Protected Species Economics
NEFSC Economics and Human Dimensions
Science Program Review

May 1-4, 2017
Outline

How did we get here?
- Regulatory History and policy instruments for MMPA and ESA species (i.e., Large Whales, Harbor Porpoise, and Sea Turtles)

What have we learned?

Some research findings

What next?
Policy Instruments used to mitigate MMPA and ESA species interactions in commercial fisheries

Regulatory

- Command & Control
  - Technology Standards
  - Input Restrictions
  - Output Restrictions
- Gear Modifications (e.g. pingers)
- Time/area closures
- Mortality Caps
What have we learned?
PR Threats: Commercial Fisheries

Data/Interaction Rates
- NEFOP is primary source for measuring some PR interaction rates
- Not all PR interactions observed

CEA good enough
- When outcomes can be linked to policy instruments ~ CEA
- If no link ~ may need valuation research for CBA

Policy Instrument success linked to multiple factors
- Biological
- Economic
- Social-Normative
- Longevity

1 Bisack and Magnusson (2016)
Some Research Findings

A collective consideration of policy instrument choice, observer sampling as well as economic and normative factors should support greater success in achieving management objectives.

Motivation:

• TEDs were proposed in Bottom Trawl to protect loggerhead sea turtles ~ non-compliance expected.
• Used pinger non-compliance problem in gillnet fishery to figure out how to think about PR non-compliance.
• If goals not met, non-compliance could be source of failure and not the policy instrument.

1 Bisack and Magnusson (2016)
Compliance Research

Bycatch

• Negative externality: unintended cost imposed on others
• Multiple approaches to avoid or reduce bycatch
• Multiple policy instruments (input vs output based)

Key issues in policy design

• Observability and/or monitoring (input vs outputs)
• Stochasticity (risk)
• Information sharing
• Individual vs collective approaches

Key question~ What policy approaches will be most effective?

• Most cost-effective?
Compliance Research

We need to:

• Lower the bycatch
• Account for fishers’ behavioral responses to policy instruments

Old way of doing business does not work

• Biased sampling
• Non-compliance
• Unmet goals
Compliance Framework

Economic incentive for non-compliance high
• Low detection rate
• Fines non-existent
• Perceived revenue gains

Normative factors may explain compliance ~ 3 broad types of normative factors via proxy variable
• Moral: Previous violations
• Social: Port Behavior
• Social: Sector
• Legitimacy: TRT member in vessel’s port

What we did:
• Compliance model (2007-10)¹
• Focus Group Research²
• Compliance model (2007-12)³

¹ Bisack and Das (2015); ² Bisack and Clay run focus groups in 2012-13; ³ manuscripts in prep
Consequential Closures
If non-compliance too high!

- Coastal Gulf of Maine CCA (Oct 1 – Nov 30)
- Eastern Cape Cod CCA (Feb 1 – April 30)
- Cape Cod South Expansion CCA (Feb 1 – April 30)
Compliance Research (2007-2012)
In 2010 consequential closure (CC) incentives & sectors established.

**Issue:** Non-compliance as high as 60% prior to 2010.

**Question:** Did CC, sector management or both influence increase in compliance after 2010?

**Focus Group results** show fishers are aware of:
- pingers a solution to deter porpoise; however, harbor porpoise stock is ok and does not need managing and TRT unfamiliar (legitimacy of solution, problem and process).
- other violators and see punishments as non-existent prior to CCs (detection, punishment)
- heavy over sampling of sector trips (social, under sampling induce non-compliance),
- financial advantages among sectors to purchase pingers (cost);

**Common Statement:** “You would not penalize a guy who only has one pinger missing, would you?”
Compliance Research Results (2007-2012)

Part 1: Did the threat of CC, sectors or both influence the increased compliance rate after 2010?
  • Two distinct group of violators: vessels with 1 missing pinger (safety reasons) and multiple pingers missing
  • Vessel more likely to violate if lower observer coverage (detection)
  • Vessels belonging to “multiple violations” group responded to CC.
    • Vessels with “one pinger missing” were not responsive to the CC threat; they did not believe one missing pinger would be recorded as a violation.

Part 2: How does observer coverage relate to compliance?
  • We may be able to “nudge” individuals to comply with increased sampling.

