

# What to do with multiple models?

John M. Hoenig

Virginia Institute of Marine Science



## Point estimation

- Pick best (one), ignore the rest?
- Average over credible models?
- Pick most conservative if biomass low, or most liberal if biomass high?

## Risk assessment/tolerance

A Paradox: with 1 model → no disagreements → high confidence (?)  
*BUT* multiple models → disagreements → less (?) confidence even though more information

## PRINCIPLE:

Looking & not seeing problems is reassuring

NOT looking & not seeing problems is NOT reassuring

Catch limits should be lower if there's no corroboration (i.e., from multiple models)

## PRINCIPLE (Hilborn & Walters):

When 2 models are in fundamental conflict  
the worst thing to do is average them  
because then you're sure to be wrong

## PRINCIPLE:

Model averaging (sensu Burnham & Anderson) can give more reliable estimates and larger estimated standard errors than unimodel estimates: the estimated standard errors are larger because they are more realistic

Caveats:

- (a) Set of models is chosen a priori based on biological intuition
- (b) Models

## Caveats for model averaging:

(a) Set of models is chosen *a priori* based on biological intuition

(b) Models are rejected before model averaging if diagnostics show problems.

Given (a) & (b), a weighted average is computed



Make sure no penalty for using more realistic s.e. (!)



The Hilborn-Walters principle is (perhaps) accommodated by the extra-wide s.e. when 2 models in conflict are averaged

## PRINCIPLE:

Independent corroboration may be stronger than dependent corroboration (tweaks)

Example:

SCAA with dome-shaped selectivity fits better than flat-topped

vs.

Tagging data corroborates selectivity is dome-shaped



# CONCLUSIONS

1) Need one number, but multiple models & types of data must be examined & “conflicts” need to be communicated to the SSC.

Consequence analysis where all consequences are similar vs. highly variable consequences

- annotated histogram of all models
- Analysis/comparison of best 5
- Identification of key assumptions

## 2) SSC's advice should reflect:

- Goodness of fit of credible models & diagnostics
- Effort expended to find conflicts
- Magnitude of conflicts
- How close the biomass may be to thresholds

3) Need to come to terms with what corroboration means

## 4) SSC catch decisions should be:

Lower when

Models imprecise or have problems

Little/dependent corroboration

Models are in strong conflict

Biomass could be low

Updated information not timely

Higher when

Models precise/no problems

Much, independent corroboration

Models largely agree

Biomass appears high

Rapid updating of information

5) Avoid penalizing an assessment for having more information