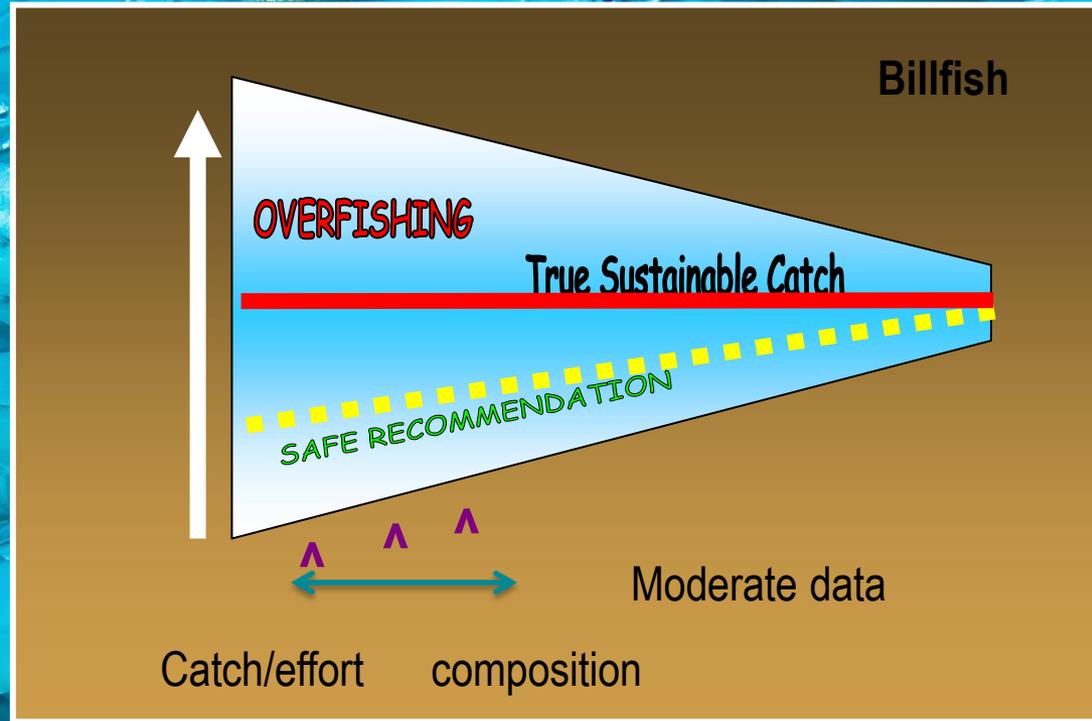


11.3 Billfish: Swordfish example



Kevin Piner

Topics

1. Relevant Biology Understanding
2. Data
3. Modeling
4. Problems
5. Strengths, Challenges and Strategies

Stock Scenario - 1

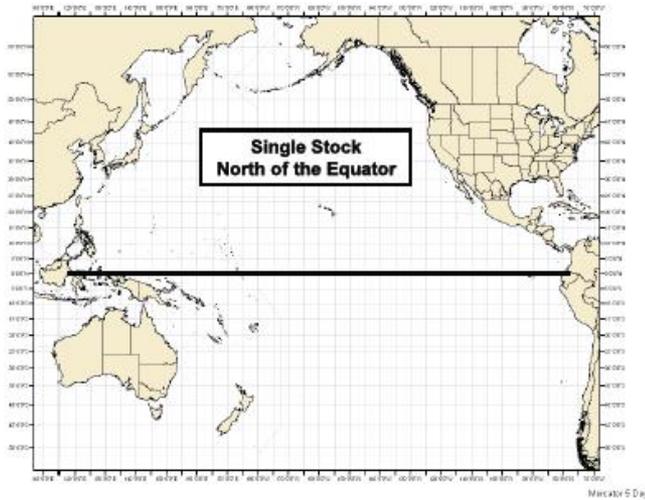
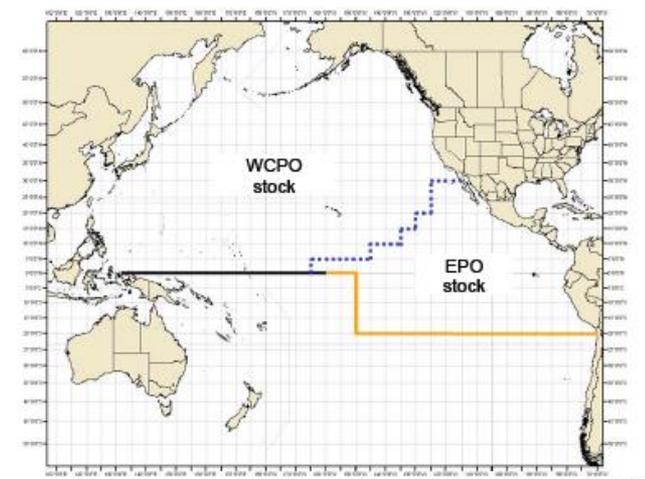


Figure 3. Stock Scenario-1, a single North Pacific swordfish stock north of the equator.

