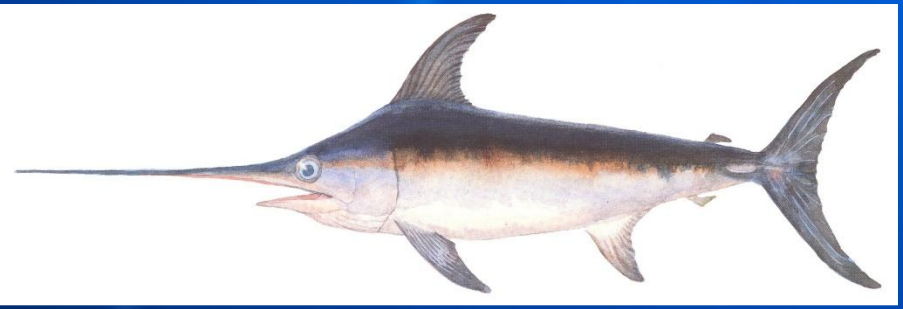
North Pacific Swordfish Stock Status and Trends

Jon Brodziak
National Marine Fisheries Service
Pacific Islands Fisheries Science Center
Honolulu, HI 96816, USA
Jon.Brodziak@NOAA.GOV

Overview

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



Stock Assessment and Management Strategy Evaluation Process

Catch
Logbooks,
Observers,
Age/Size Data

Abundance
Resource Survey,
Fishery CPUE,
Age/Size Data

Biology
Age,
Growth,
Maturity

Advanced Model
Habitat,
Climate,
Ecosystem

Population Model

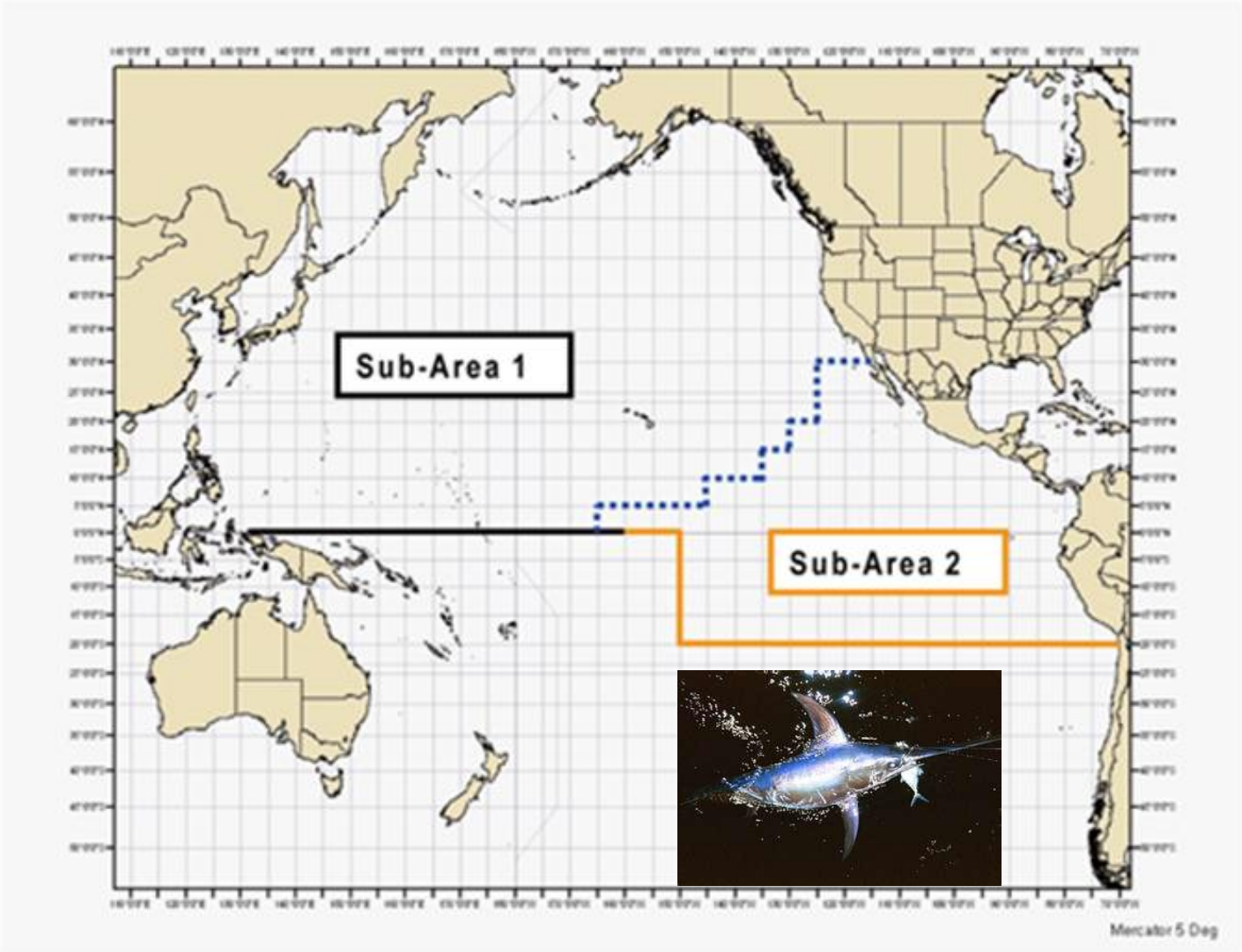
Stock Status

Mgt. Strategy Evaluation

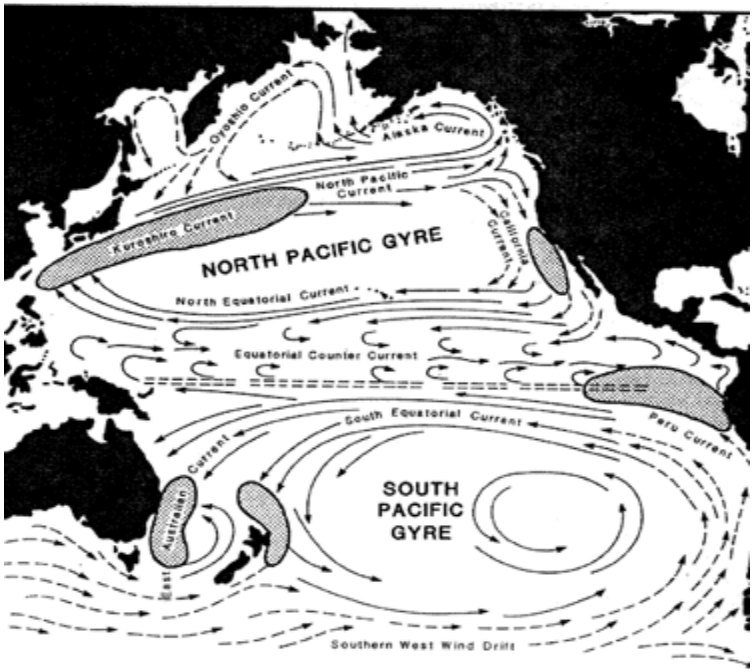
Socioeconomics

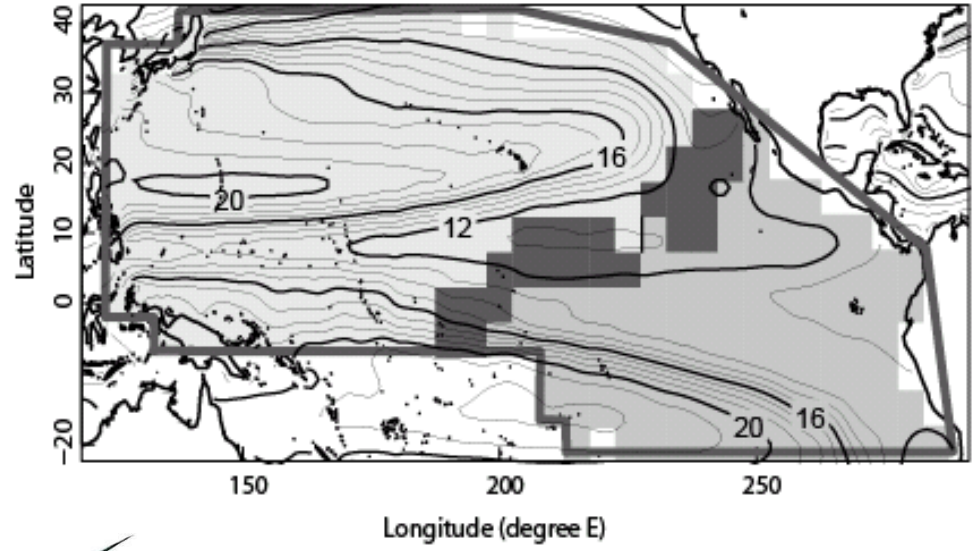
Optimum Yield

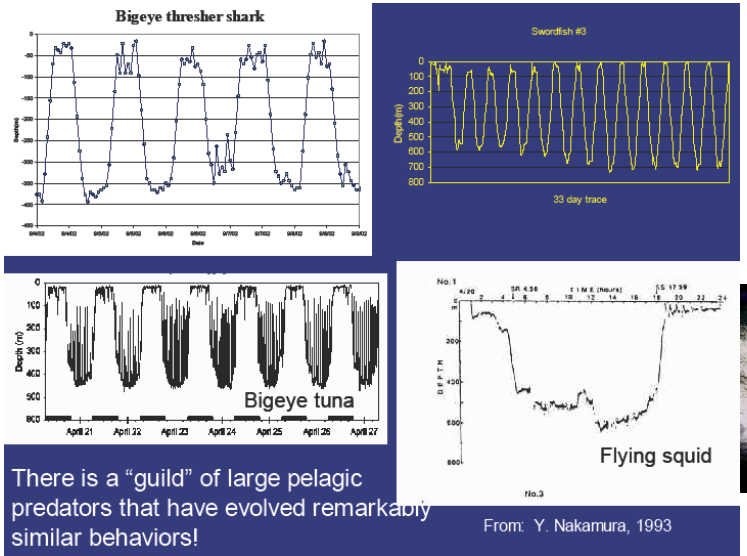
North Pacific Swordfish Stock Structure



North Pacific Swordfish Stock Structure







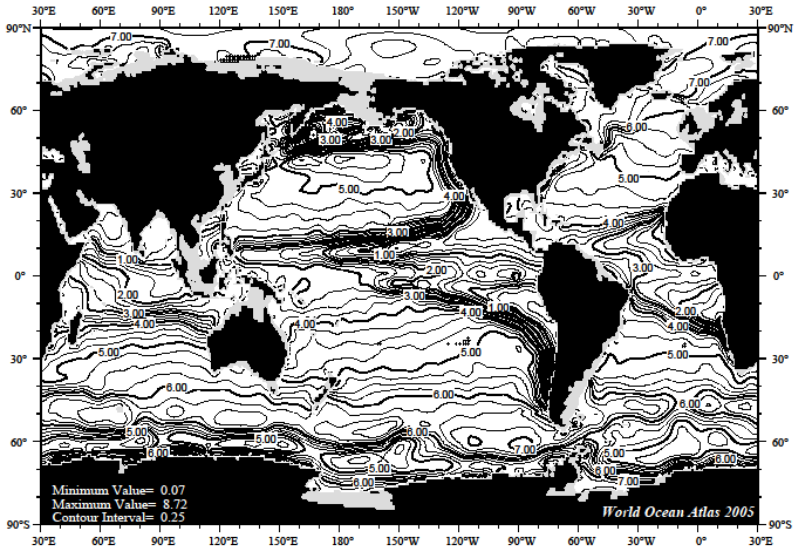


Fig A22 Annual oxygen [ml/l] at 200 m. depth.

