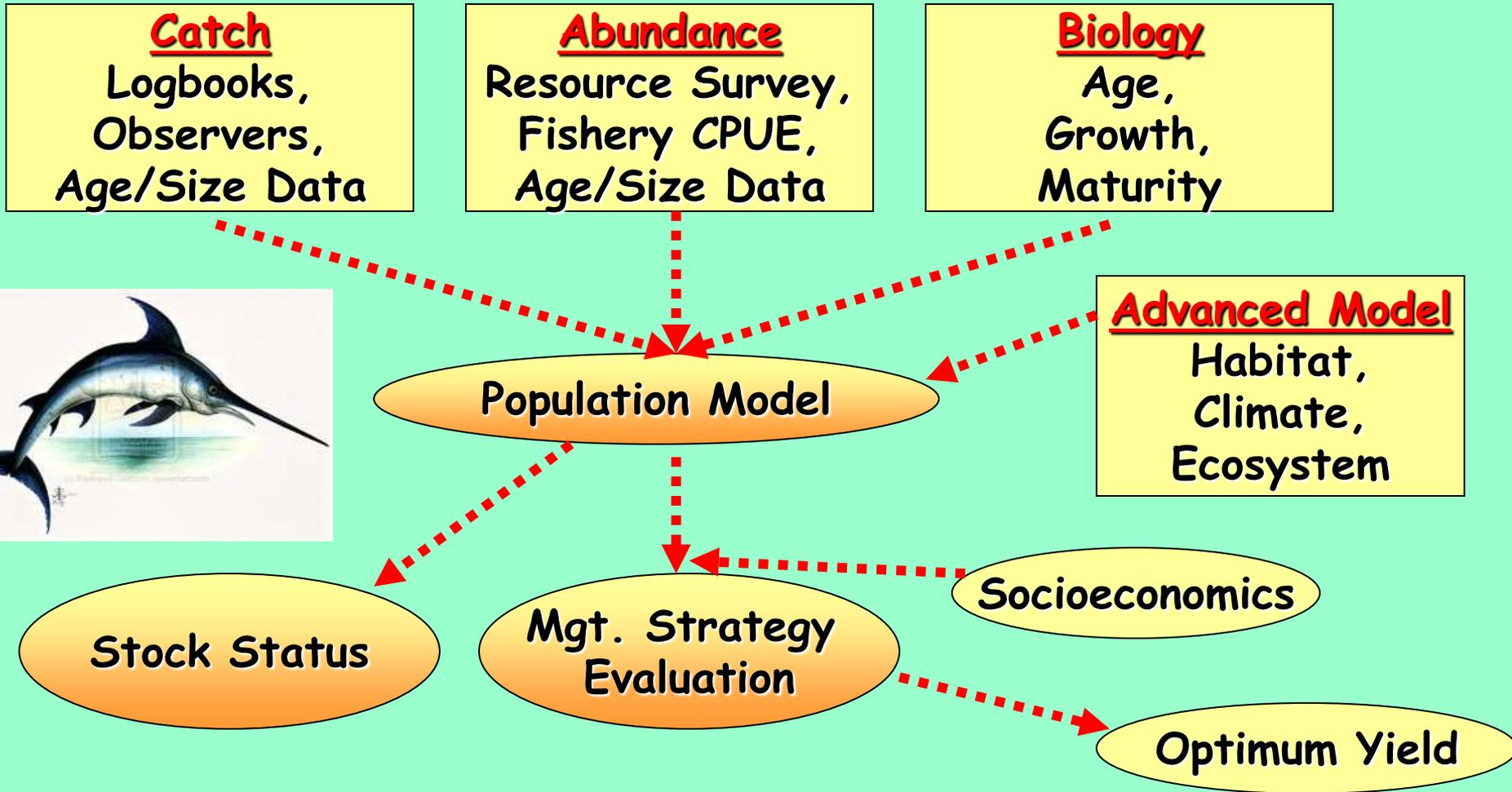


Overview

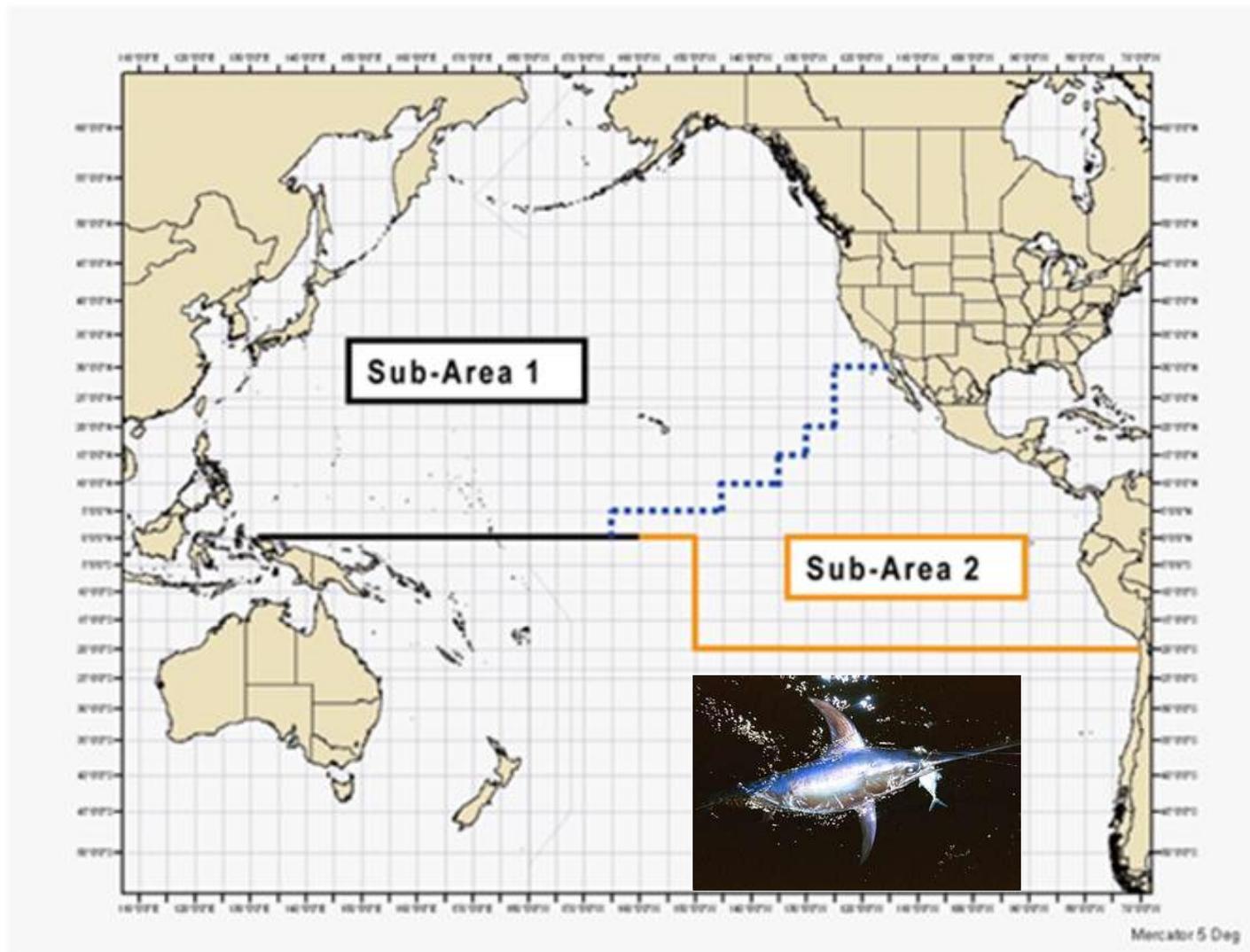
- **North Pacific swordfish assessment**
- **Total quality improvement**
- **Future research directions**



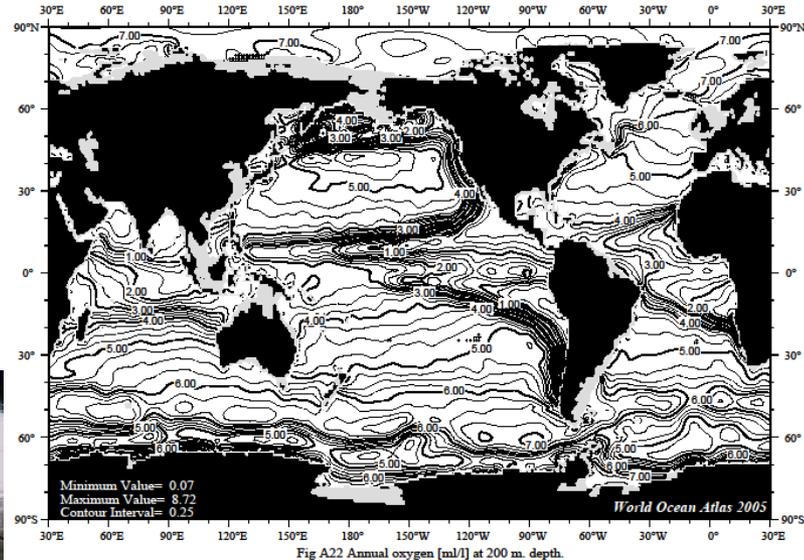
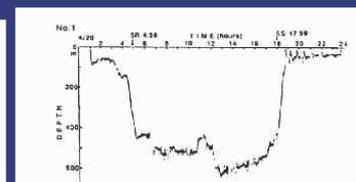
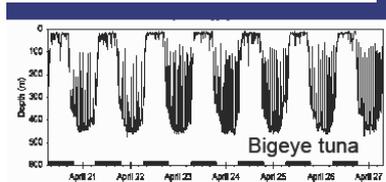
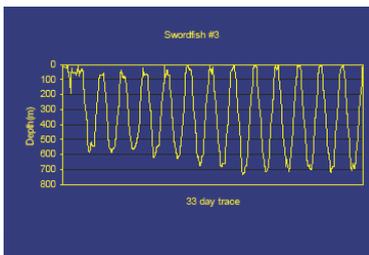
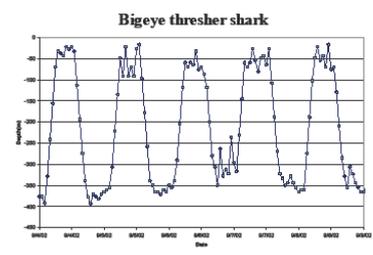
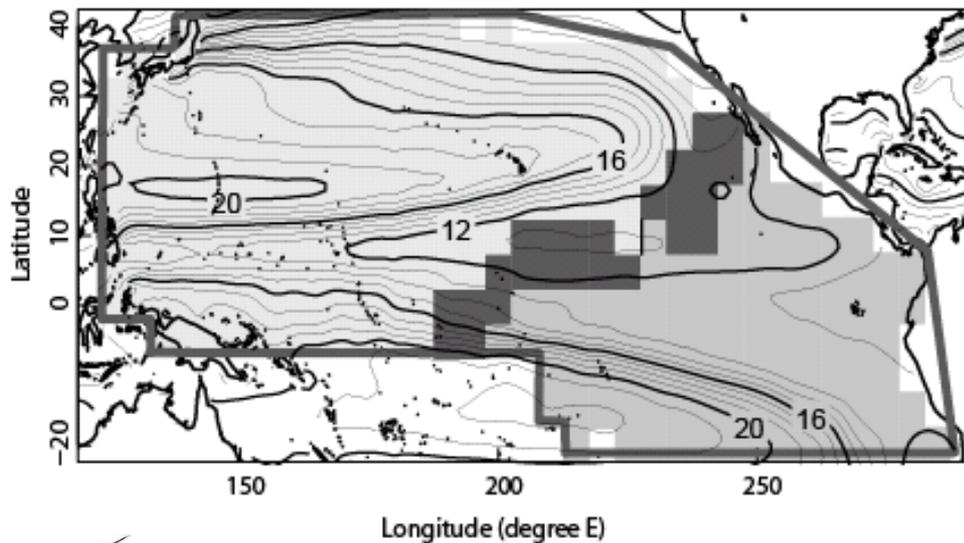
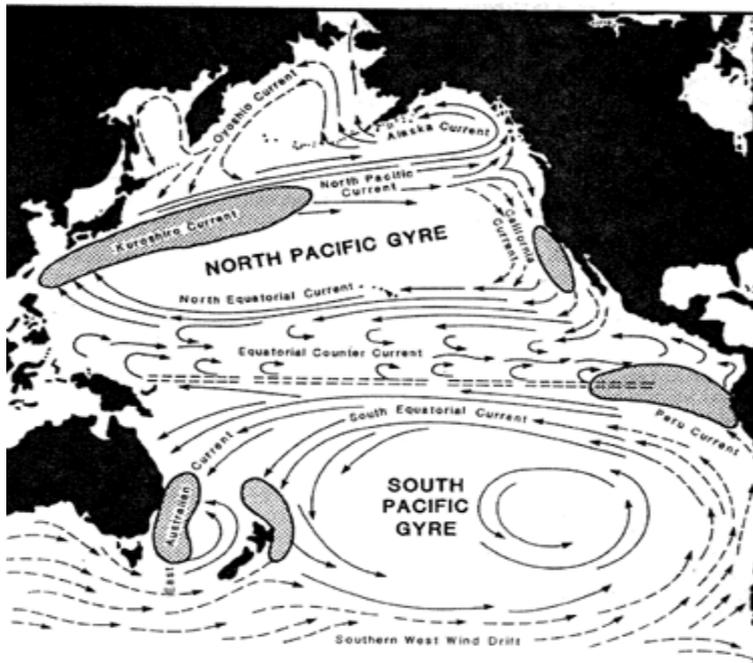
Stock Assessment and Management Strategy Evaluation Process