Stock Scenario - 2



..... Proposed boundary
Adapted from Ichinokawa and Brodziak (2008; Figure 7d)

Uncertainty in Stock Structure

Population/stock?

Supported by genetics

Life history and size structure of the catch

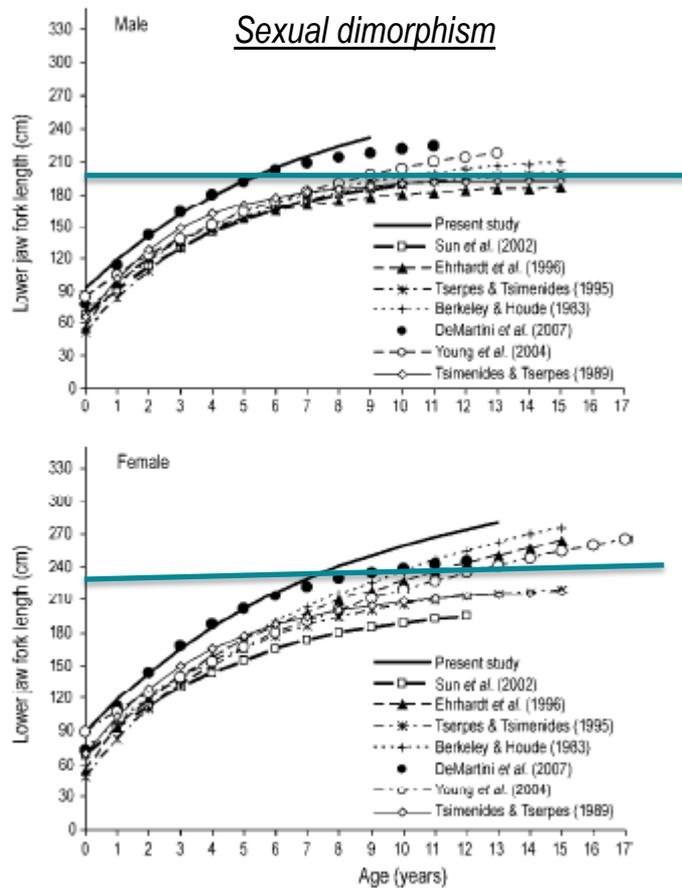
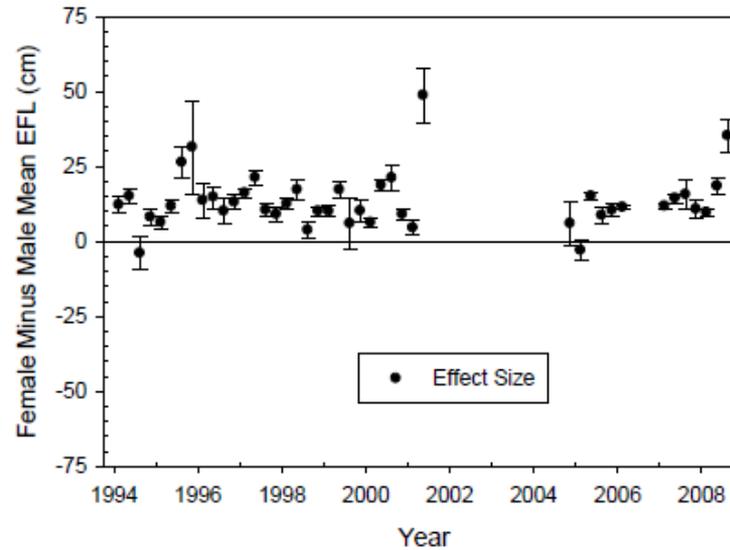


Figure 8. Summary of Von Bertalanffy growth curves of swordfish estimated by different studies.