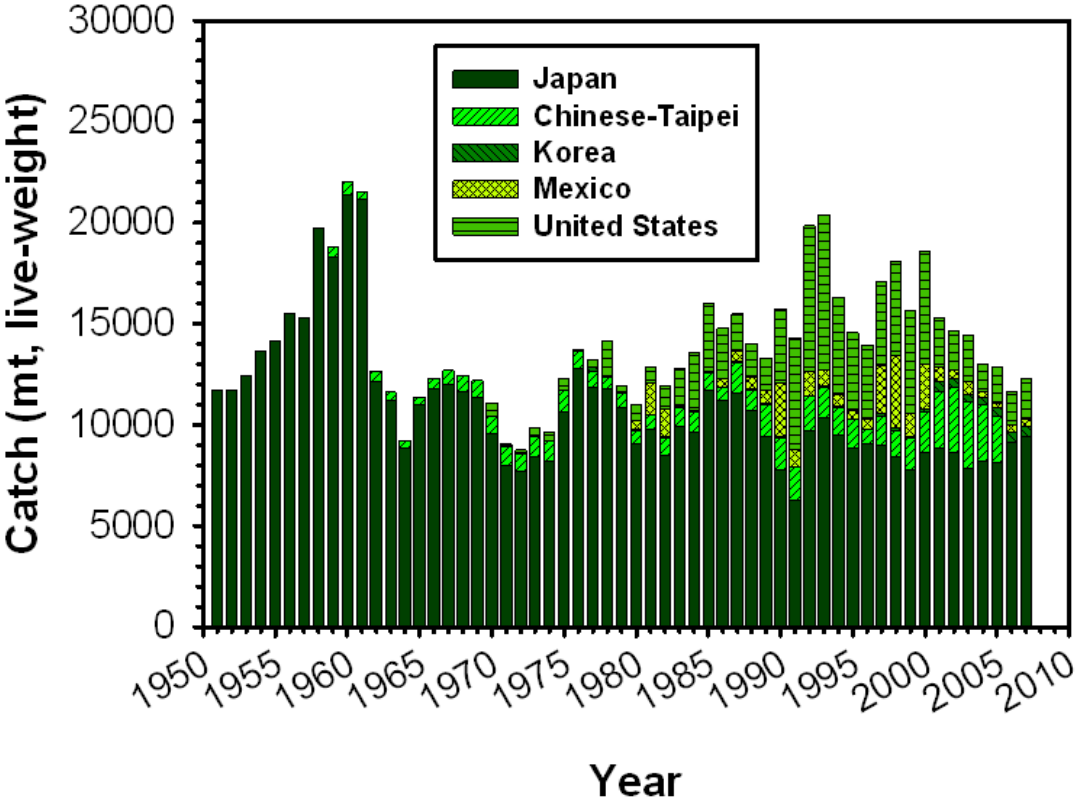
North Pacific Swordfish Stock Mixing

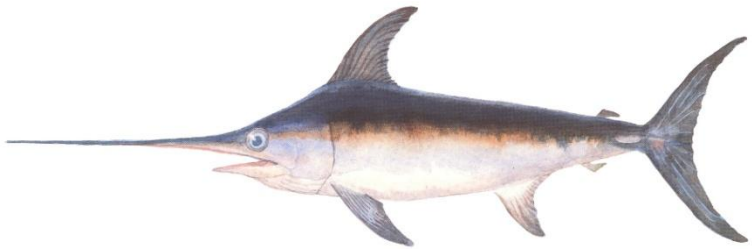
200°E 210°E 220°E 230°E 240°E 250°E 260°E

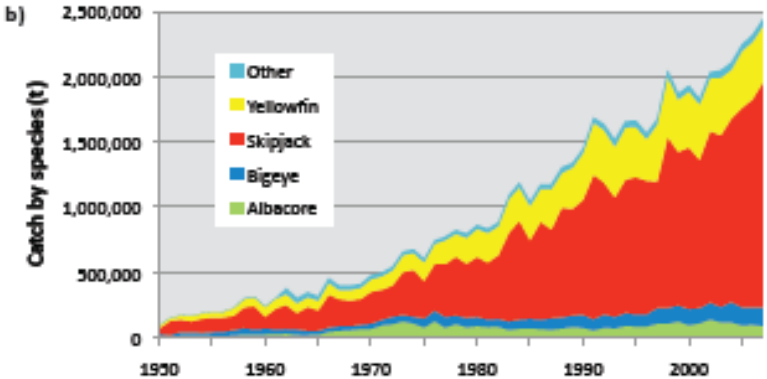
40°N 30°N 20°N 10°N 0°

▽ deploy
△ pop–off

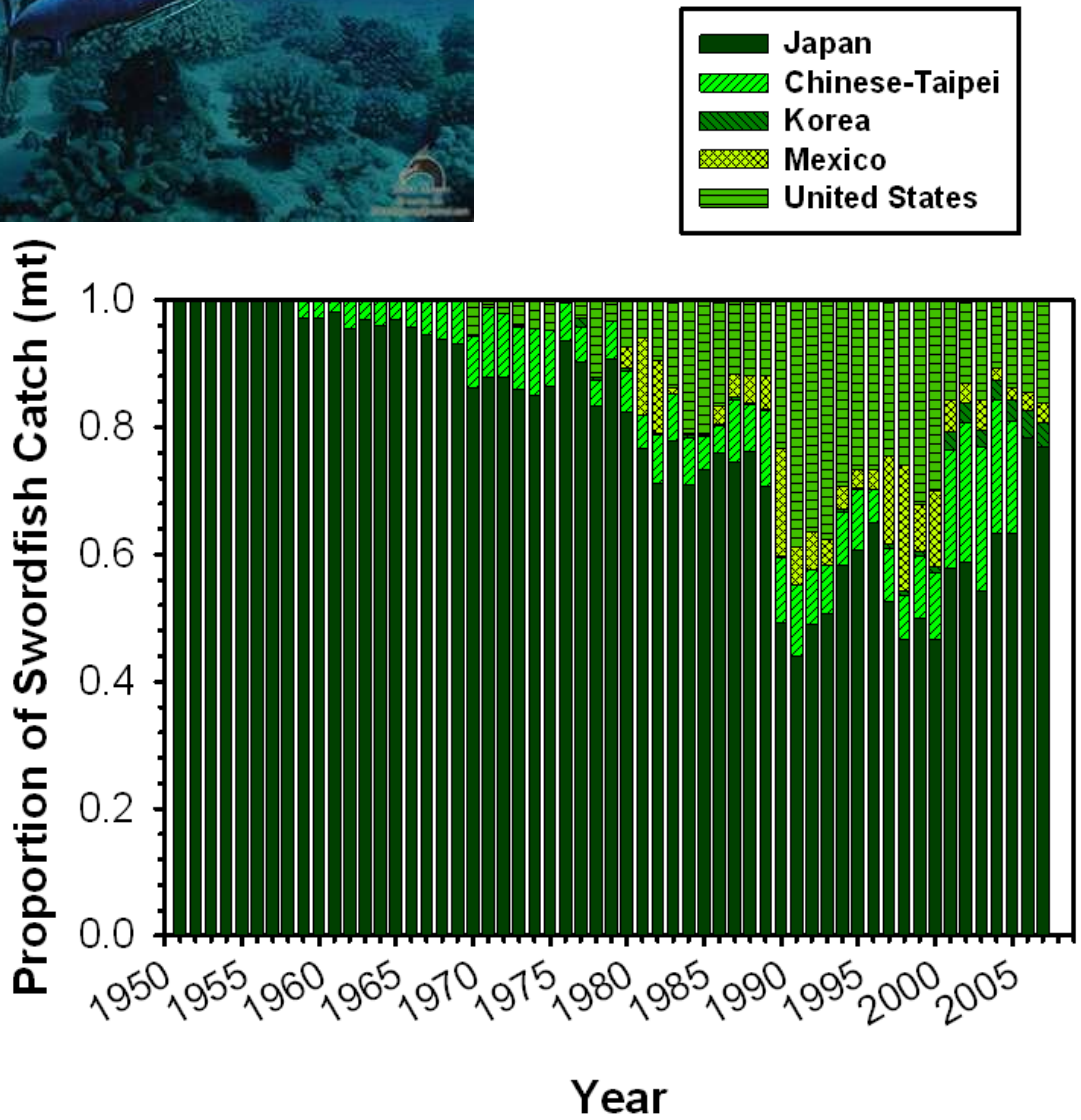
Trends in Catch of North Pacific Swordfish By Country