North Pacific Swordfish Stock Structure



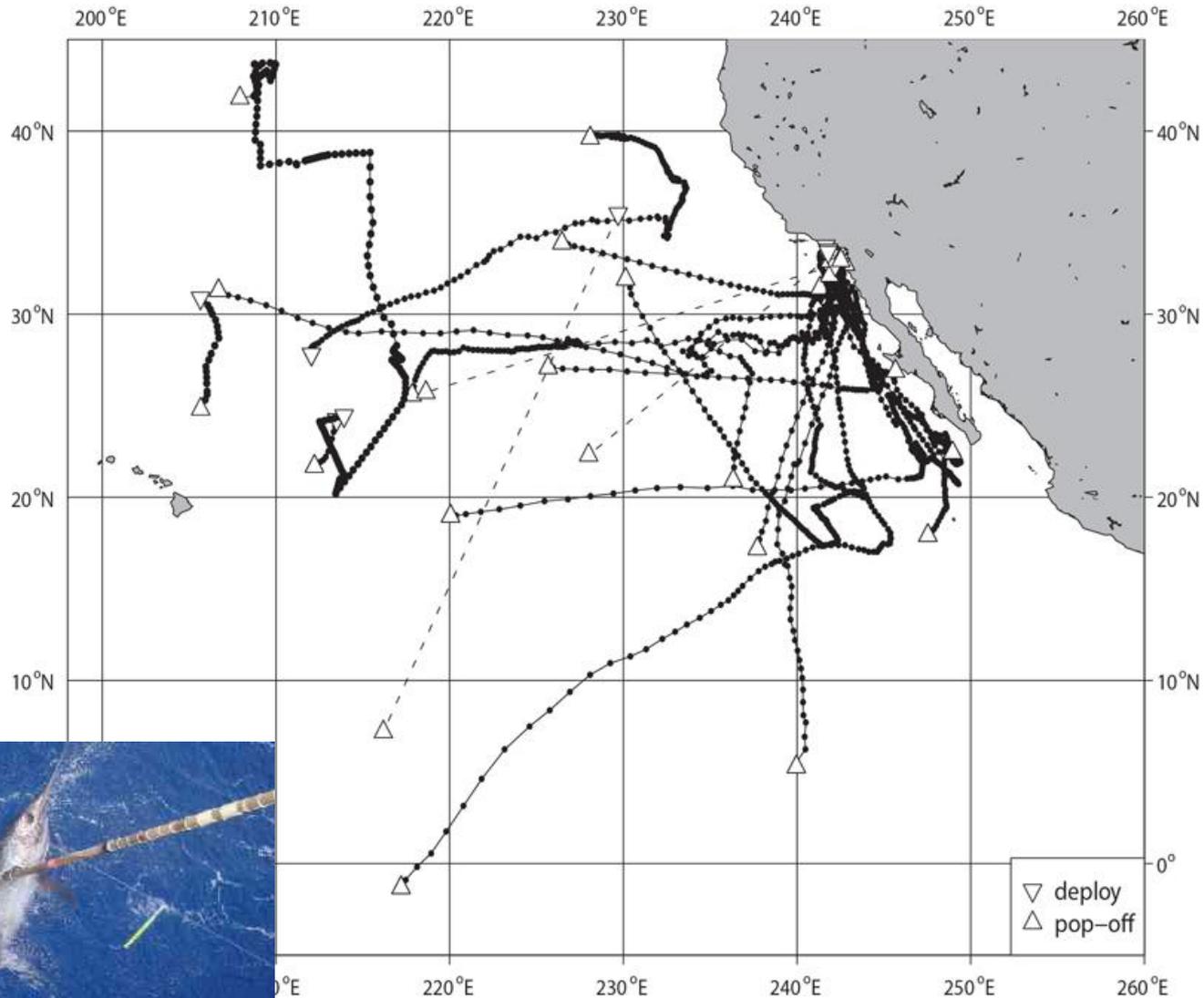
North Pacific Swordfish Stock Structure



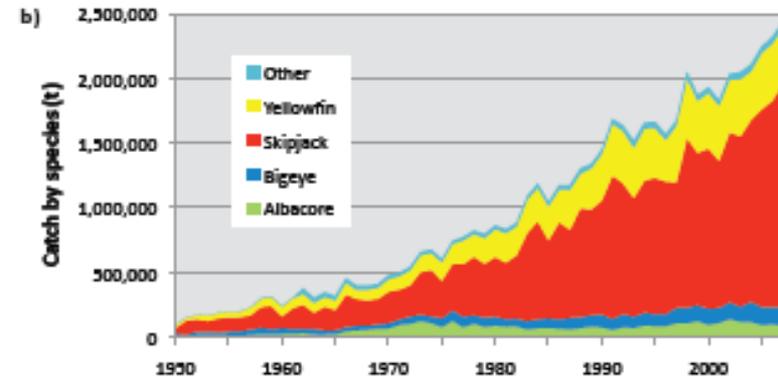
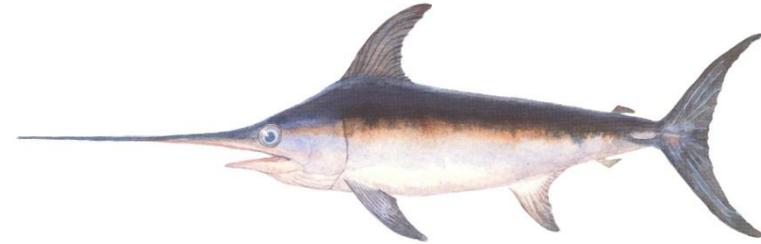
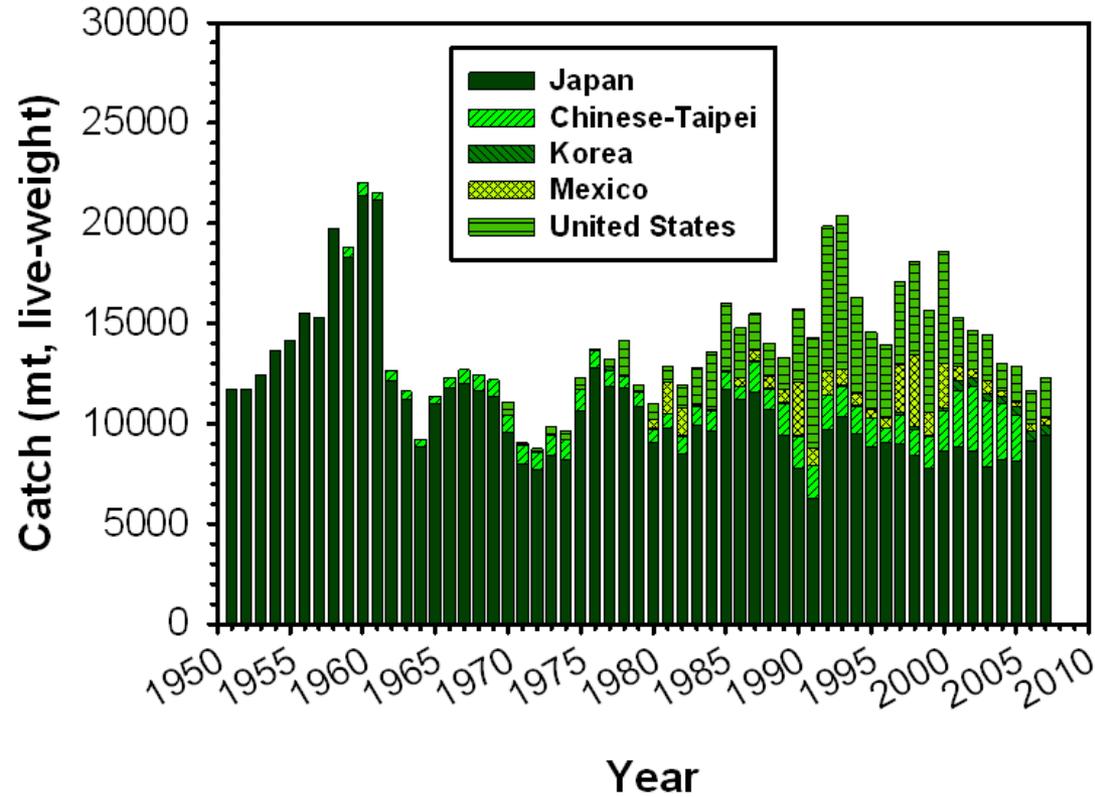
There is a "guild" of large pelagic predators that have evolved remarkably similar behaviors!