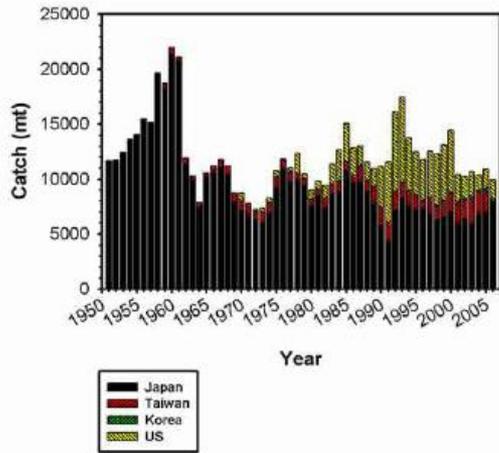
Cerna *Lat. Am. J. Aquat. Res.*, 37(1): 59-69, 2009

Figure 3. Observed effect size (solid) for two-sample T-test comparing mean lengths of female and male swordfish along with sample precision of effect size (± 1 standard deviation) in the directed Hawaii longline fishery.



Sexual Dimorphism affects size structure of catch

North Pacific Swordfish Two-Stock Scenario
Catch by Country - Sub-Area 1



Data:

North Pacific Swordfish Two-Stock Scenario
Catch by Country - Sub-Area 2

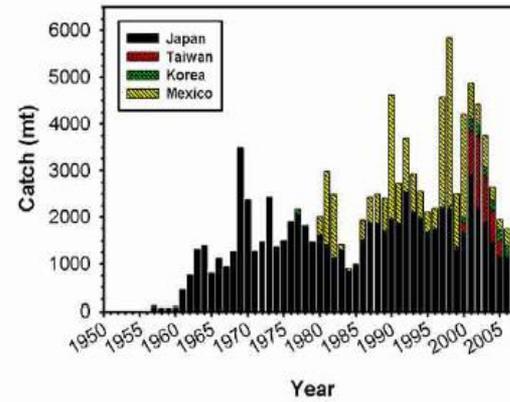
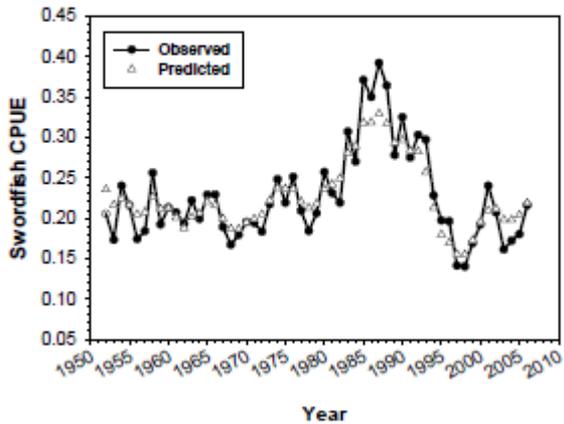


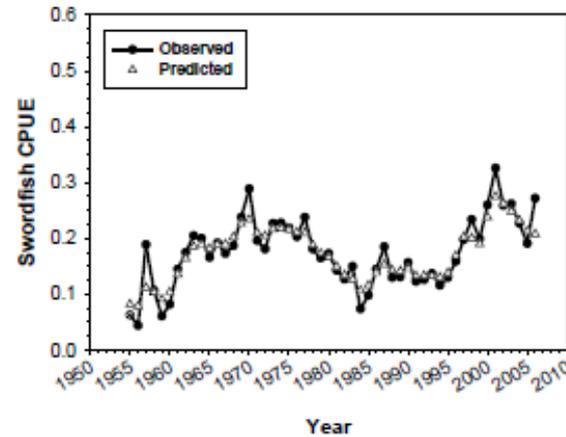
Figure 4. Total Sub-Area 1 swordfish catch by country under Stock Scenario-2, two North Pacific stocks.

Figure 5. Total Sub-Area 2 swordfish catch by country under Stock Scenario-2, two North Pacific stocks.

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



Observed Japanese CPUE versus predicted CPUE
in the North Pacific Sub-Area 2 by fishing year, 1955-2006



What type of model to use.....

Working Group Criteria

Availability of data

Modeler preference and Completeness of assessment modeling

Bayesian Surplus Production Model

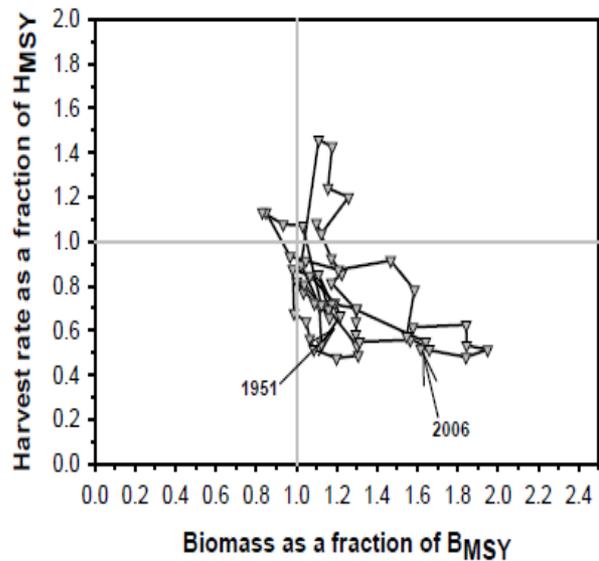


Figure 12. Sub-Area 1 biomass as a fraction of B_{MSY} and harvest rate as a fraction of H_{MSY} (1951 – 2006).