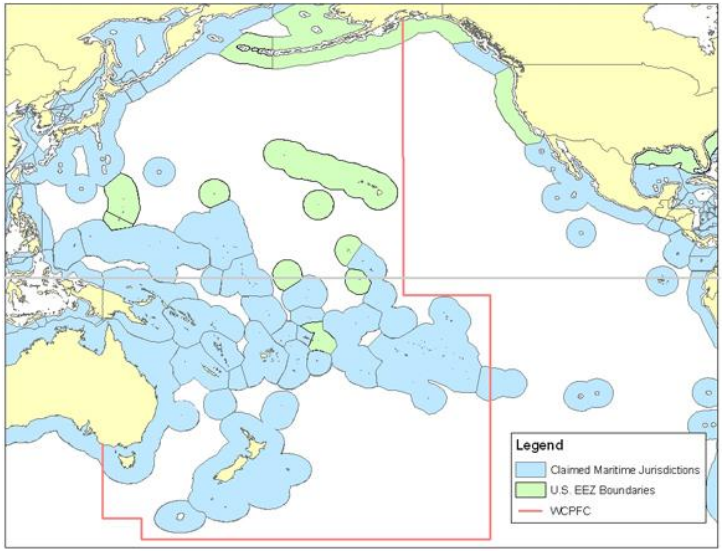


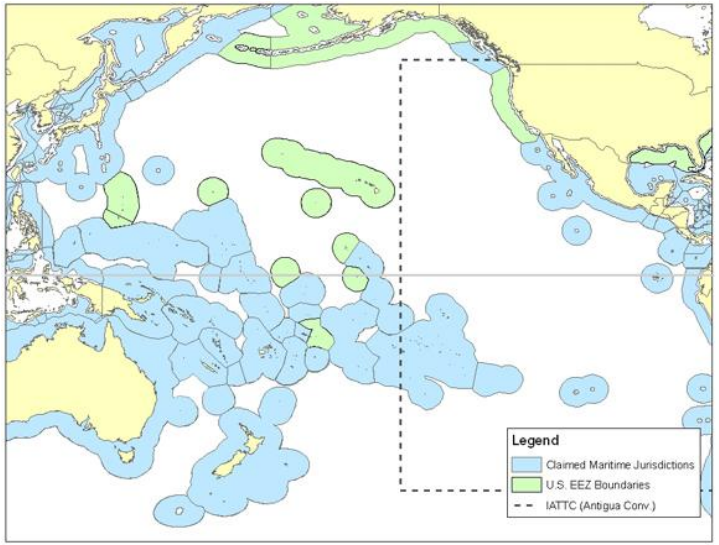




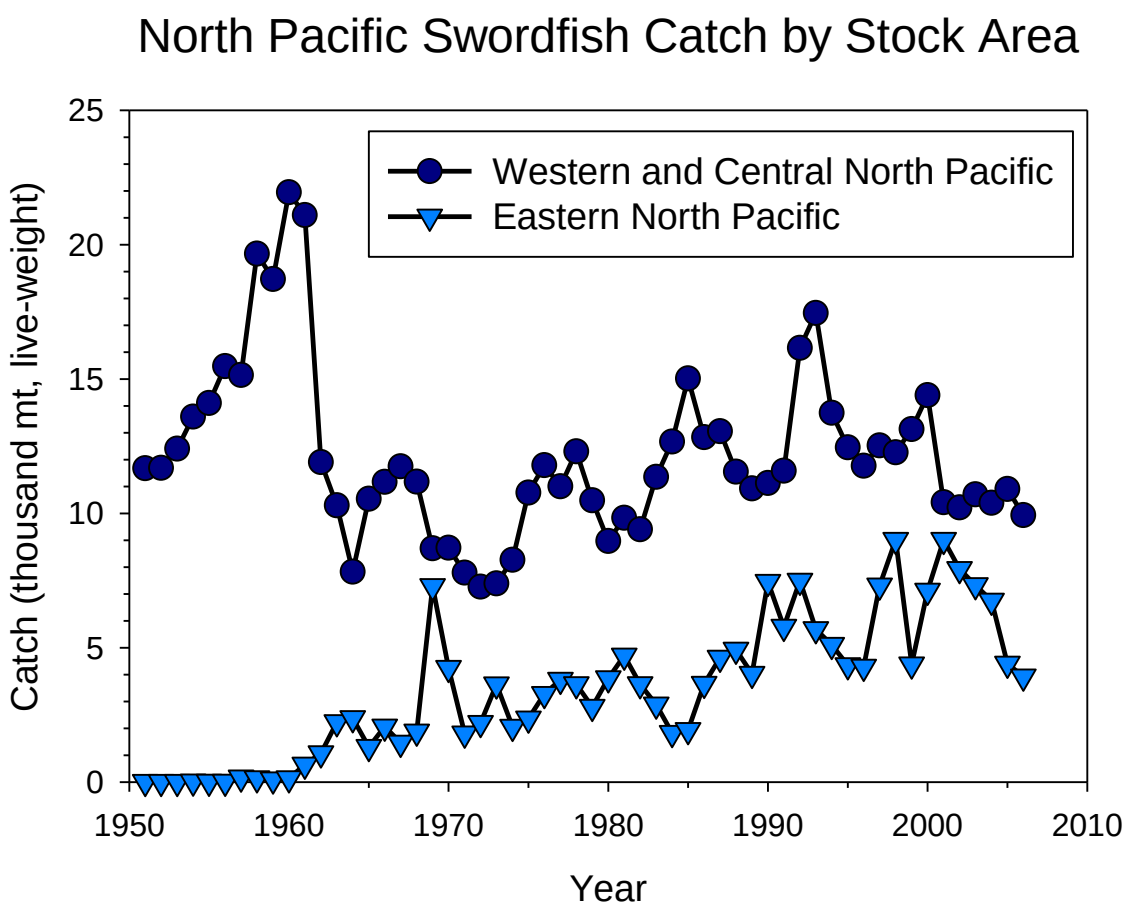
Trends in Proportion of North Pacific Swordfish Catch By Country



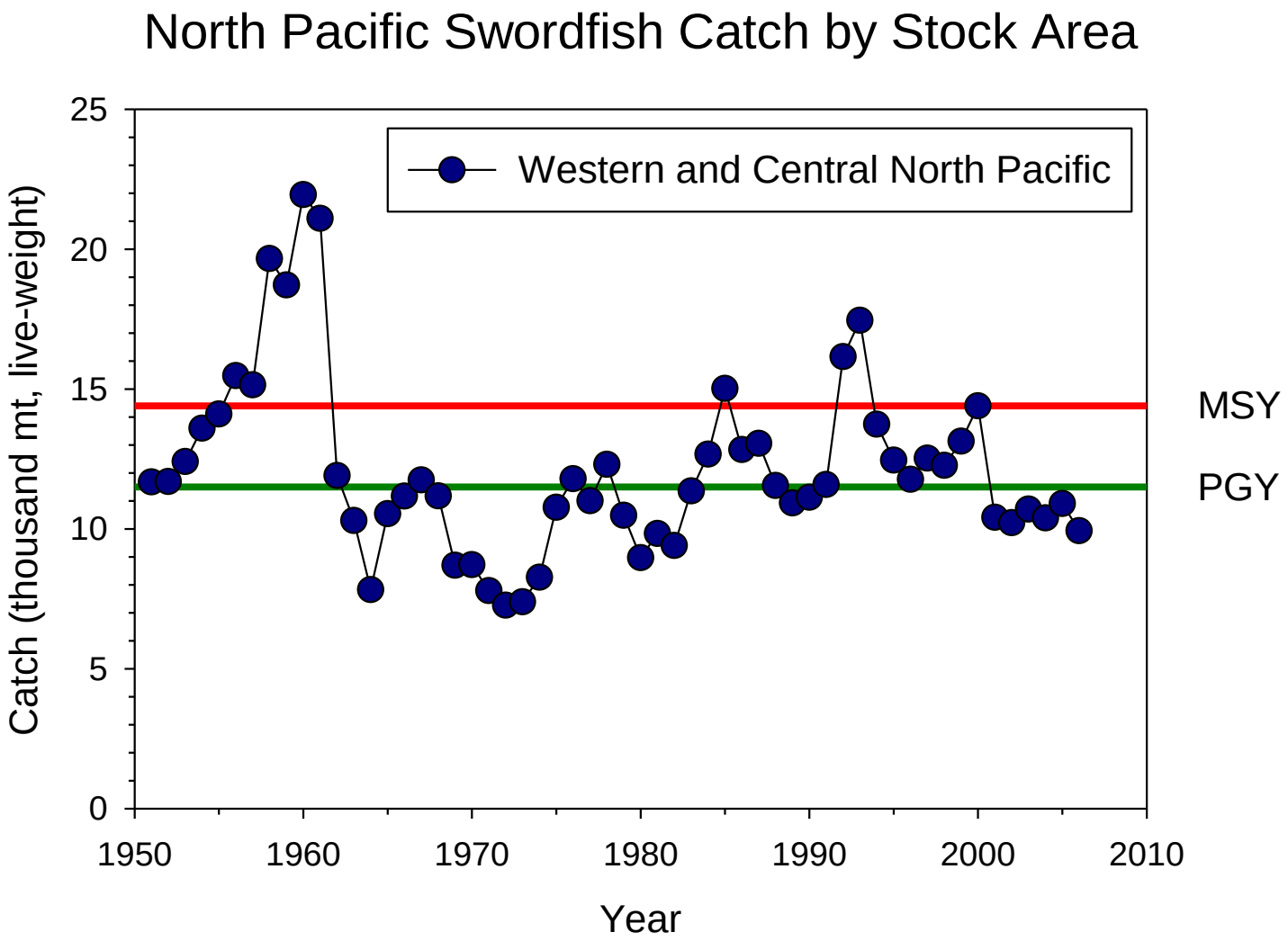




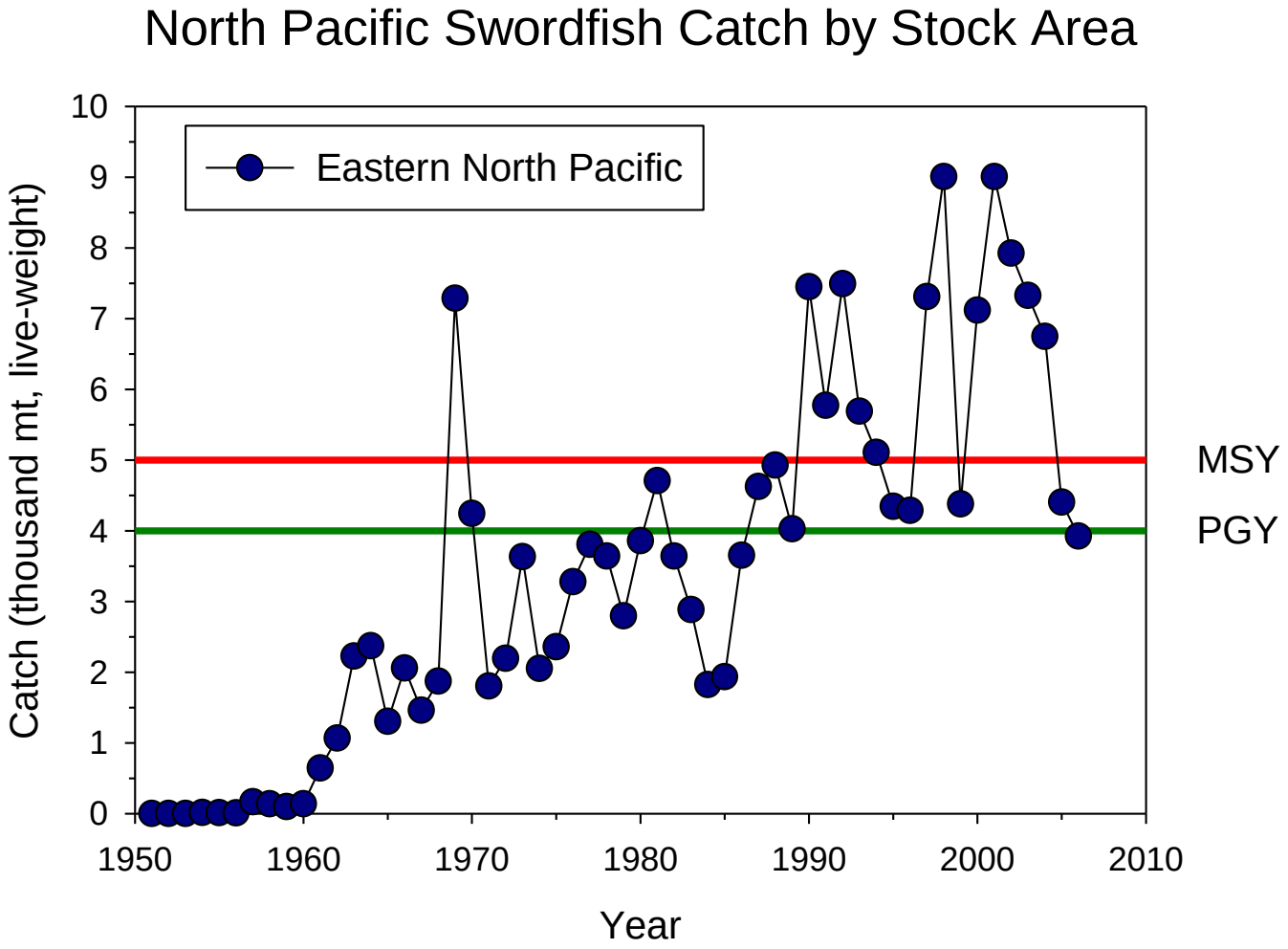
Trends in North Pacific Swordfish Catch By Stock Area



