Law, science and managing fisheries

Josh Eagle, Stanford Fisheries Policy Project
“Conservation and management measures shall be based upon the best scientific information available.”
- National Standard Two

• What scientific information should be used in management? What role can law play in assuring that we use the “right” information?

• Should we (or can we) require managers to follow scientific advice? What does “based upon” mean?
Case study #1: King mackerel
Case study #2
Widow rockfish

HEAD SPINES
1 2 (3) (4) (5) 6 (7) 8

pectoral, pelvic, and anal fins w/ black membranes
anal fin w/ strong posterior slant
<table>
<thead>
<tr>
<th>Species</th>
<th>King mackerel</th>
<th>Widow rockfish</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Council</strong></td>
<td>Gulf of Mexico</td>
<td>Pacific</td>
</tr>
<tr>
<td><strong>Primary fishery</strong></td>
<td>Recreational</td>
<td>Mid-water trawl</td>
</tr>
<tr>
<td><strong>Quota Management begins</strong></td>
<td>1985</td>
<td>1982</td>
</tr>
<tr>
<td><strong>Declared overfished</strong></td>
<td>1985</td>
<td>2001</td>
</tr>
</tbody>
</table>
Gulf king mackerel

“Science”

observations → model → predictions → decision

E.g., catch-at-age
E.g., Beverton-Holt
E.g., $X > ABC > Y$

“Management”

$ABC = Z$
King mackerel management, 1985-1999
Gulf Council quota as a percentile of the recommended ABC range
Likelihood that Gulf Council quota would achieve target F
Widow rockfish

[Image of Widow rockfish]

Observations → Model → Predictions → Decision

E.g., catch-at-age

E.g., Beverton-Holt

E.g., $X > ABC > Y$

Most likely $ABC = Z$
Widow rockfish management, 1982-2000
Stock assessment authors’ recommendations with respect to the range
This discretion exists in all “pre-decision decisions”:

1. Choice of data
2. Choice of model
3. Choice of life history parameters

The myth of the insulated scientist:

1. Pressure from decision-makers
2. Experiential influences
3. Cognitive biases
Bluefin tuna

**“Science”**

- **observations**
  - E.g., catch-at-age
- **model**
  - E.g., Beverton-Holt
- **predictions**
  - E.g., $X > ABC > Y$

**“Management”**

- decision
  - $ABC = Z$
Using the **two-line model**, maximum sustainable yield is estimated to be 2,800 mt, and current spawning stock biomass is estimated to be at approximately **48 percent** of levels necessary to produce maximum sustainable yield. **The two-line model assumes that recruitment will not increase with spawning stock biomass.**

Using the **Beverton-Holt model**, maximum sustainable yield is estimated to be 7,700 mt, and the current spawning stock biomass is estimated to be at **approximately seven percent** of levels necessary to produce maximum sustainable yield. **This model indicates higher chances of good recruitment as spawning stock biomass increases.**
Bluefin tuna

Observations $\rightarrow$ Model $\rightarrow$ Predictions $\rightarrow$ Decision

E.g., catch-at-age

E.g., Beverton-Holt

E.g., $X > ABC > Y$

ABC = Z
E.g., catch-at-age

E.g., Beverton-Holt

E.g., $X > ABC > Y$

$ABC = Z$
Why clarifying the respective roles of science and management in the decisionmaking process *ex ante* might be important:

1. Integrity of the management process
2. Accountability
3. Review is difficult and impractical
Why clarifying the respective roles of science and management in the decisionmaking process *ex ante* is impossible:

1. Linguistic uncertainty inherent in legislation
2. Line between policy and science is not clear
3. Cannot isolate science from influence of politics
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Linguistic Uncertainty

- After considering science
- Supported by science
- Mandated by science
- Selected by scientists

Weaker

Stronger
• Insofar as it is a decision about the level of acceptable risk, we can paint nearly any decision, even one regarding which data to accept or which model to use, as a political decision.

  This becomes less true as scientific consensus is approached, and more true in areas characterized by scientific disagreement.

• There are influences that cross the “line” in both directions:

  *King mackerel* - scientists attempt to shape decision
  *Widow rockfish* - managers pressure scientists to make higher recommendations
Some legislative options for governing scientific advice:

1. Define “best available science”
   - Grey literature
   - Anecdotal information
   - Peer review

2. Establish protocol for identifying best available science
   - Identify scientists
   - Consensus, majority, other voting rules

3. Fund particular kinds of science

4. Incentives

5. Establish review procedures
   - Who, when, how
Some legislative options for governing management decisionmaking:

1. Identify decisionmakers
   - Councils
   - Agency
2. Process
   - Public
   - Trustee
3. Substantive guidelines
   - National standards
   - The 51% rule
   - The precautionary approach
4. Incentives
5. Review procedures/standards
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