Part 3: Increased sampling is more cost-effective than closure threats (Command & Control)
  • Cost of CC was greater (~$1.95M)\(^1\) than increasing observer sampling (~$1.69M)

\(^1\)Bisack and Magnusson (2009)
Meeting of models, data, and focus groups

Counting “1 missing pinger” as still being compliant seems reasonable.

• 90% pinger compliance does not compromise bycatch reduction goals\(^1\)
• FG suggests it may improve legitimacy of agency, solution and management of bycatch. Group responsive to outreach

Increased sampling can achieve compliance goals

• PR stock assessment precision objectives are met at lower sampling levels compared to policy instrument compliance objectives.
• Increased sampling is a cost-effective alternative

\(^1\)Palka et al. (2008)
The need for evaluation

Regulatory
- Command & Control
  - Technology Standards
  - Input Restrictions
  - Output Restrictions

Non-Regulatory/ Voluntary Approaches
- Incentives
  - Market-based
  - Social/ Normative
    - Financial
    - Tradable Quotas
    - Access
  - Self-regulation
  - Negotiated agreements
  - Public programs
Bycatch & **Policy Instruments**
Managing Cod and Porpoise¹

**Problem:**
- Policy instruments can manage several species simultaneously; single species management and policy design prevalent for PR and non-PR species.

**Research shows**
- Input (fishing effort) controls approached a porpoise ITQ program in terms of *economic efficiency* while achieving the same porpoise conservation goals.
- Seasonal surcharges in high bycatch areas performed similar to ITQs
- Alternative selection may then rest on the goal of cod management.
- Significant differences in vessel profits, however, may make consensus on the appropriate program difficult.

**Notes:**
- The design/choice of the policy instrument can influence the incentives for compliance.
- Not one policy instrument fixes all problems
- Evaluation of previous actions can improve our understanding of behavioral responses to different policy instruments to support forecasting, needed for regulatory policy analysis and recovery planning.

¹Bisack (2008)
Value of Scientific Information
Harbor Porpoise Bycatch
Spotlight

Setting:
• Harbor Porpoise are bycatch in the NE and Mid-Atlantic gillnet fishery
• Though managed under different systems (MSA vs. MMPA and ESA), same general issues for PR and non-PR species.

Issue:
• Value of scientific information can quantify the economic benefits of reducing uncertainty in various aspects of management
• Variations in government funding can disrupt the collection of scientific data resulting in negative consequences for the private sector

Research shows: There is an Incentive for private sector investment in data collection when the collection reduces uncertainty.

Benefits: This type of analysis can help inform decisions on research, funding, and priorities.

Bisack and Magnusson (2014)
What next?

Multiple threats remain and there remains much to learn from evaluation of exiting policy instruments that may support innovative management.

Consider the Biodiversity Mitigation Hierarchy as framework¹

- Avoid Bycatch (e.g. closures)
- Minimize
  - (e.g. Command & Control, Non-regulatory/Econ Instruments)

Case Studies

- North Atlantic Right Whales
- Atlantic loggerhead sea turtles

1 Squires and Garcia (in review)
North Atlantic Right Whales
Case Study 1: North Atlantic Right Whale - Endangered

Question: Why are NARW not recovering?  
- Policy instruments not working?  
- Not enough protection?  
- Recovery feasible without elimination of all human threats?

Primary sources of mortality  
- Entanglement in fishing gear (gillnet, lobster traps)  
- Ship strikes  

Lack of recovery based on multiple biological factors: Abundance/Population Viability Analysis (Pace et al 2014); Mortality: (Pace et al. 2014) (Van der Hoop et al. 2012); Scarring rates; Calf production

We examine Dynamic Area Management (DAM), one of several policy instruments  
- Triggered when density of whales greater than critical threshold
North Atlantic Right Whale Protection: DAMs 2002-2009

2002

Public Sector Cost: Aerial Surveys

In 2007 82 flights:
- 14 flights triggered a DAM

Private Sector Cost: Lobster\(^1\) Gillnet

Raster Data
- Statistically assesses the precision of self-reported VTR fishing locations based on NEFOP\(^2\)