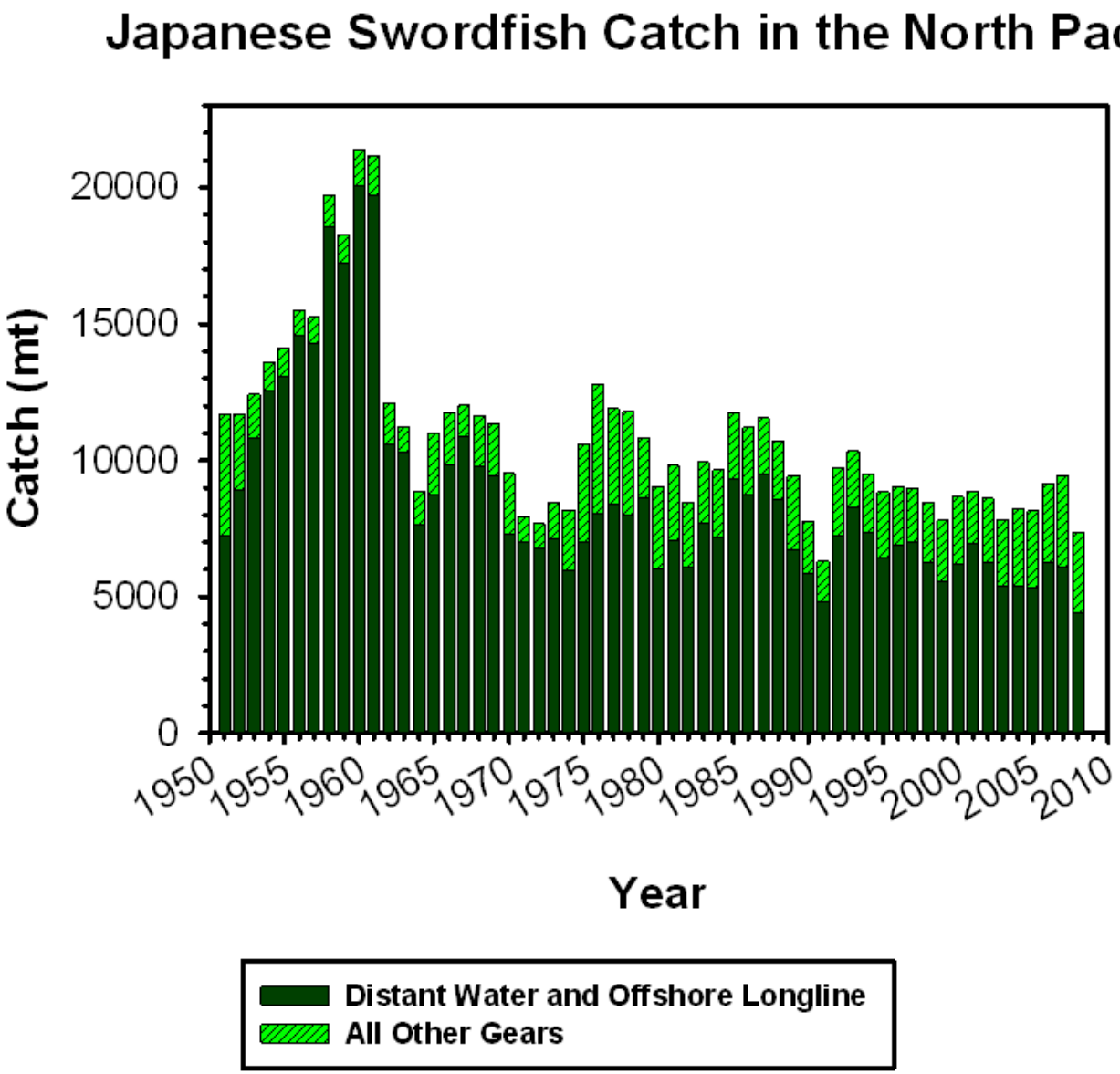
Trends in Western and Central North Pacific Swordfish Catch Relative to Maximum Sustainable Yield



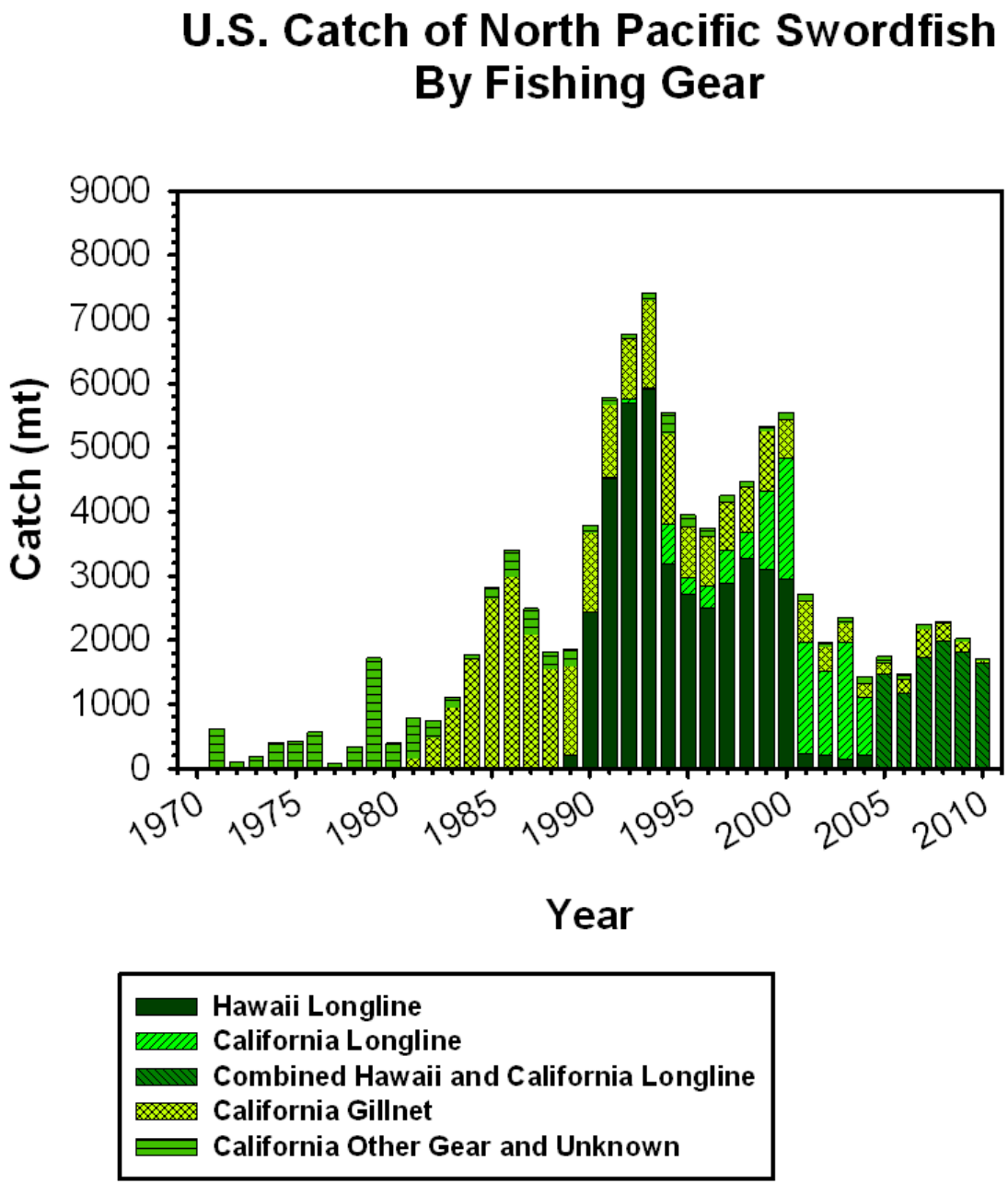
Trends in Eastern North Pacific Swordfish Catch Relative to Maximum Sustainable Yield