From: Y. Nakamura, 1993

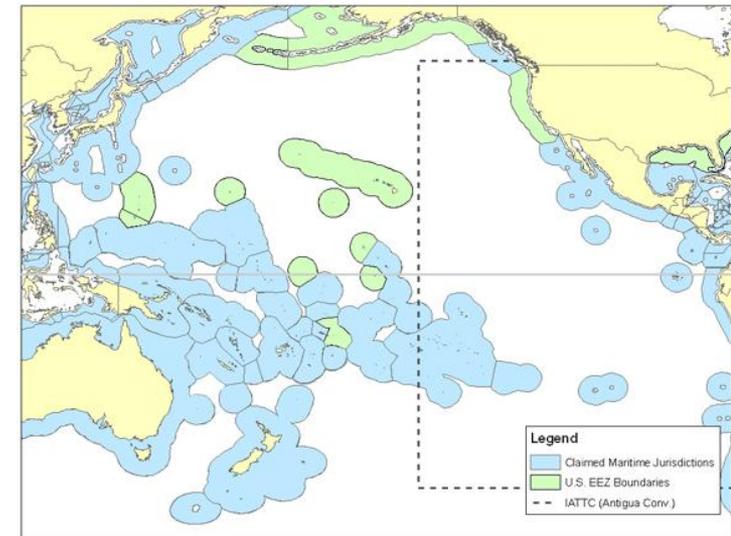
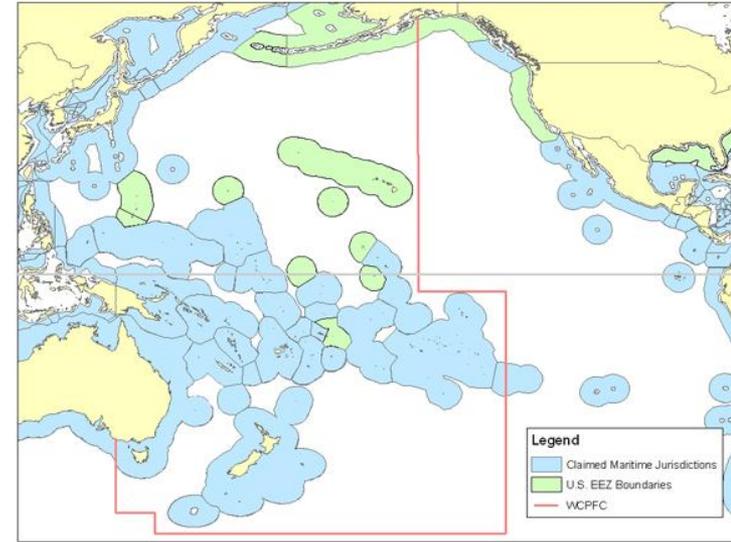
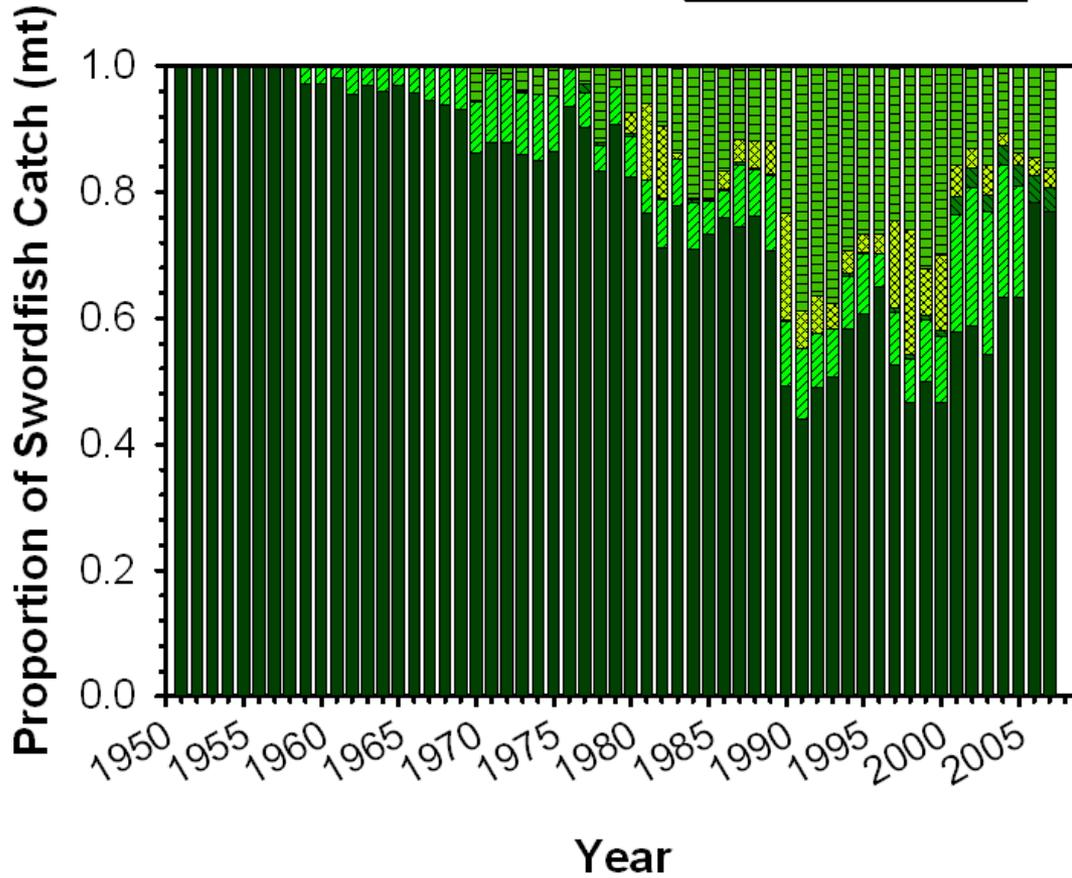
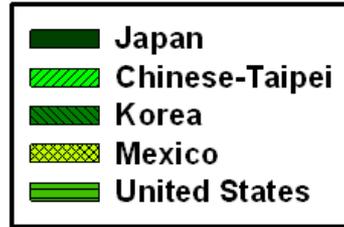
North Pacific Swordfish Stock Mixing



Trends in Catch of North Pacific Swordfish By Country

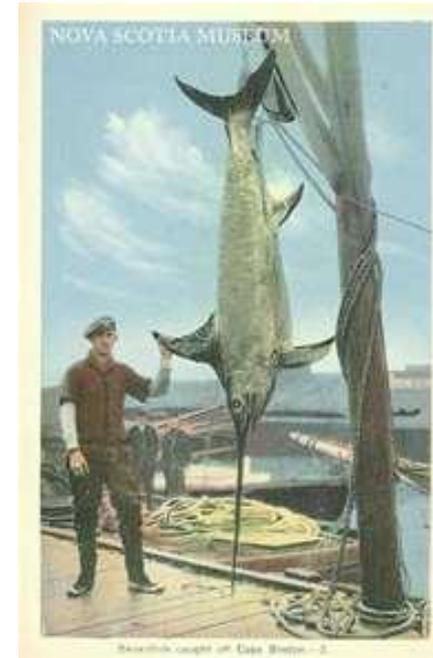
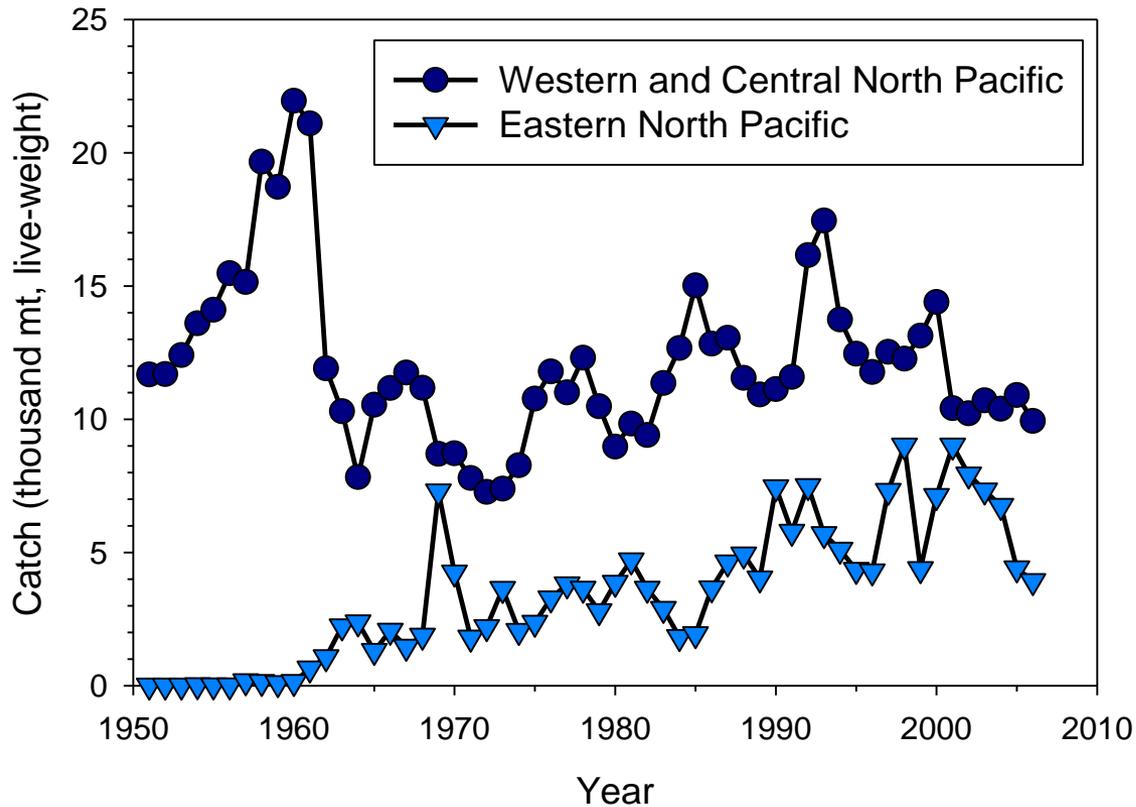


Trends in Proportion of North Pacific Swordfish Catch By Country



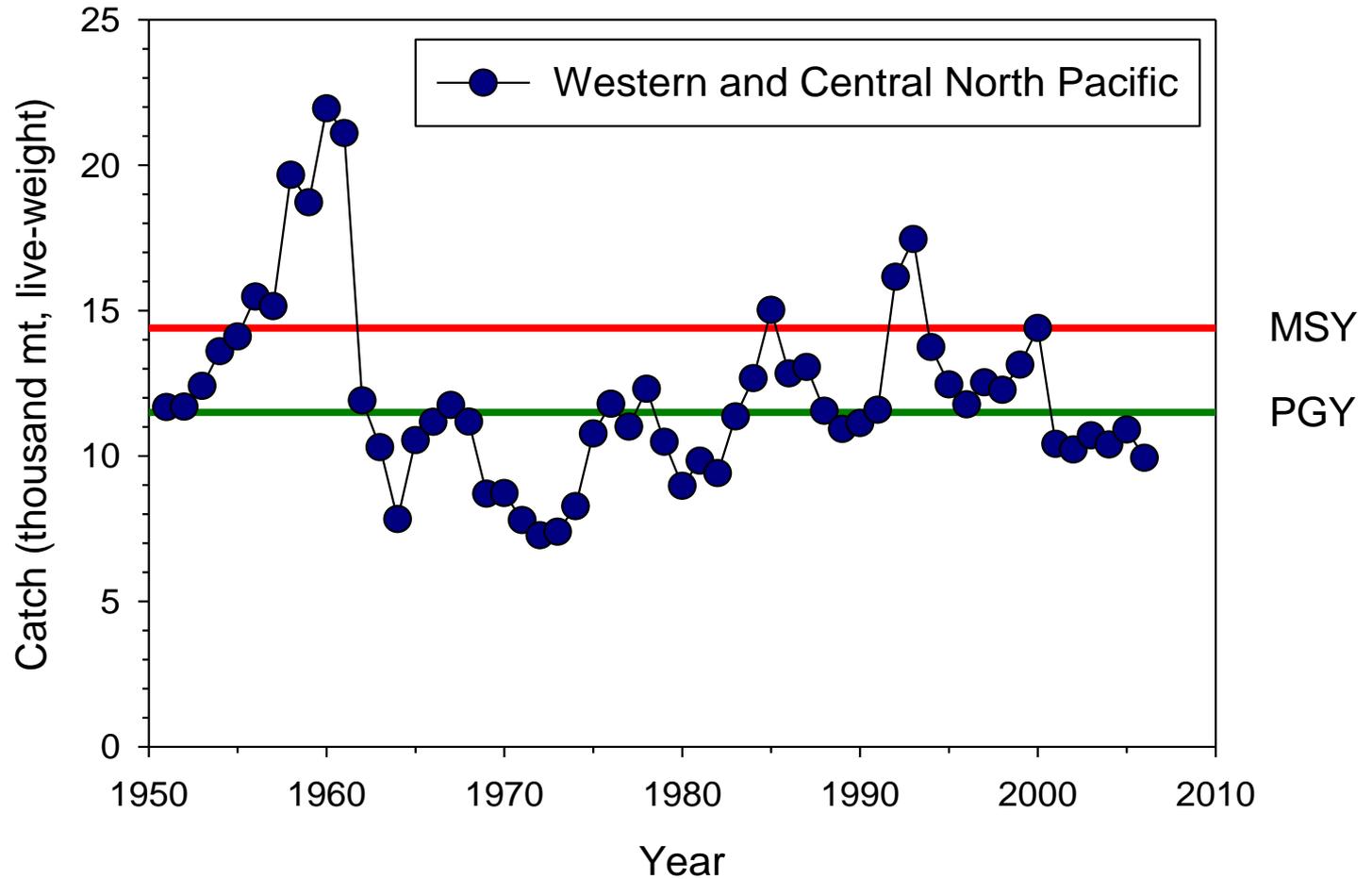
Trends in North Pacific Swordfish Catch By Stock Area