Resulting Dynamics

Model Results

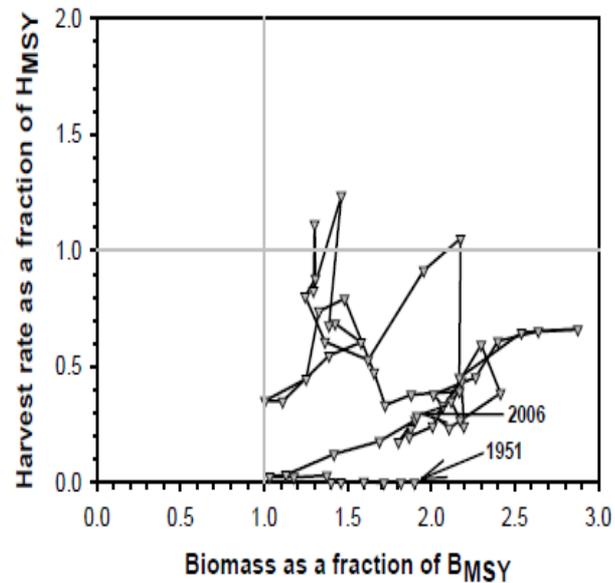


Figure 13. Sub-Area 2 biomass as a fraction of B_{MSY} and harvest rate as a fraction of H_{MSY} (1951 – 2006).

But Wait.....catch series in area 2 revised in the next year!

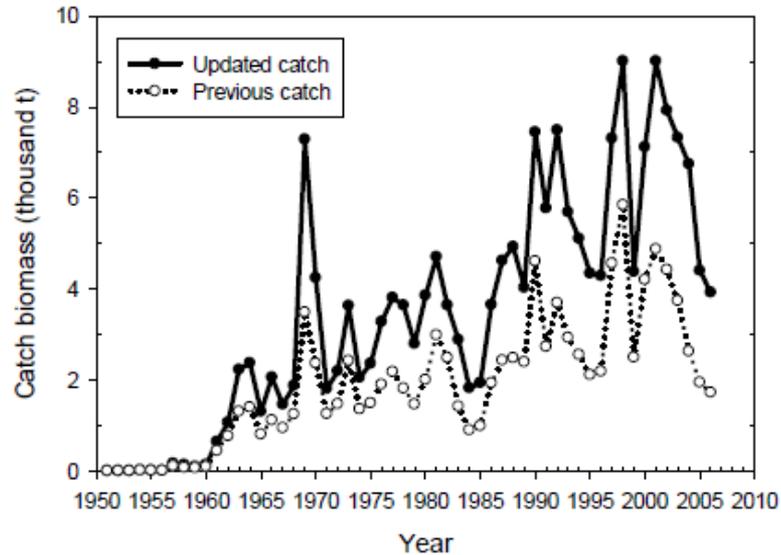
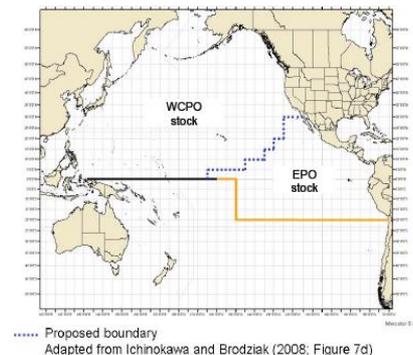


Figure 3. Total catch biomass estimates for the Eastern North Pacific (EPO) swordfish stock from 1952-2006. The updated catch biomass (solid line, filled circle) shows the catch used in the 2010 update of the EPO stock assessment reported at ISC 10. The previous catch biomass (dotted line, open circle) shows the catch used in the previous EPO stock assessment reported at ISC 9 in 2009.



strengths

Swordfish targeted and unrecorded catch or discards not a major issue
Enough data to construct a preliminary age structured model for comparison

challenges

Did not account for sexual dimorphism or differences in sex/size of the catch by fleet
CPUE as proxy of abundance

strategies

More timely/complete submission of data
Better understand biology/lifehistory
Collect sex-specific composition information for all fleets
Add relevant model process