Trends in Japanese Catch of North Pacific Swordfish By Gear

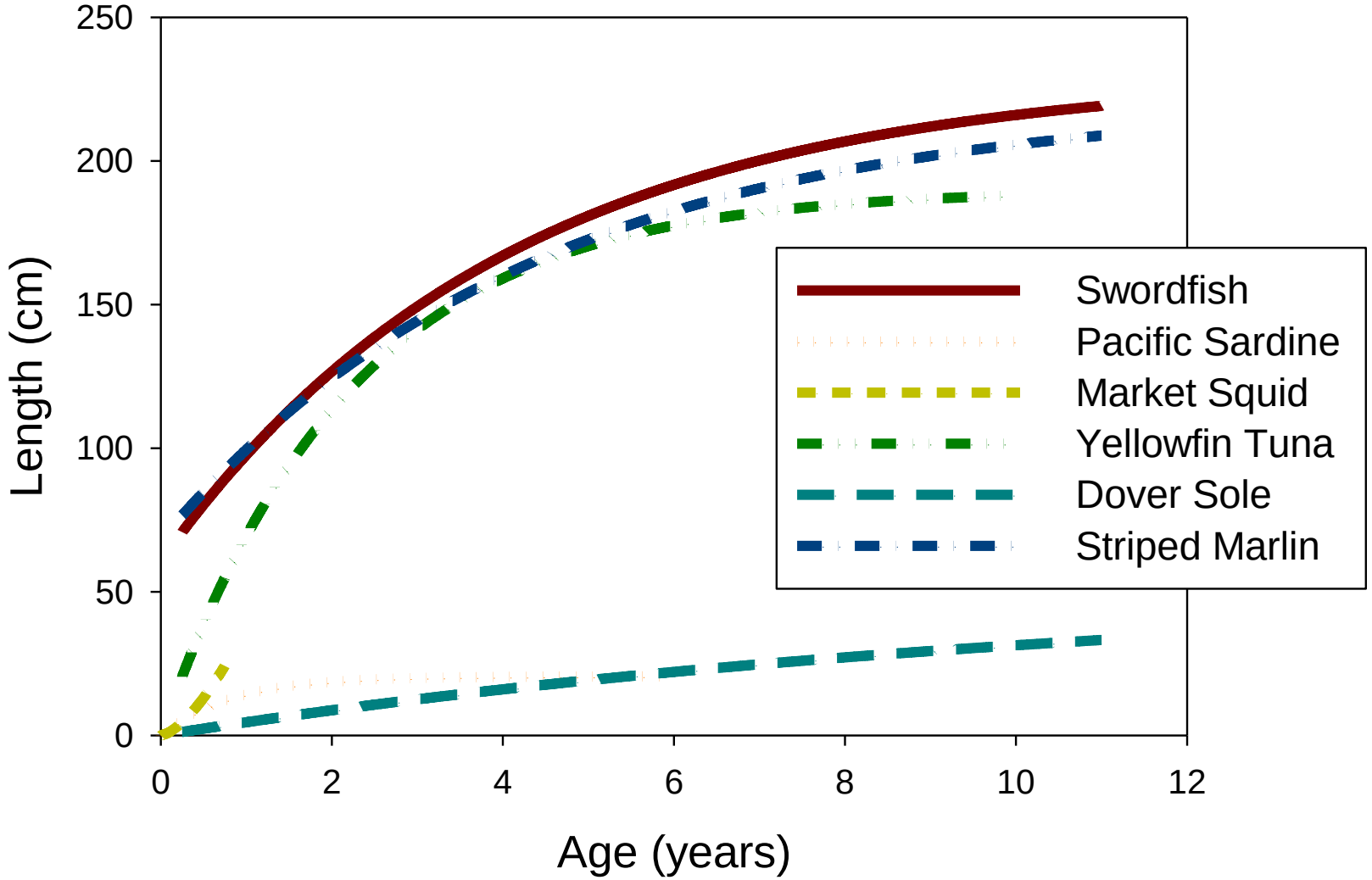


Trends in U.S. Catch of North Pacific Swordfish By Gear



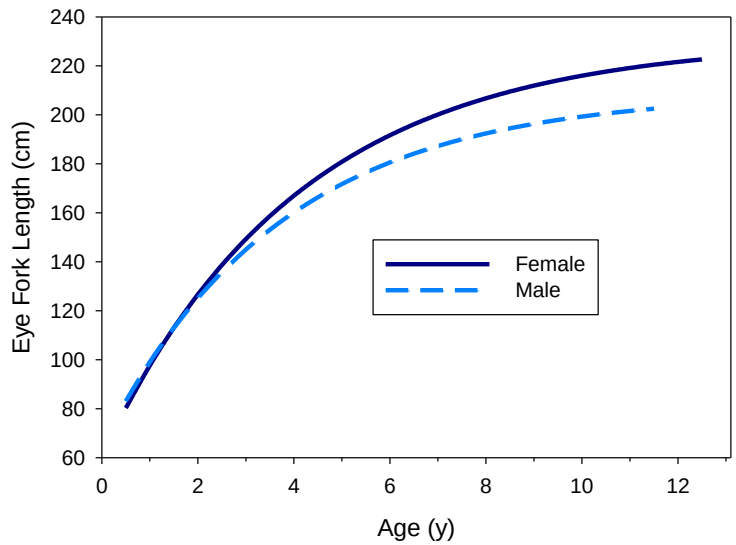
Western and Central North Pacific Stock: Growth Comparison With Other Fishery Resources

Comparison of North Pacific Swordfish Size at Age

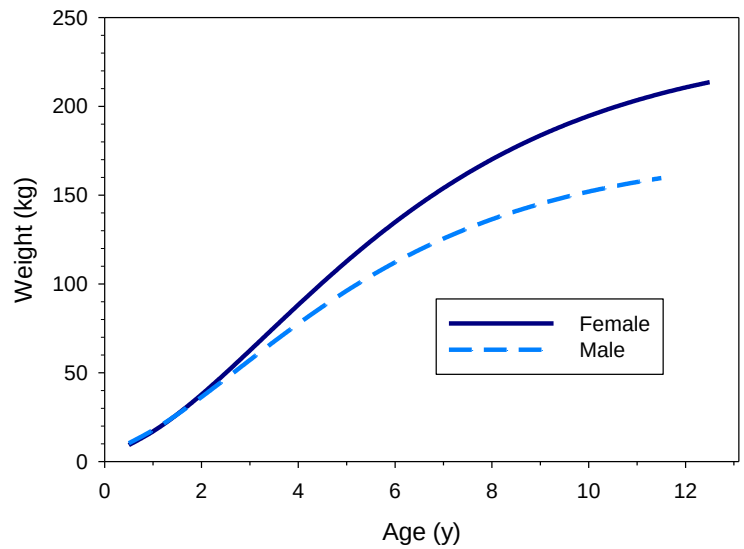


Western and Central North Pacific Stock: Life History Characteristics and Sexual Dimorphism

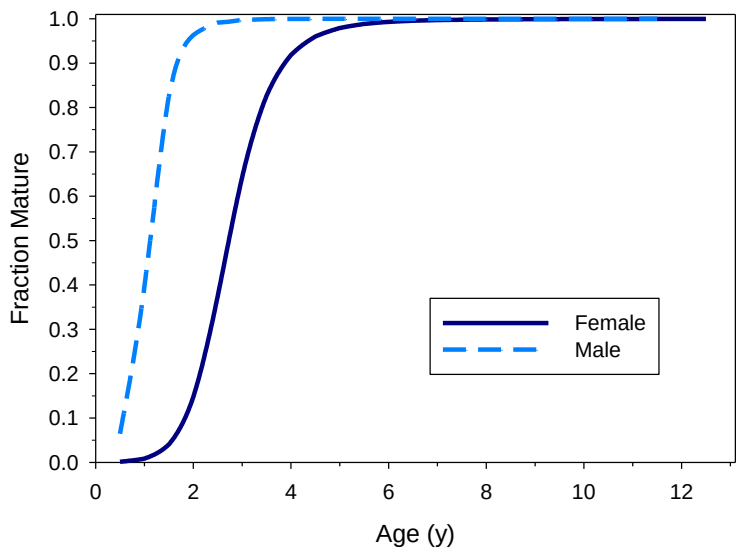
Western and Central North Pacific Swordfish Length at Age



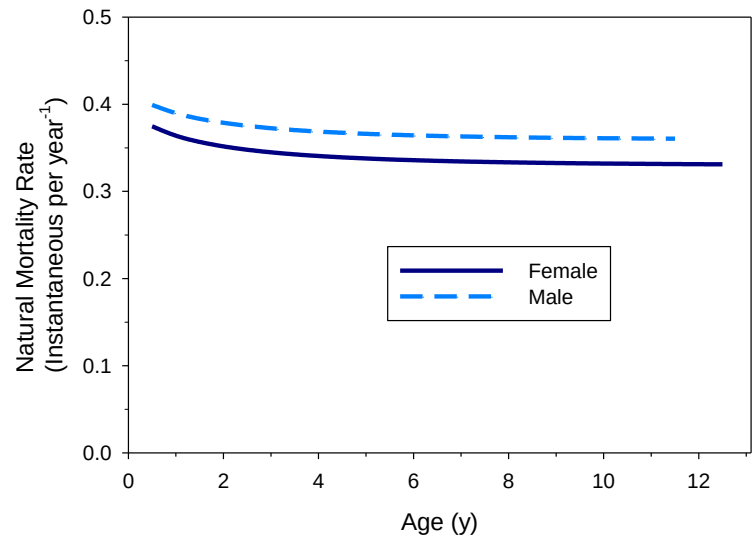
Western and Central North Pacific Swordfish Weight at Age



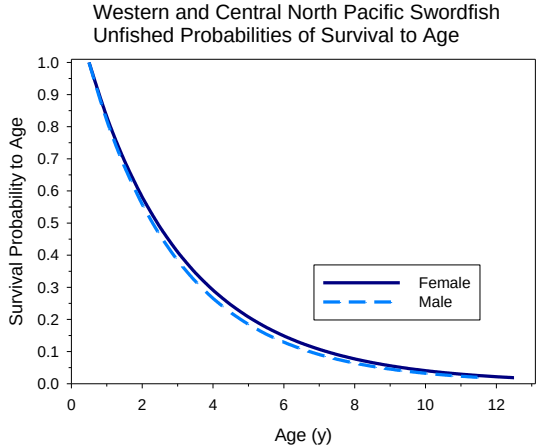
Western and Central North Pacific Swordfish Maturity at Age

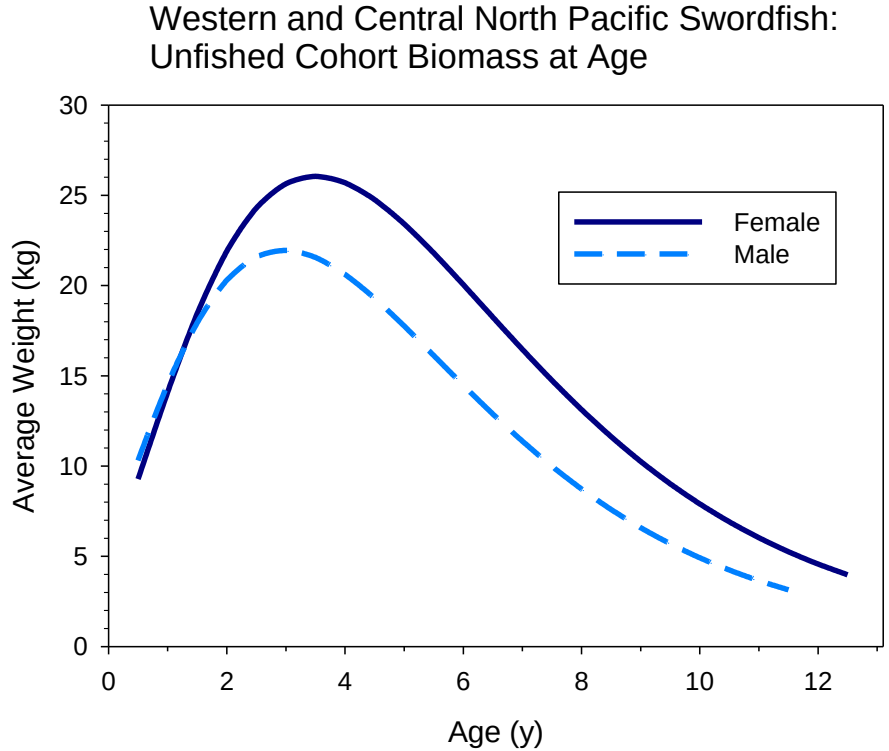


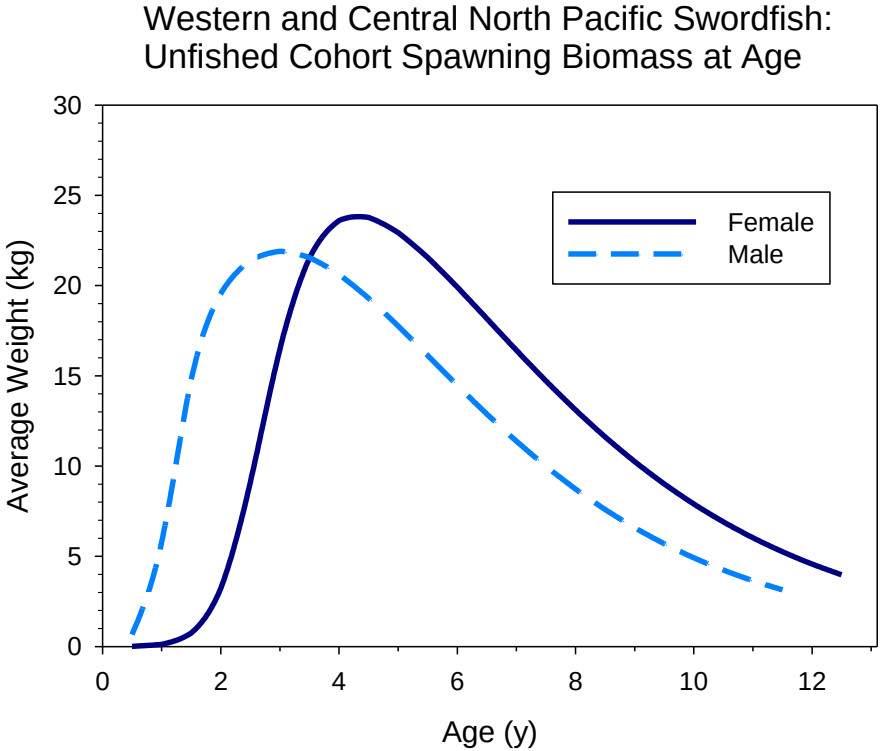
Western and Central North Pacific Natural Mortality at Age