North Pacific Swordfish Catch by Stock Area



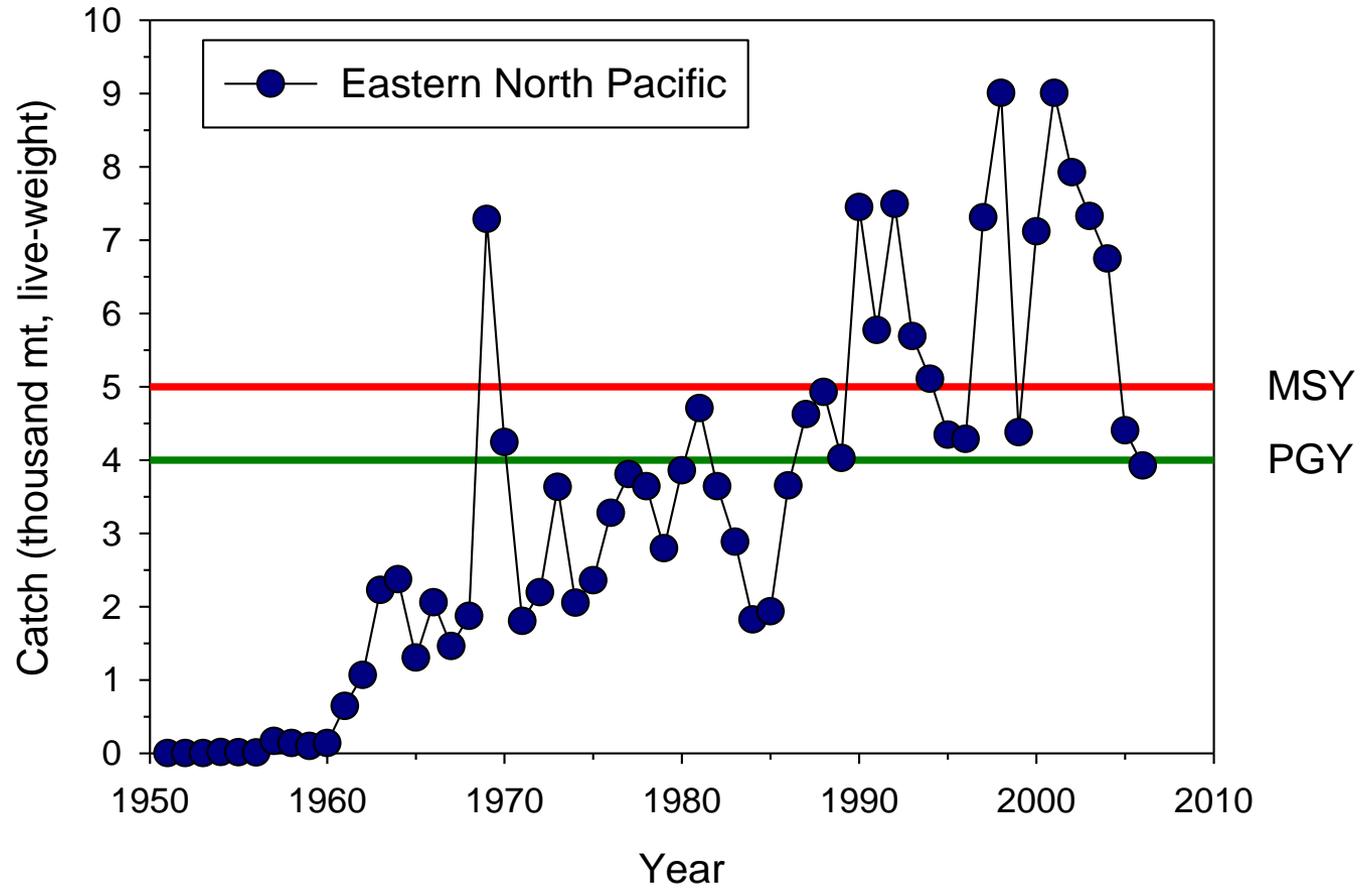
Trends in Western and Central North Pacific Swordfish Catch Relative to Maximum Sustainable Yield

North Pacific Swordfish Catch by Stock Area



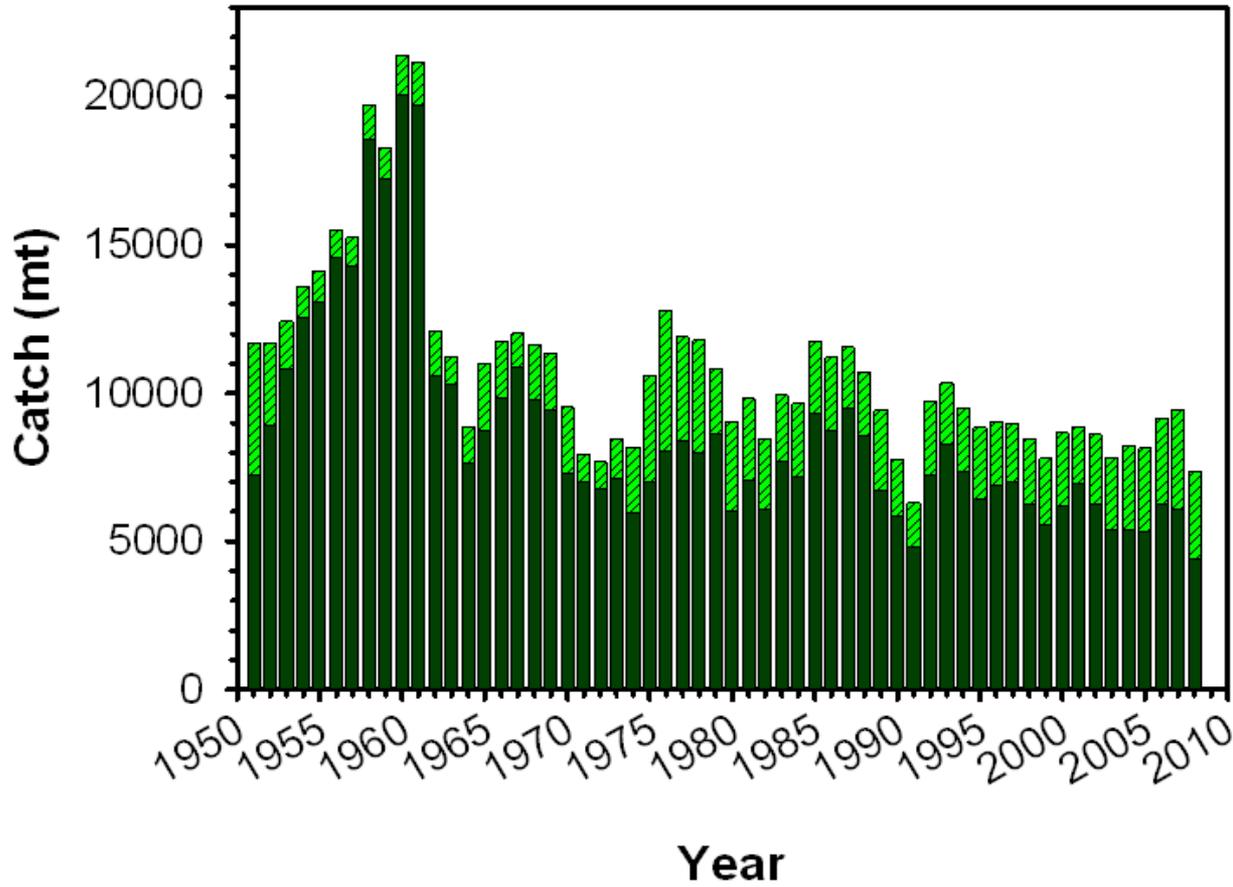
Trends in Eastern North Pacific Swordfish Catch Relative to Maximum Sustainable Yield

North Pacific Swordfish Catch by Stock Area



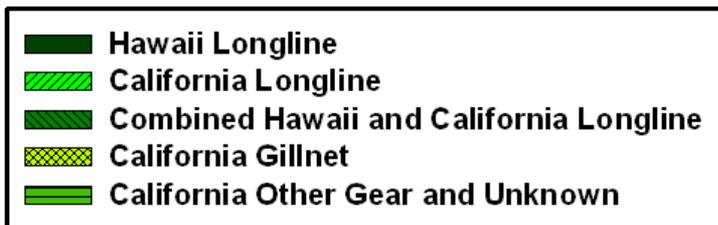
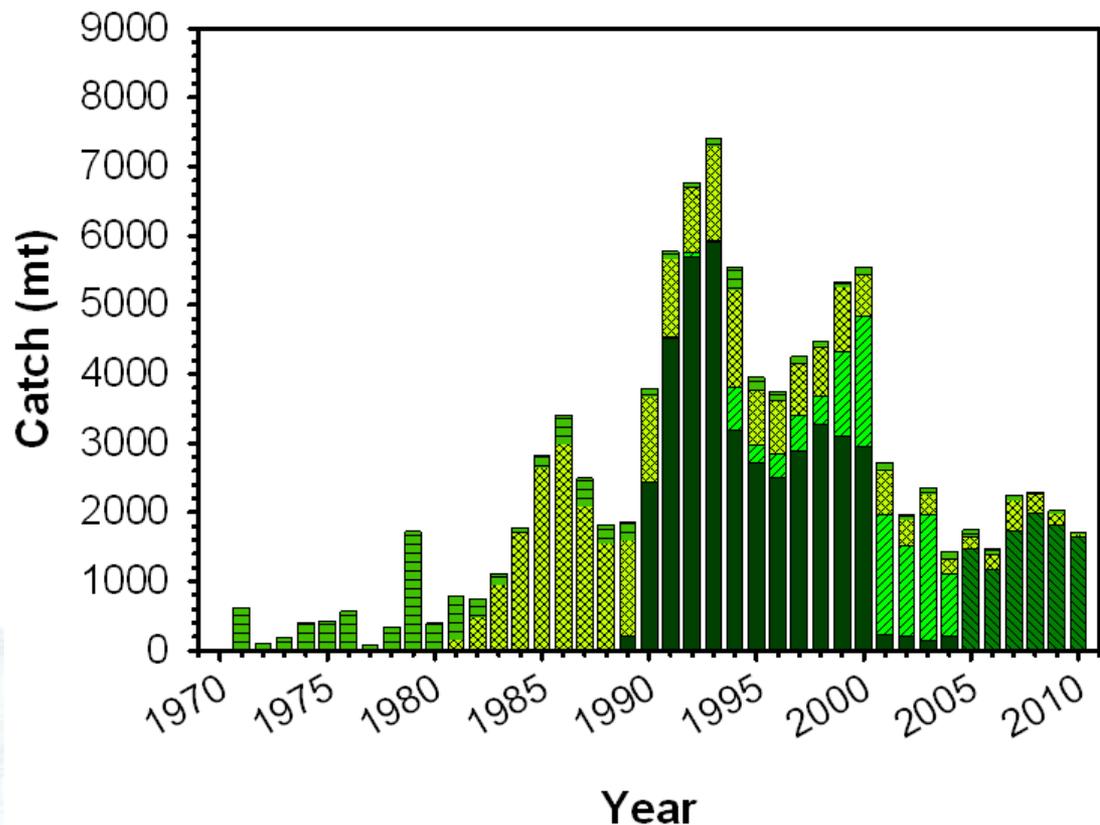
Trends in Japanese Catch of North Pacific Swordfish By Gear