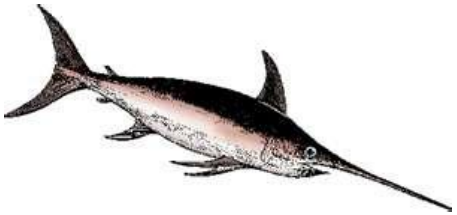
Western and Central North Pacific Stock: Life History Characteristics and Sexual Dimorphism

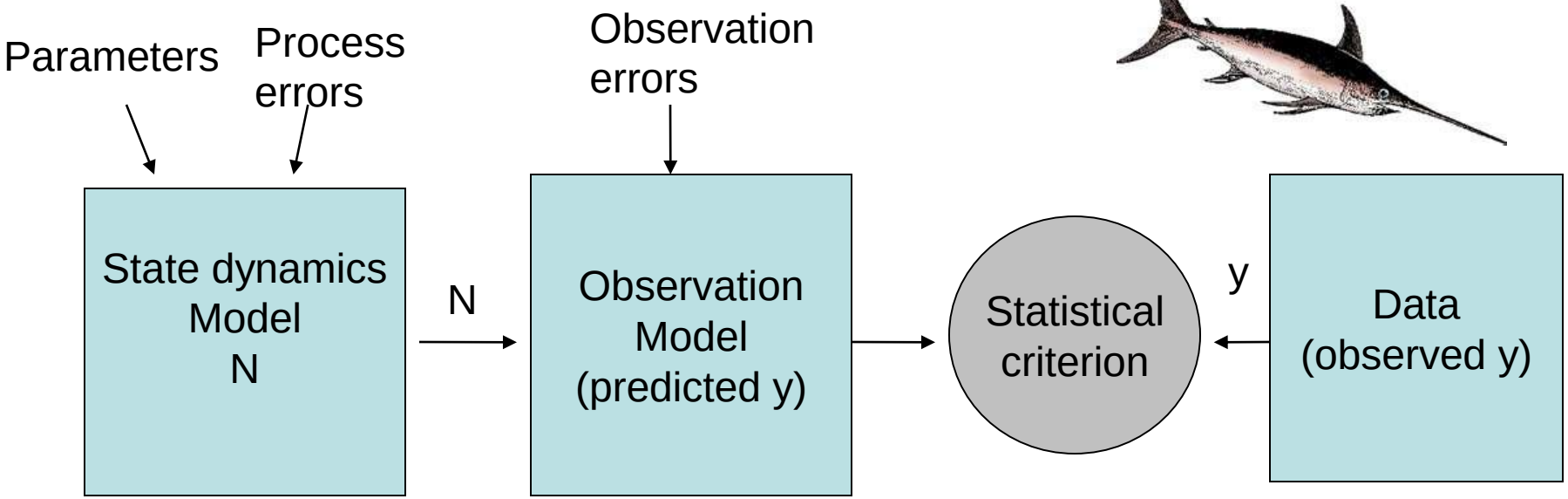






Parameter estimation and state dynamics for integrated assessment models (e.g., Stock Synthesis)





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

Parameter N_o

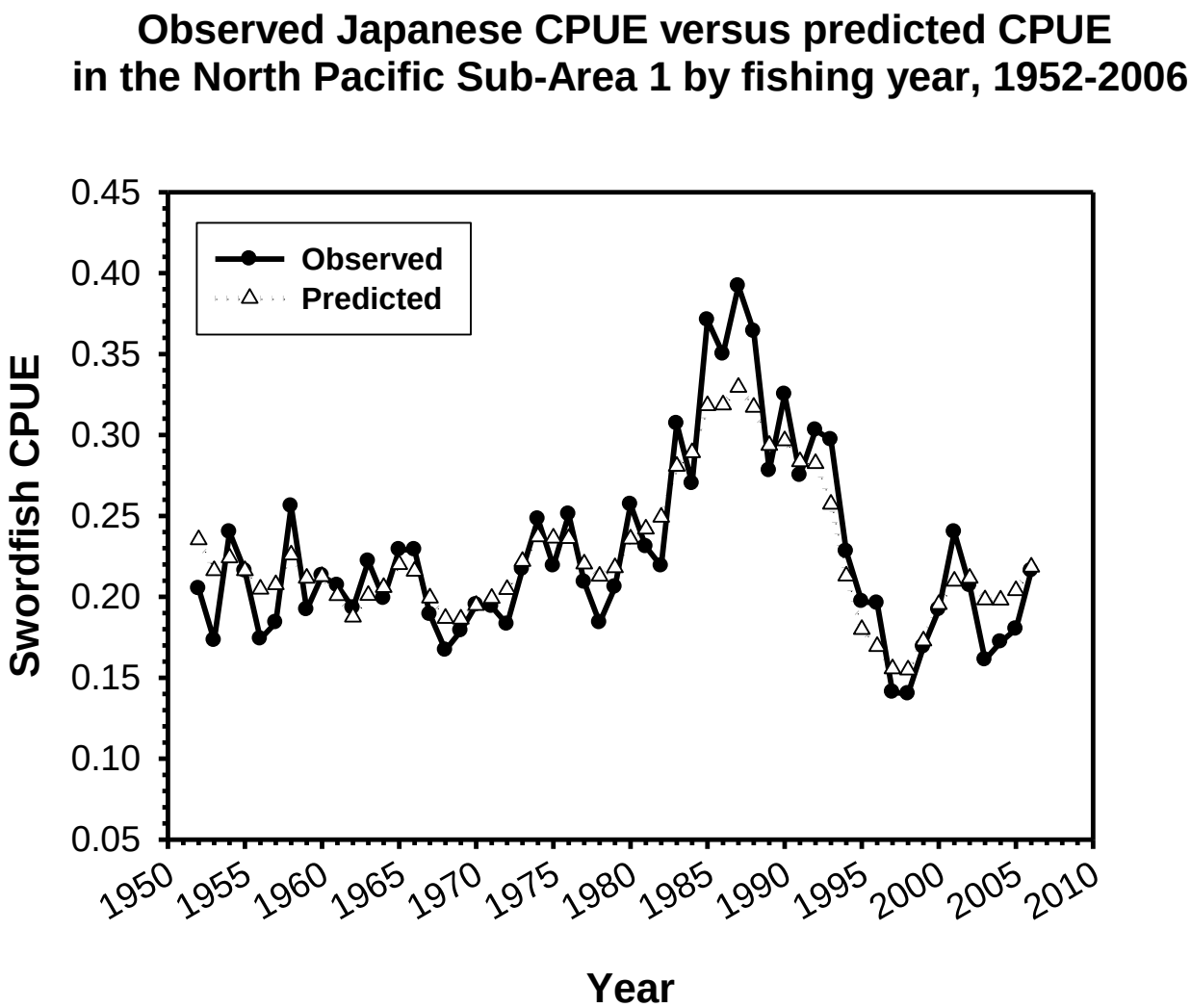
$y_t=qN_t$

Parameter q

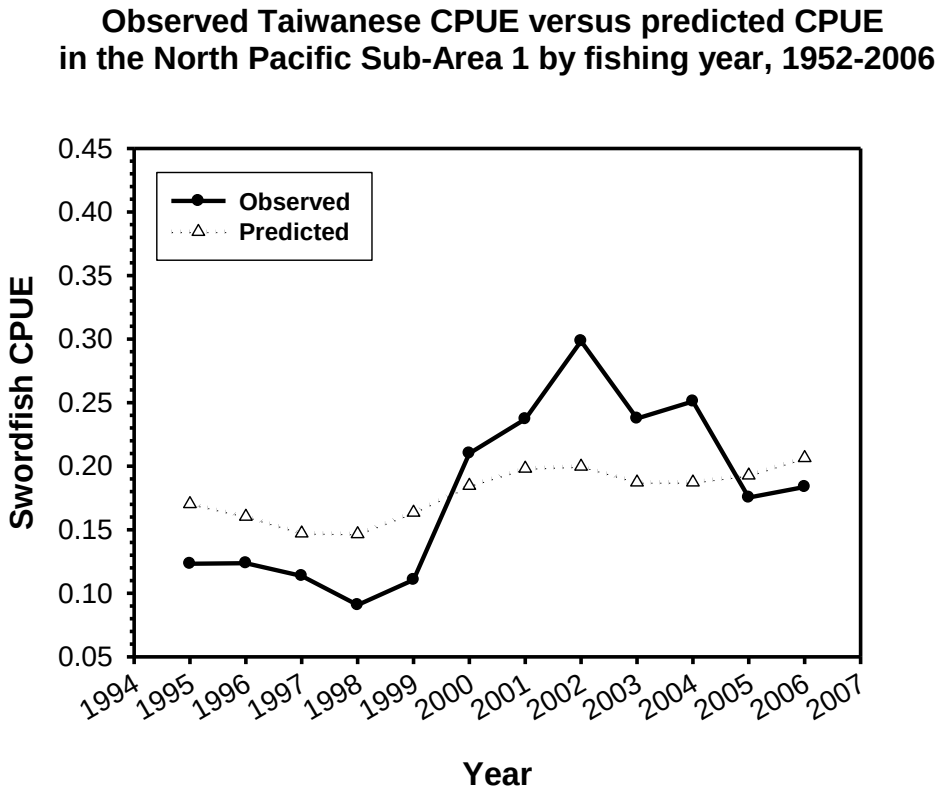
$$-\frac{n}{2}\ln[\sum(y_t-\hat{y}_t)^2]$$