Japanese Swordfish Catch in the North Pacific



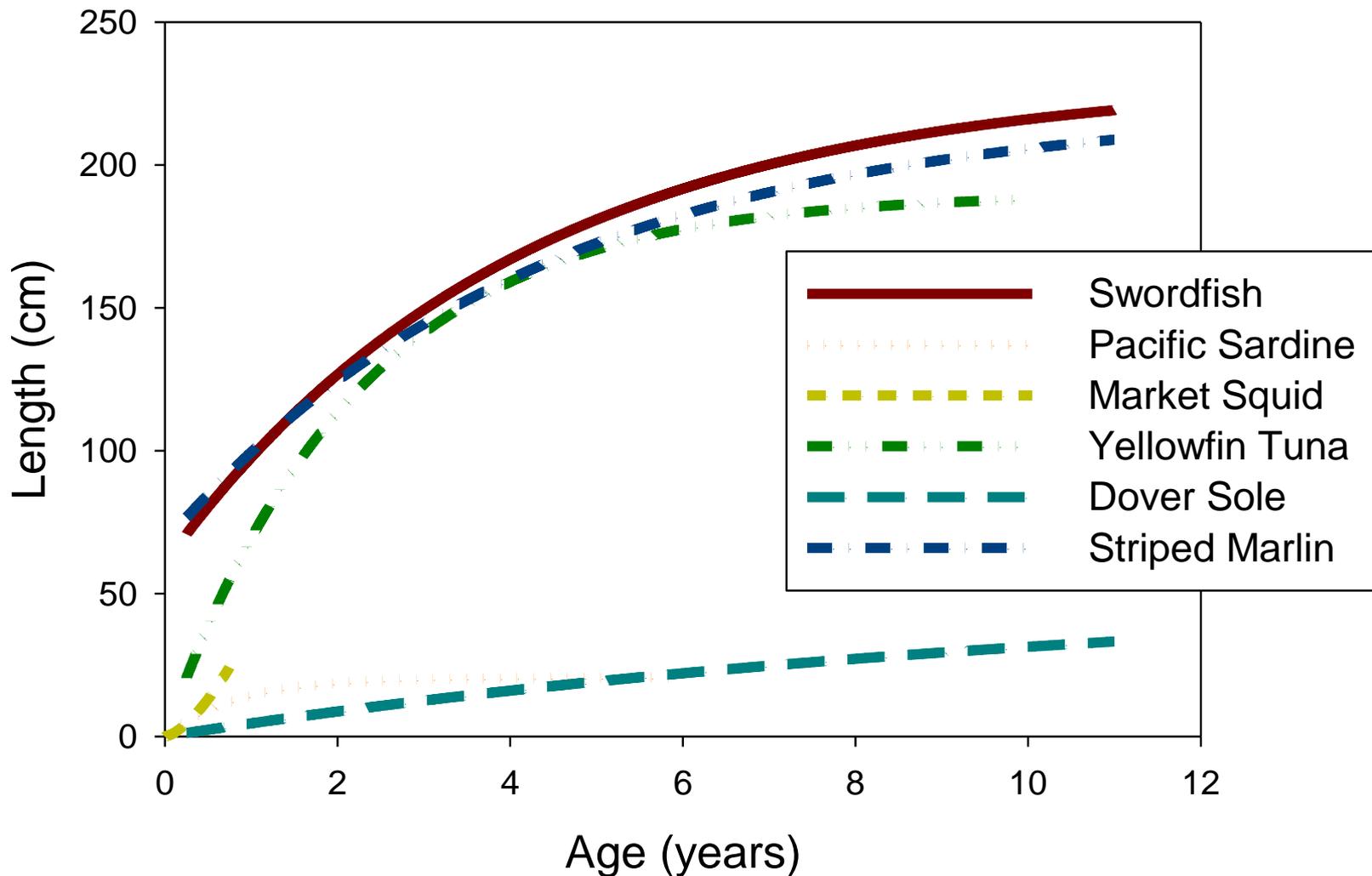
Trends in U.S. Catch of North Pacific Swordfish By Gear

U.S. Catch of North Pacific Swordfish By Fishing Gear



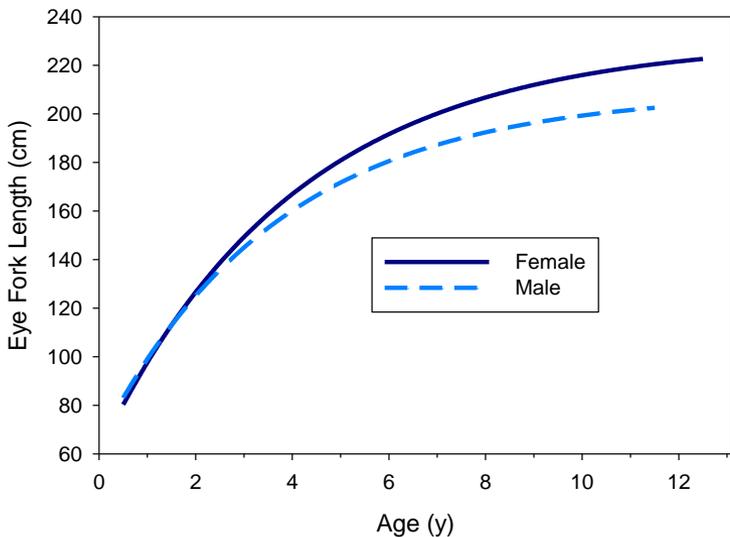
Western and Central North Pacific Stock: Growth Comparison With Other Fishery Resources

Comparison of North Pacific Swordfish Size at Age

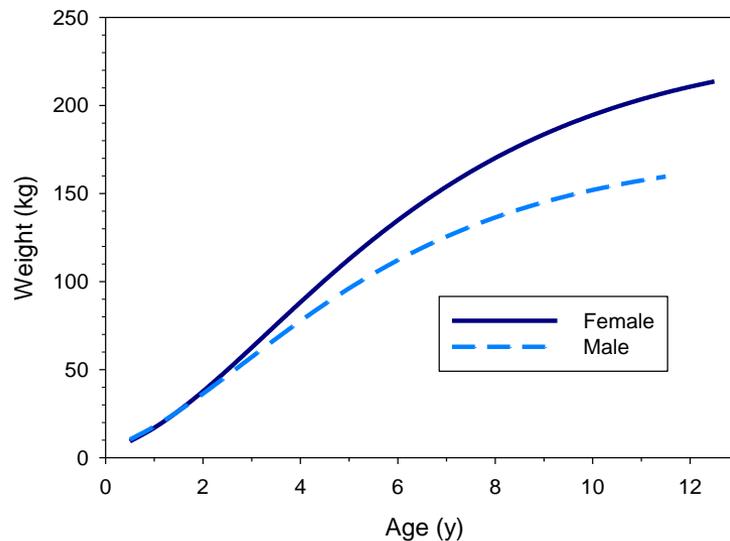


Western and Central North Pacific Stock: Life History Characteristics and Sexual Dimorphism

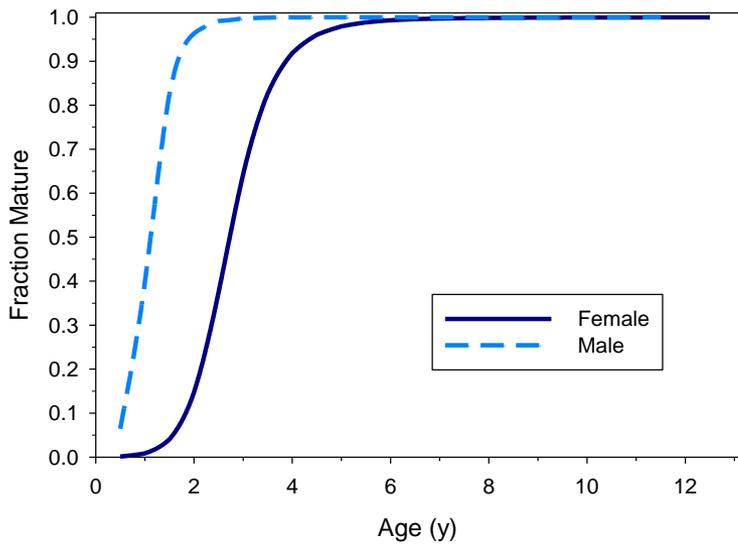
Western and Central North Pacific Swordfish Length at Age



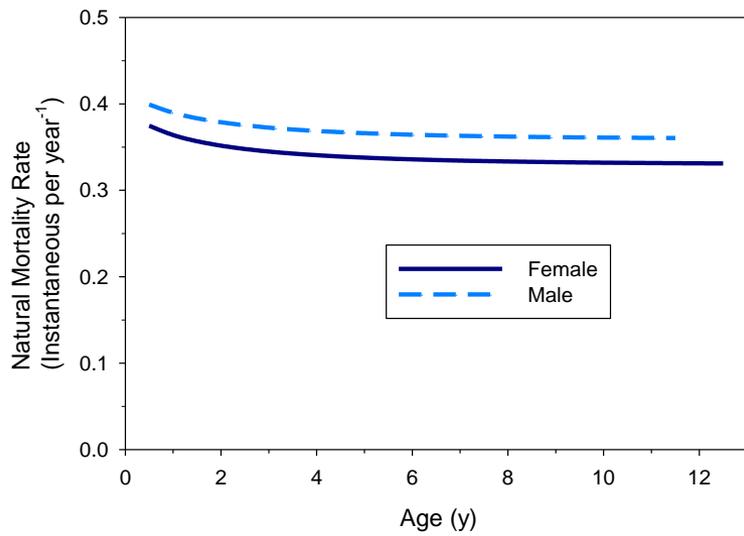
Western and Central North Pacific Swordfish Weight at Age



Western and Central North Pacific Swordfish Maturity at Age



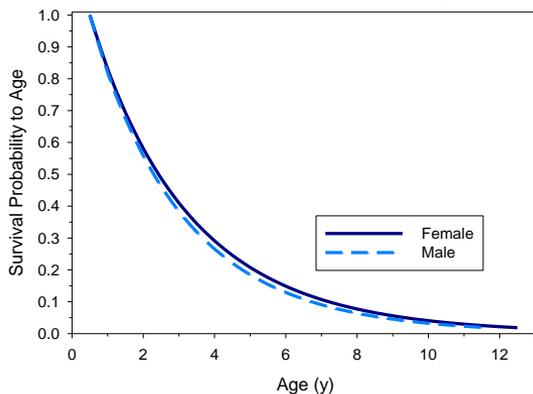
Western and Central North Pacific Natural Mortality at Age



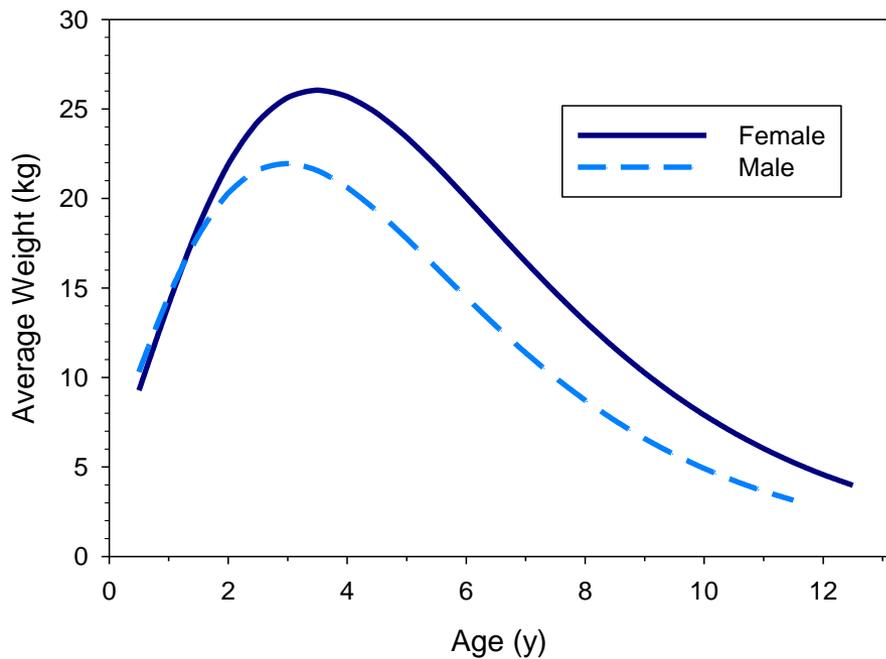
Western and Central North Pacific Stock: Life History Characteristics and Sexual Dimorphism



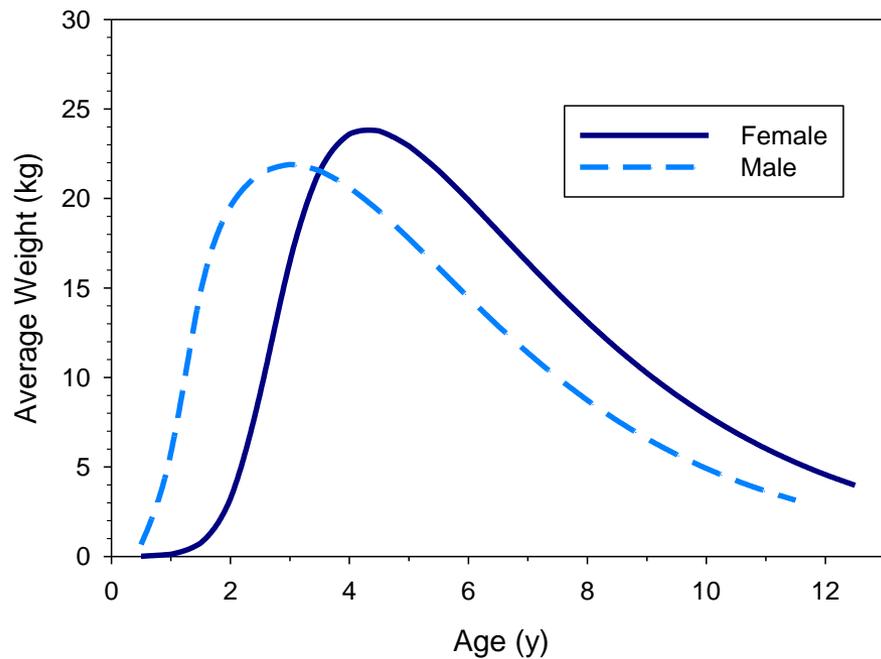
Western and Central North Pacific Swordfish
Unfished Probabilities of Survival to Age



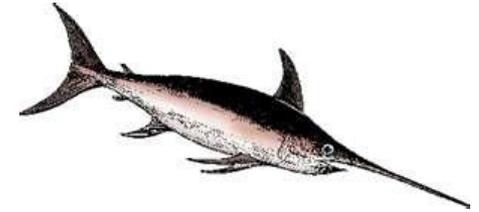
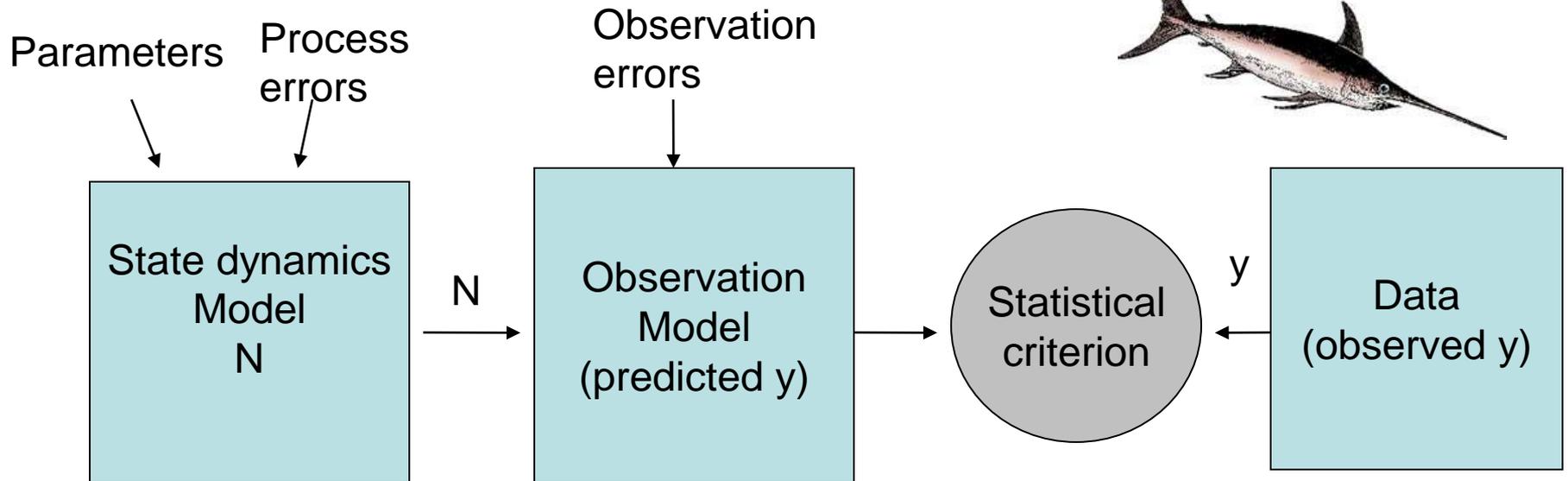
Western and Central North Pacific Swordfish:
Unfished Cohort Biomass at Age



Western and Central North Pacific Swordfish:
Unfished Cohort Spawning Biomass at Age



Parameter estimation and state dynamics for integrated assessment models (e.g., Stock Synthesis)



$$N_{t+1} = N_t - C_t$$

Parameter N_0

$$y_t = qN_t$$

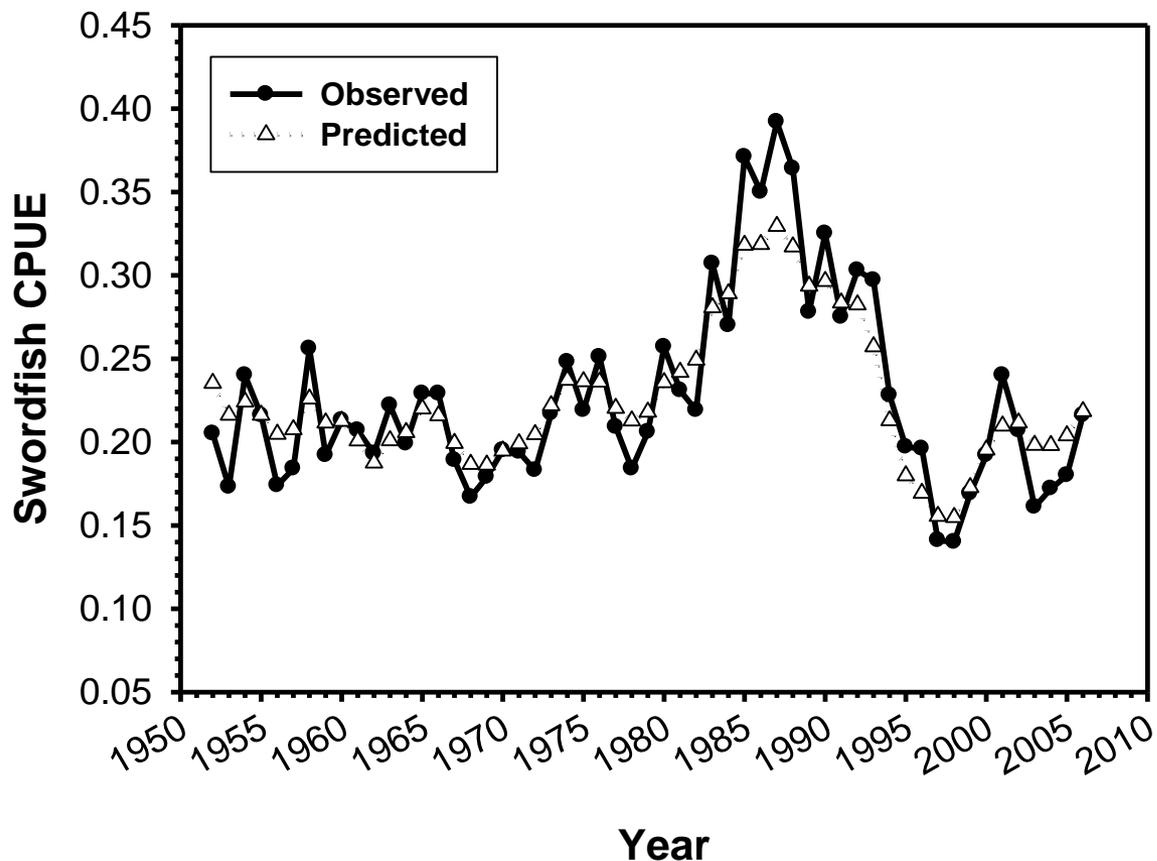
Parameter q

$$-\frac{n}{2} \ln \left[\sum (y_t - \hat{y}_t)^2 \right]$$

Log-likelihood function

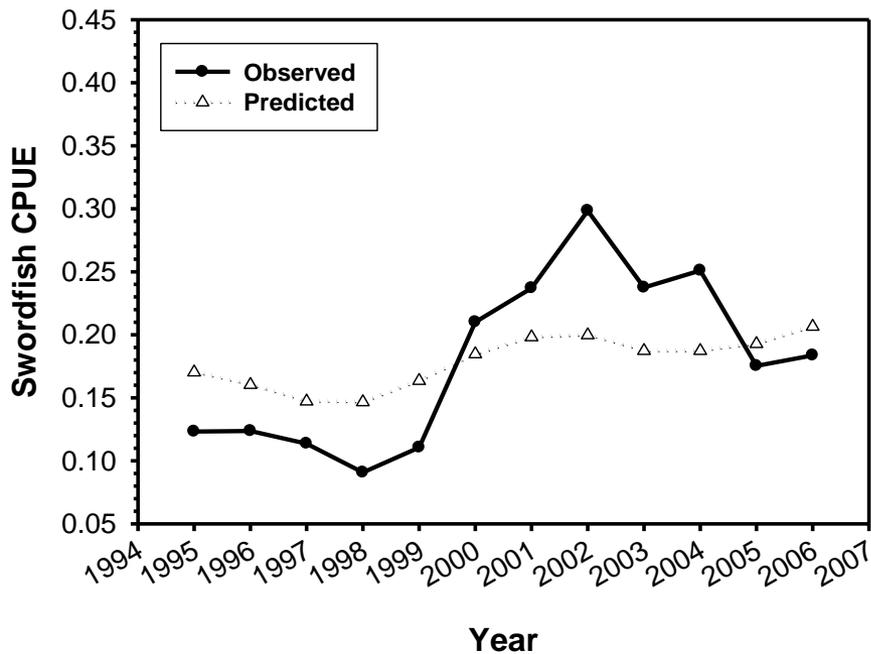
Western and Central North Pacific Stock: Production Model Fits to Catch-Per-Unit Effort Indices