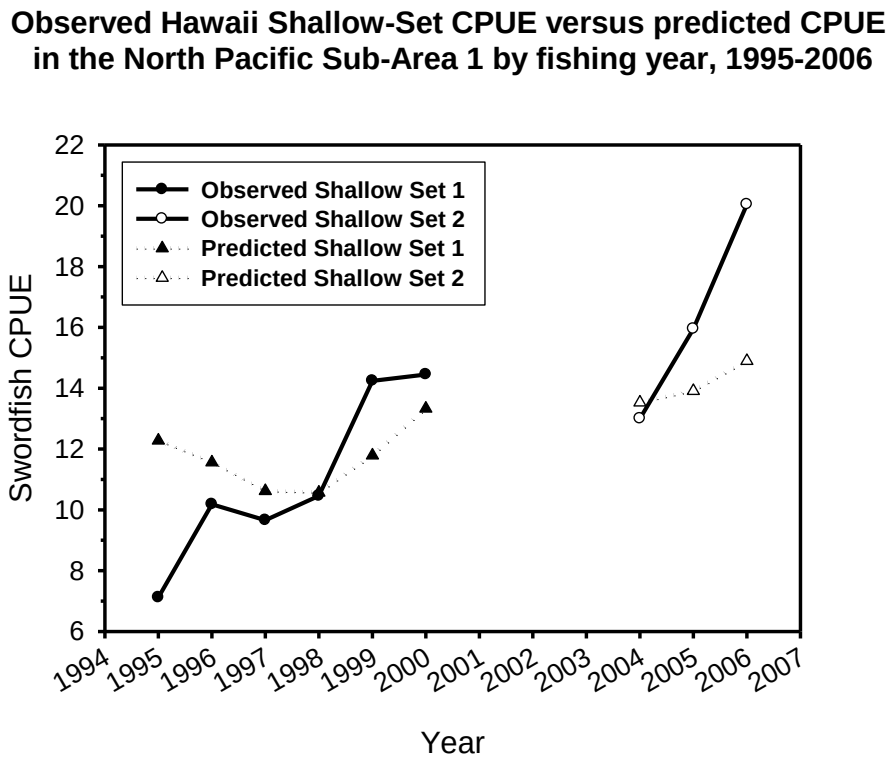
Log-likelihood function

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



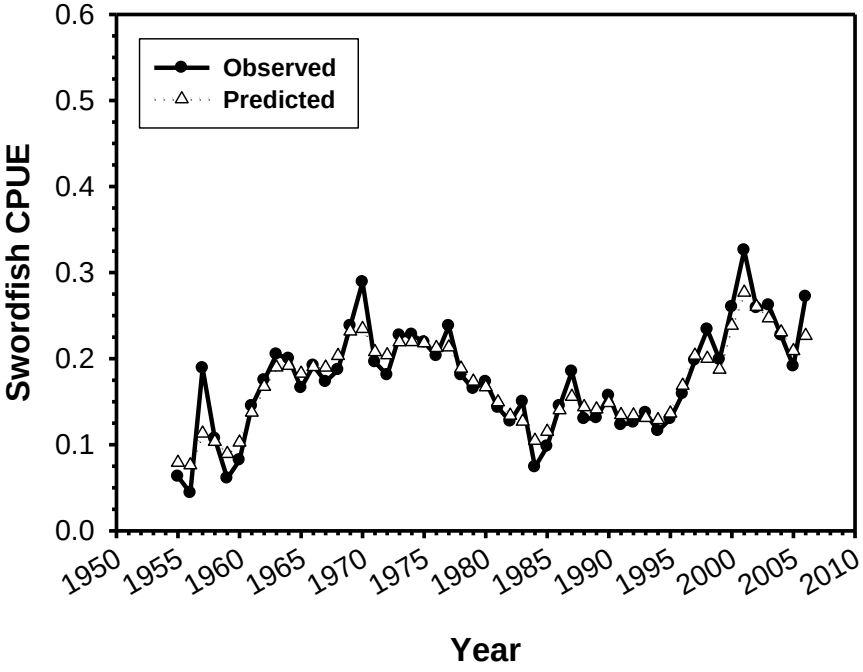
Western and Central North Pacific Stock: Production Model Fits to Catch-Per-Unit Effort Indices



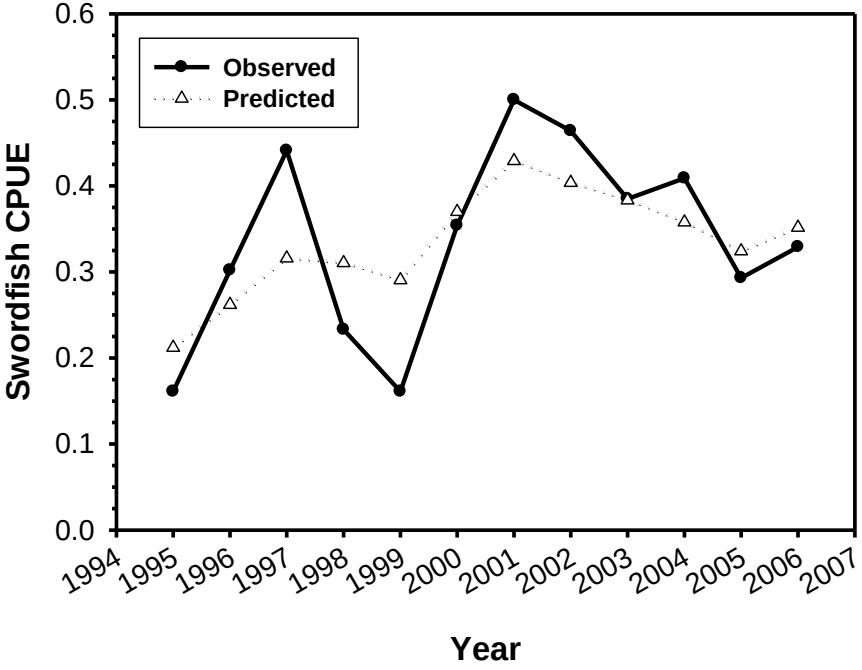


Eastern North Pacific Stock:
Production Model Fits to Catch-Per-Unit Effort Indices

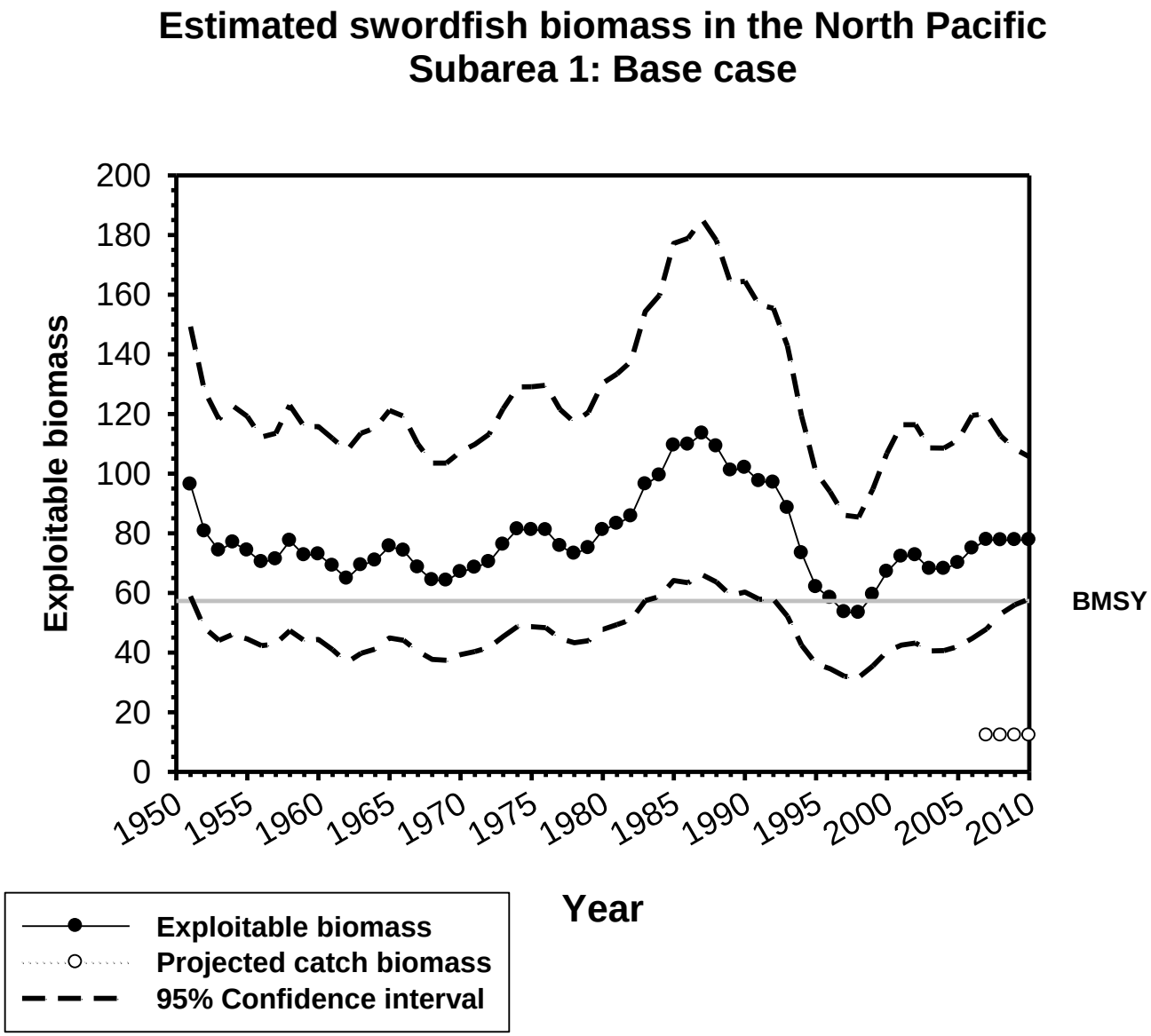
Observed Japanese CPUE versus predicted CPUE in the North Pacific Sub-Area 2 by fishing year, 1955-2006 Updated swordfish catch, March 2010



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

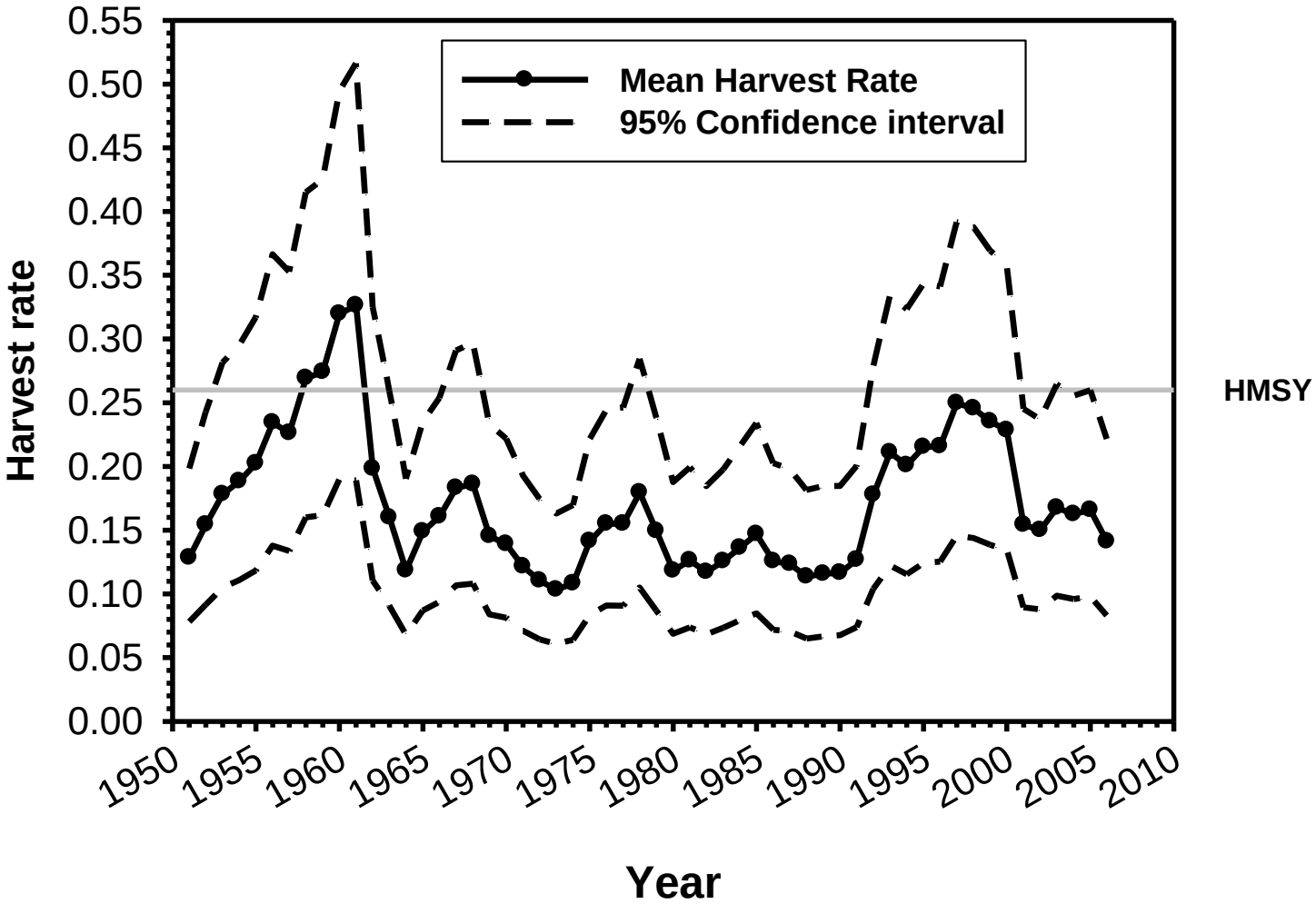


Western and Central North Pacific Stock: Production Model Estimates of Exploitable Biomass