**Observed Japanese CPUE versus predicted CPUE
in the North Pacific Sub-Area 1 by fishing year, 1952-2006**

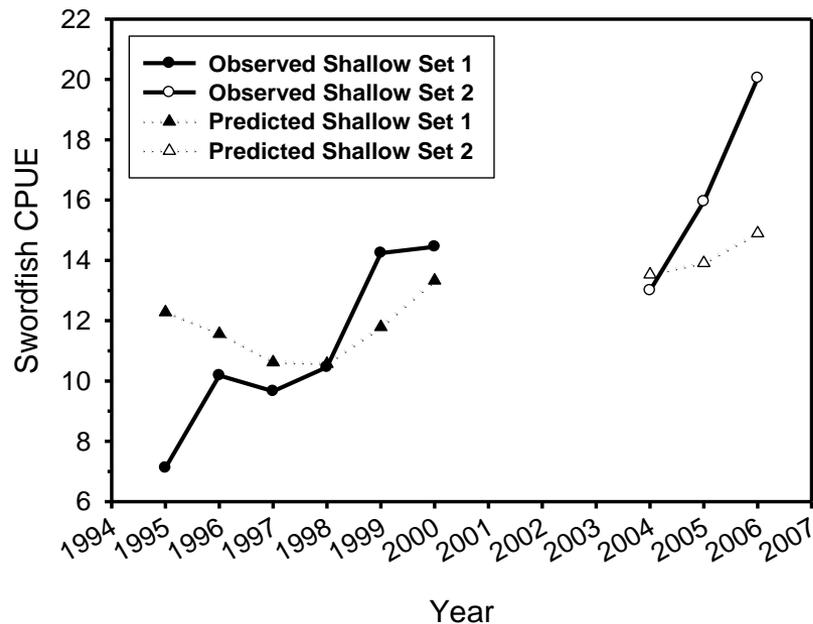


Western and Central North Pacific Stock: Production Model Fits to Catch-Per-Unit Effort Indices

**Observed Taiwanese CPUE versus predicted CPUE
in the North Pacific Sub-Area 1 by fishing year, 1952-2006**

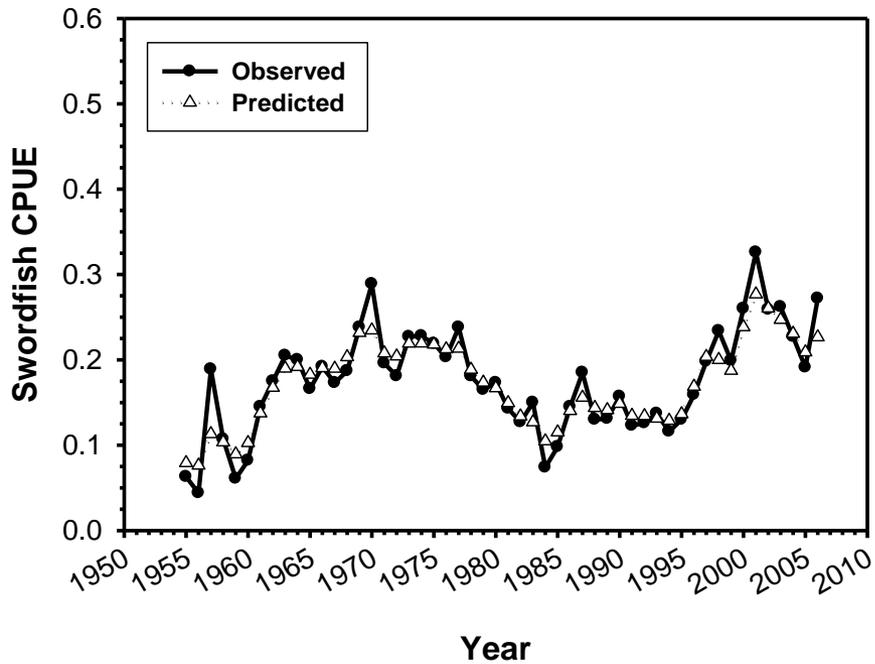


**Observed Hawaii Shallow-Set CPUE versus predicted CPUE
in the North Pacific Sub-Area 1 by fishing year, 1995-2006**

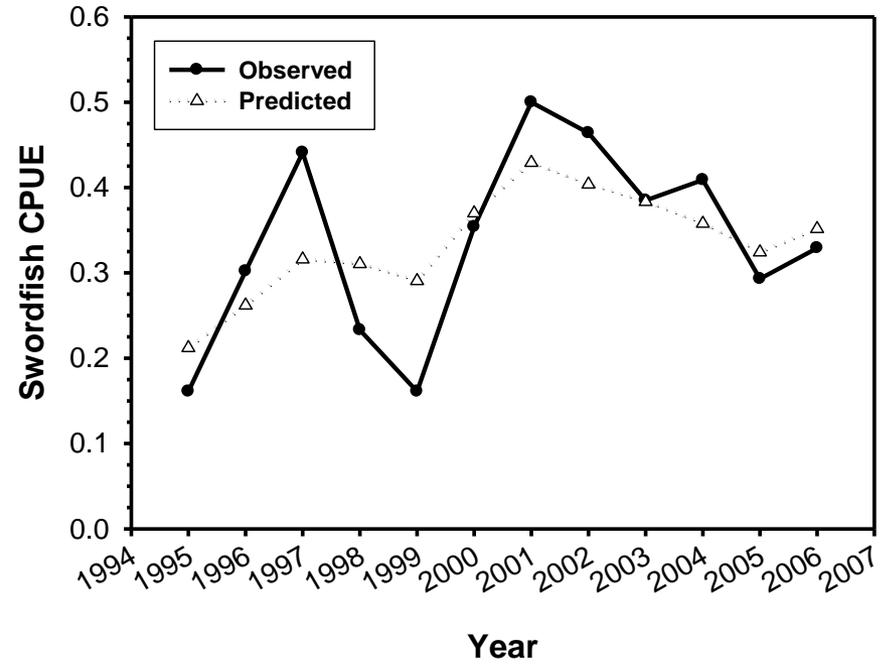


Eastern North Pacific Stock: Production Model Fits to Catch-Per-Unit Effort Indices

**Observed Japanese CPUE versus predicted CPUE
in the North Pacific Sub-Area 2 by fishing year, 1955-2006
Updated swordfish catch, March 2010**

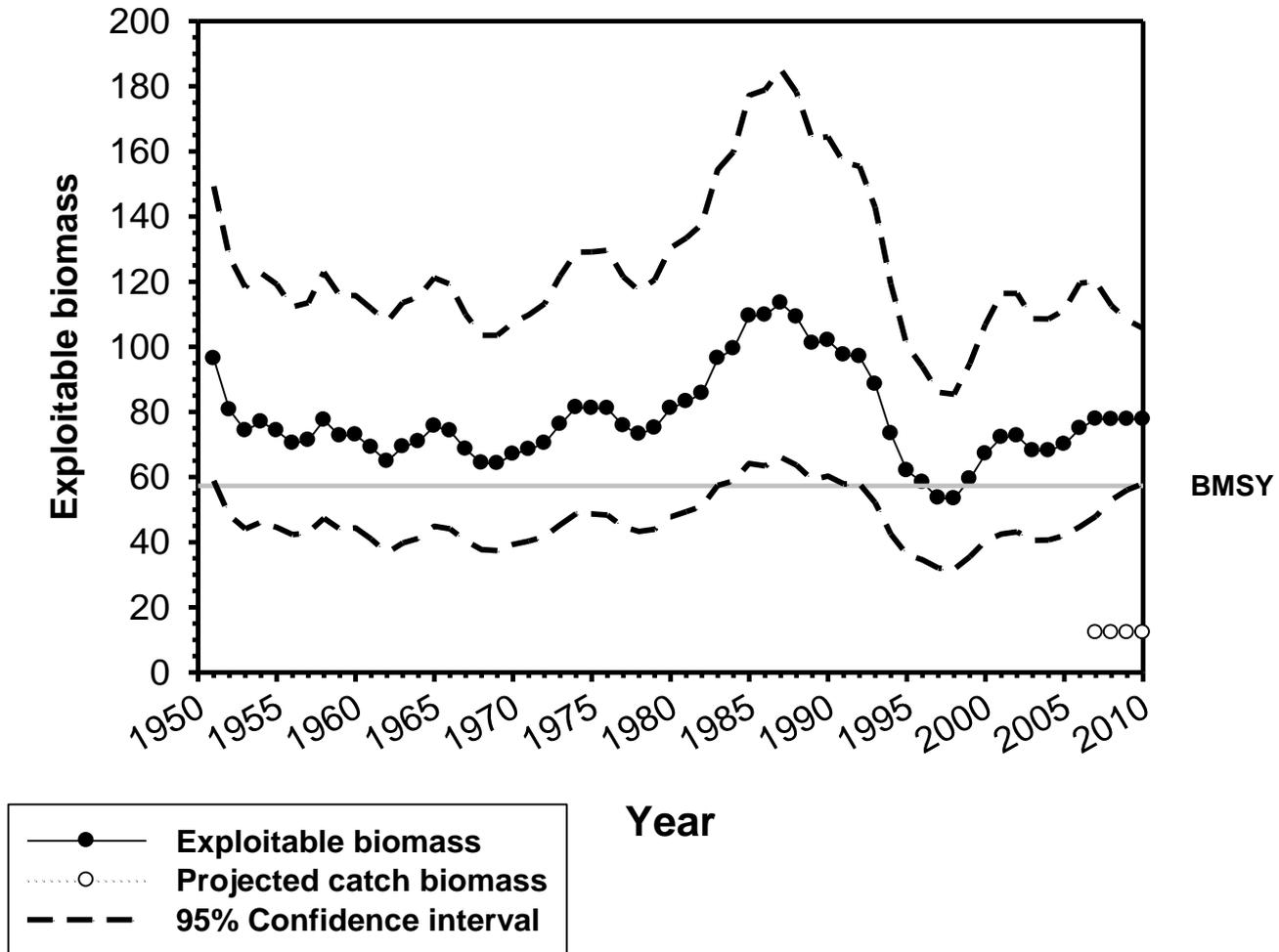


**Observed Chinese-Taipei CPUE versus predicted CPUE
in the North Pacific Sub-Area 2 by fishing year, 1995-2006
Updated swordfish catch, March 2010**



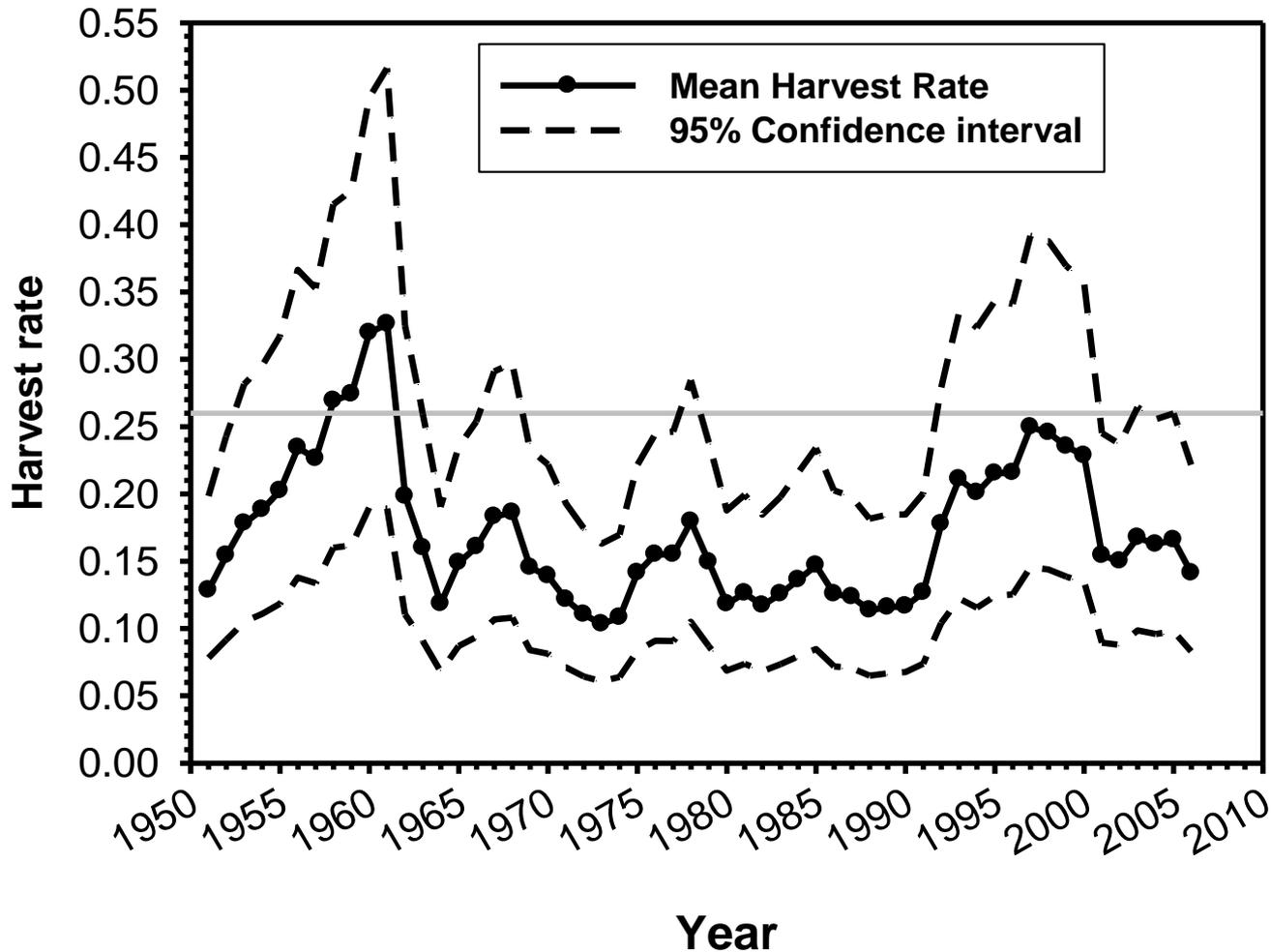
Western and Central North Pacific Stock: Production Model Estimates of Exploitable Biomass