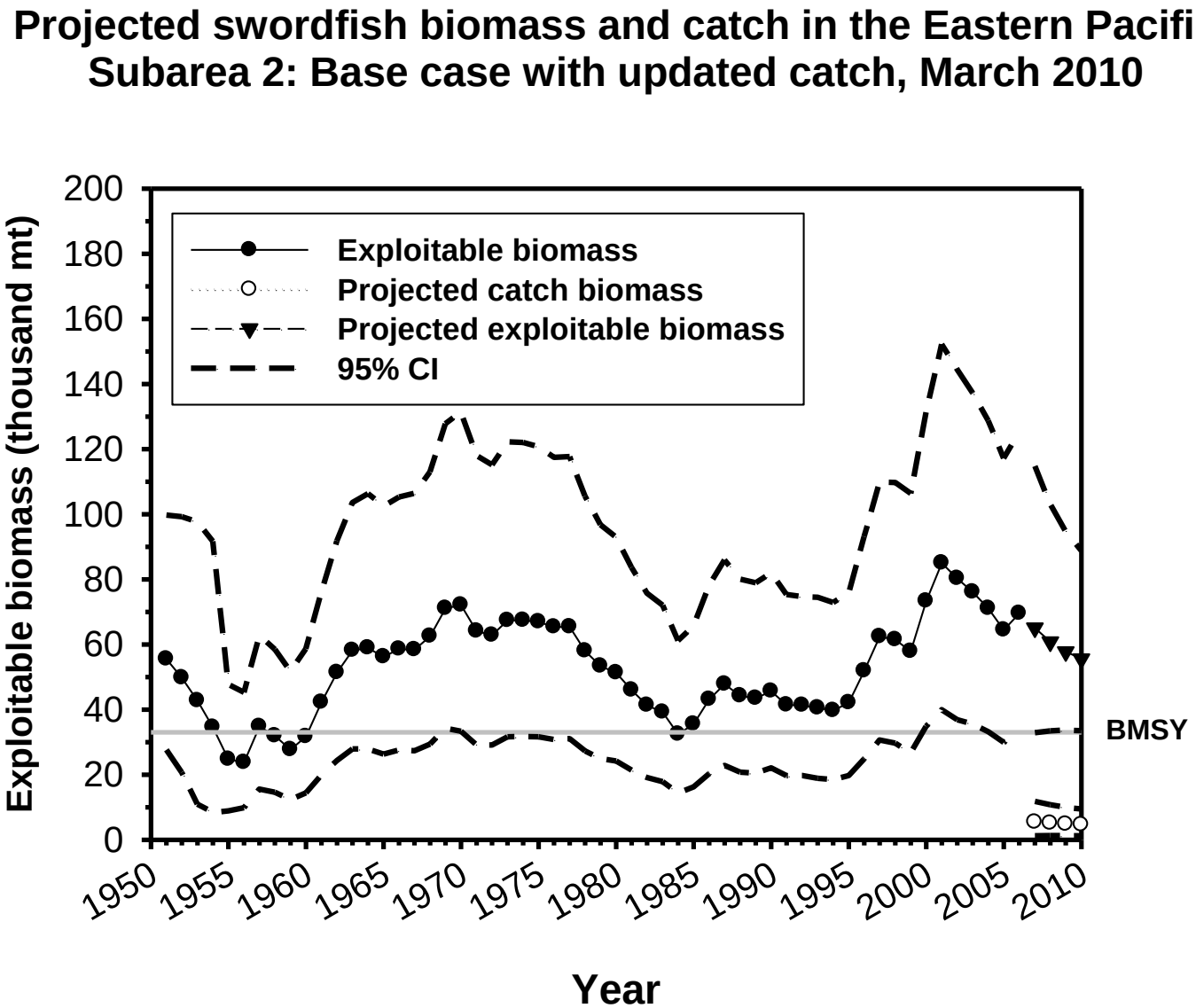


Western and Central North Pacific Stock: Production Model Estimates of Harvest Rate

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

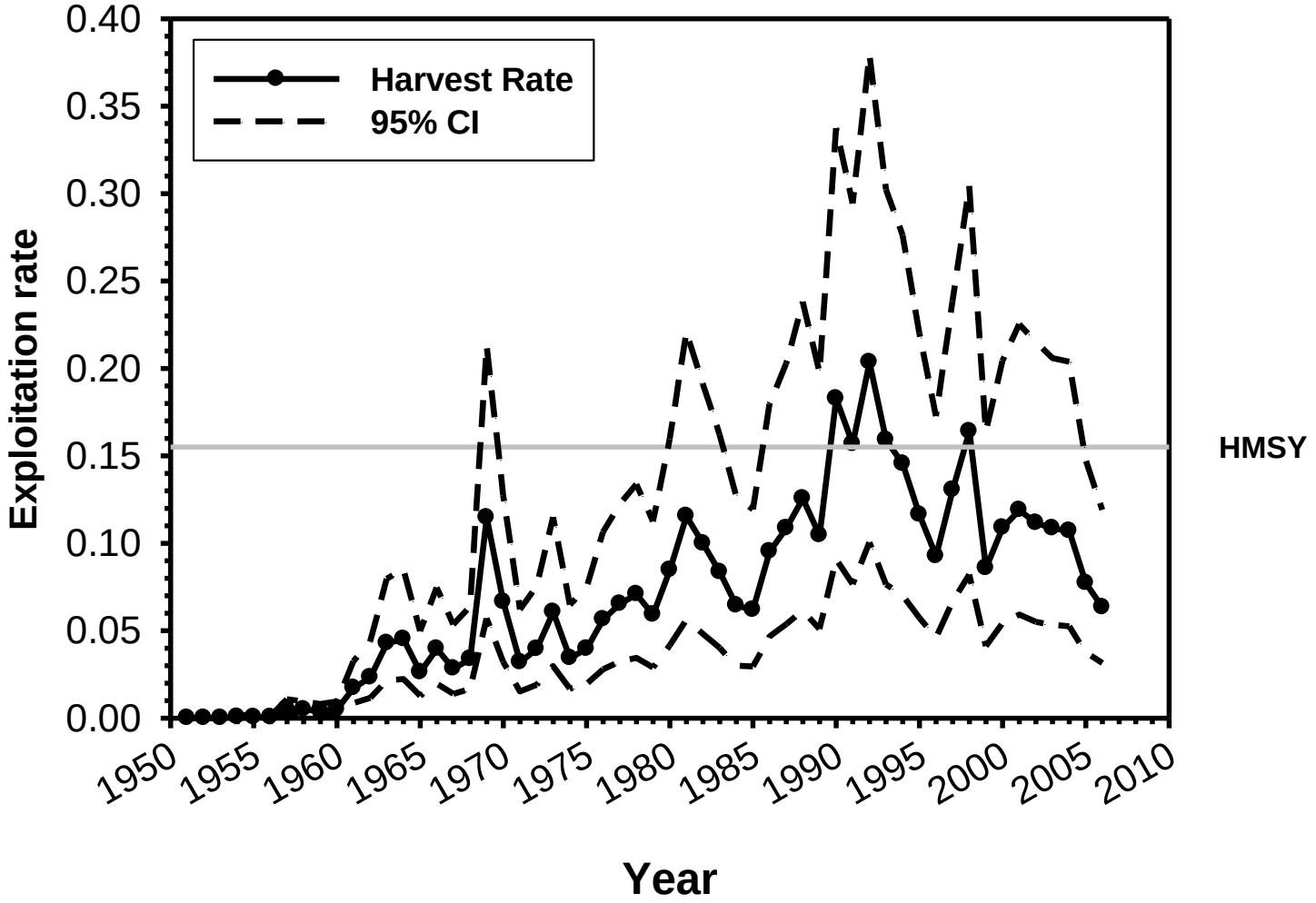


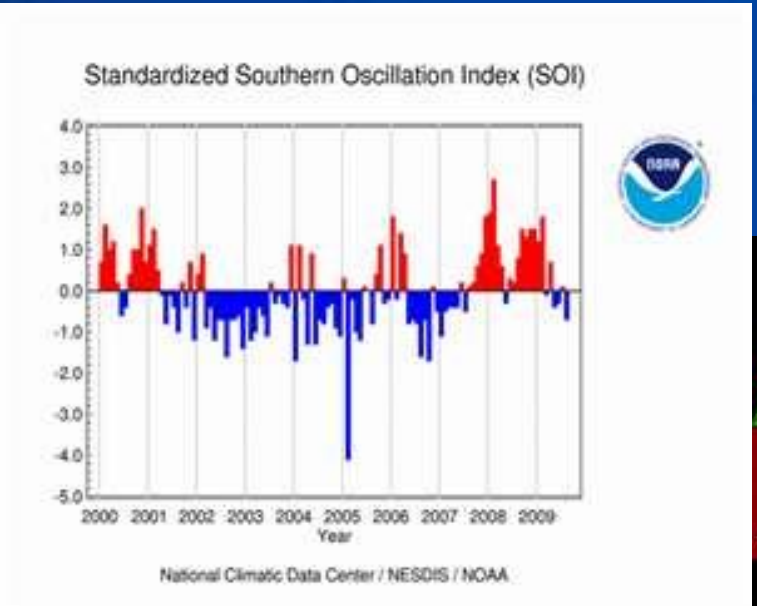
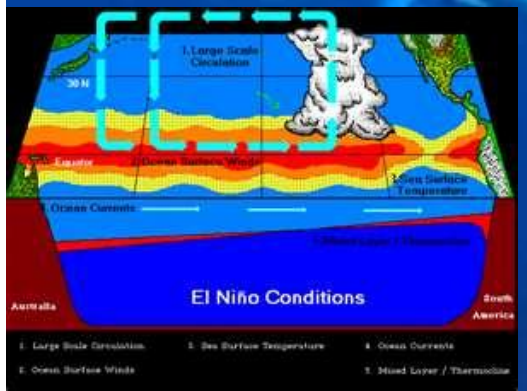
Eastern North Pacific Stock: Production Model Estimates of Exploitable Biomass



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