Estimated swordfish biomass in the North Pacific
Subarea 1: Base case

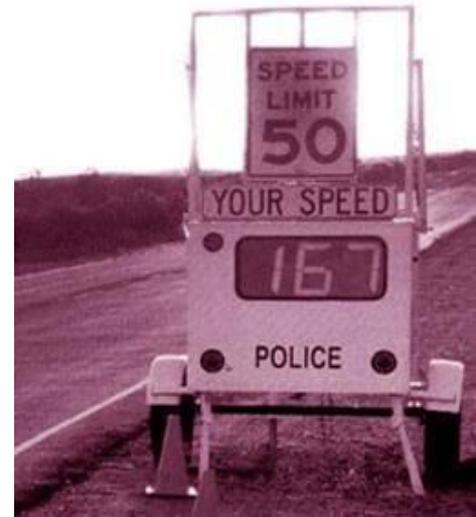


Western and Central North Pacific Stock: Production Model Estimates of Harvest Rate

Estimated swordfish harvest rate in the North Pacific Subarea 1: Base case

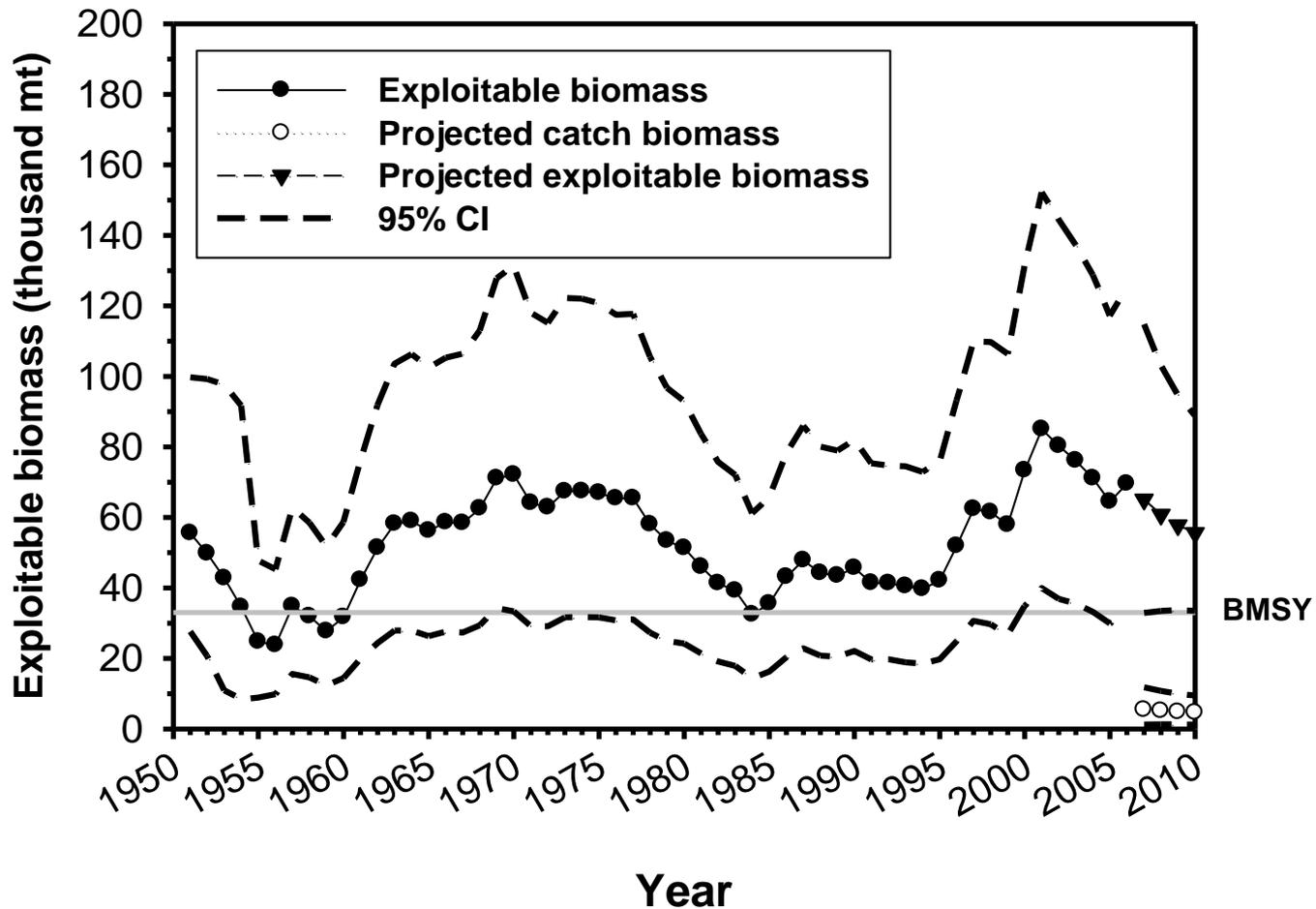


HMSY



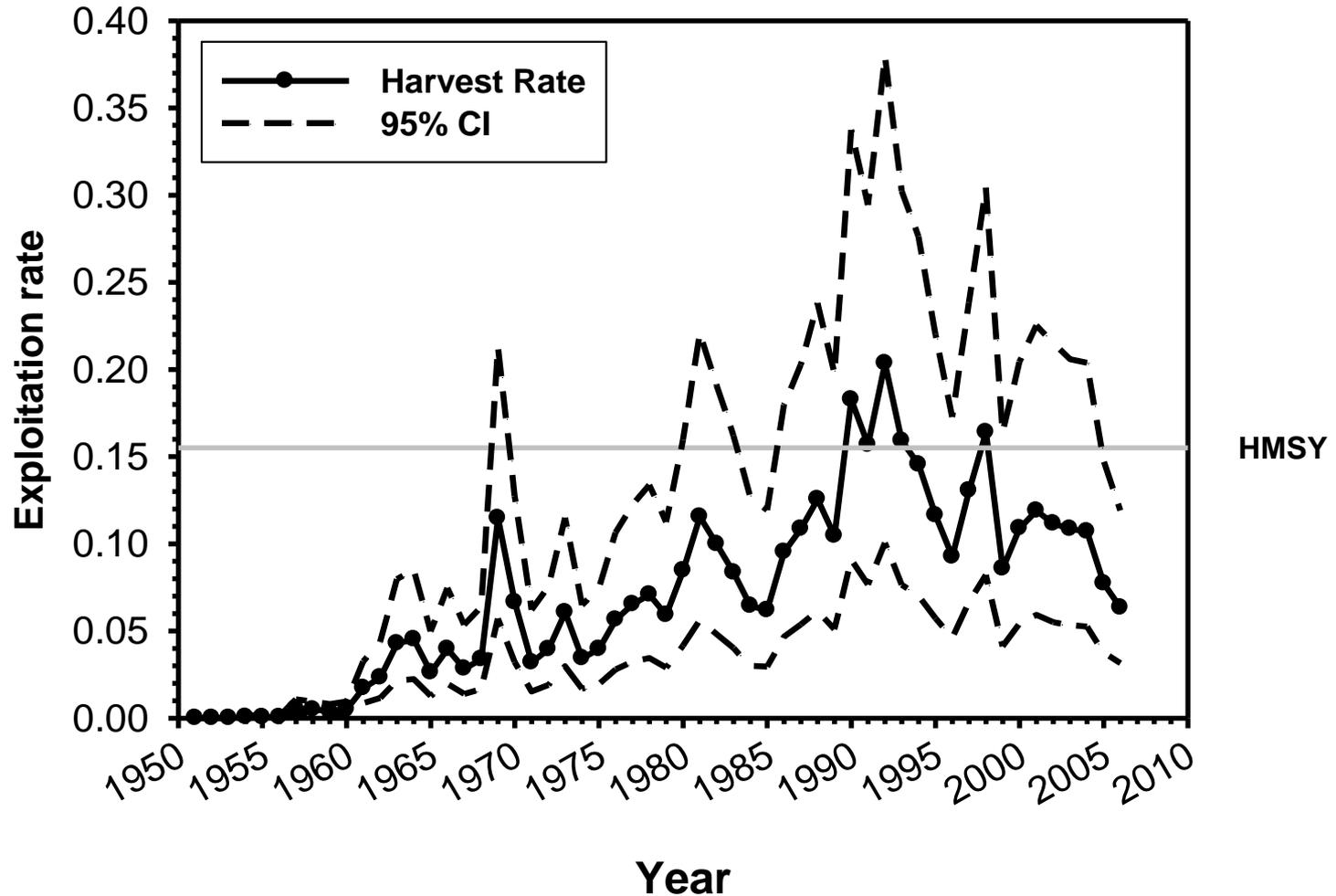
Eastern North Pacific Stock: Production Model Estimates of Exploitable Biomass

**Projected swordfish biomass and catch in the Eastern Pacific
Subarea 2: Base case with updated catch, March 2010**



Eastern North Pacific Stock: Production Model Estimates of Harvest Rate

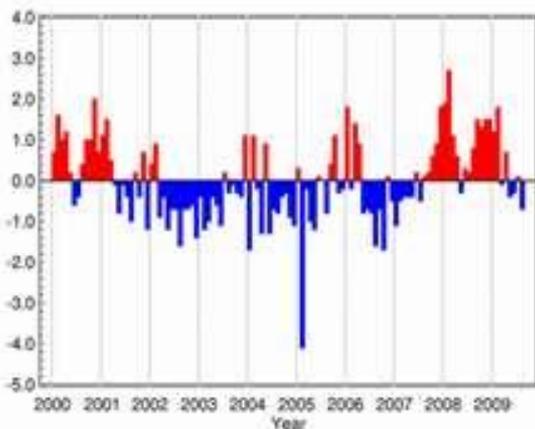
**Estimated swordfish harvest rate in the Eastern Pacific
Subarea 2: Base case with updated catch, March 2010**



Trends in Pacific Stock Assessments: How Can We Build Sustainable Fisheries ?

- Quantify Goals to Conserve Fishery Resources
- Identify Robust Management Procedures
- Ensure Adequate Data Collection & Monitoring

Standardized Southern Oscillation Index (SOI)



National Climatic Data Center / NESDIS / NOAA