Assess catch, effort (DAS) and revenue inside and outside each DAM at trip level (2007)

Assume vessels
- continue fishing in DAM with required gear
- Or vessels remove gear from DAM area

\(^1\)Federal Waters; \(^2\) DePiper, 2014;
Preliminary Conclusions: DAM Policy Instrument

**Strengths**
- Incentive to modify gear between 2003 – 2008
- Complementary to fixed seasonal closures
- Dynamic captures inter-annual variability of animals presence

**Weaknesses**
- Lack of data on biological benefits and gap on how to measure
- Compliance not evaluated
- Delay in implementation between trigger (whales) and requirement
- Limited follow-up flights

### Total Cost of 2007 DAMs (preliminary)

<table>
<thead>
<tr>
<th></th>
<th>Private: Minimize</th>
<th>Public</th>
<th>Private: Avoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gillnet</td>
<td>$305</td>
<td>$2,700</td>
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</tr>
<tr>
<td>Lobster</td>
<td>$447</td>
<td>$1,500</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$752</td>
<td>$392</td>
<td>$4,200</td>
</tr>
</tbody>
</table>

- $1.14 M if we minimize entanglements
- $4.59 M if we avoided entanglements
Loggerhead movements (2012-2014)
Conservation of Atlantic Sea Turtles (CAST)
Case Study 2: North Atlantic Loggerhead Sea Turtles ~ Endangered

Began with the loggerhead recovery plan (2009)
  • mentions economic incentives; however, theoretical and empirical approaches to management are absent and/or need development.

An inter-disciplinary team (economists, biologist and an anthropologist) from the SE and NE science centers

Using a holistic conservation approach addresses all sources of threats
  • Recovery can be achieved by increasing survival and/or decreasing mortality
  • Consider the Biodiversity Mitigation Hierarchy framework to assess conservation tradeoffs

Transboundary
  • Threats are oceanic and terrestrial
  • Mitigation is necessary (e.g. spillover effects)
Figure 1. Estimated annual number of loggerhead nests in the southeast U.S., The Bahamas (Cay Sal Bank), Cuba, and Mexico, 2001-2008.

From a global perspective, the U.S. nesting aggregation is of paramount importance to the survival of the species as is the population that nests on islands in the Arabian Sea off Oman (Ross 1982, Ehrhart 1989). The loggerhead nesting aggregations in Oman and the U.S. account for nearly 90% of all loggerhead nests reported globally.
<table>
<thead>
<tr>
<th>Threat</th>
<th>Sub-Threat</th>
<th>Sub-Threat Type</th>
<th>Threat Rank</th>
<th>Zone</th>
<th>Life Stage</th>
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<tbody>
<tr>
<td>Fisheries Bycatch</td>
<td>Trawl (Bottom)</td>
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<td>1</td>
<td>Neritic</td>
<td>Juvenile</td>
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<tr>
<td></td>
<td>Long Line</td>
<td>Pelagic</td>
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<td>Ocean</td>
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<tr>
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<td>Demersal Lg Mesh</td>
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<td>Neritic</td>
<td>Juvenile</td>
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<tr>
<td>Resource Use/Non-Use</td>
<td>Legal Harvest</td>
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<td>1</td>
<td>Neritic</td>
<td>Juvenile</td>
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<tr>
<td></td>
<td>Illegal Harvest</td>
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<td>2</td>
<td>Terrestrial</td>
<td>Egg</td>
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<tr>
<td></td>
<td>Vessel Strikes</td>
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<td>2</td>
<td>Neritic</td>
<td>Juvenile/Adult</td>
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<td>Construction</td>
<td>Beach Armoring</td>
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<td>Terrestrial</td>
<td>Egg</td>
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<td>Ecosystem Alterations</td>
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<td>Washouts/Accretion</td>
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<td>Hatch</td>
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<td>Species Interactions</td>
<td>Predation by</td>
<td>Native Species</td>
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<td>Terrestrial</td>
<td>Egg/Frenzy</td>
</tr>
</tbody>
</table>

Result of Threat Analyses: Top Ranked sub-threats (Loggerhead Recovery Plan, Appendix 2, V: 1-24)

Key: 300 (11-100); 3000 (101-1000); 30000 (10001-100000); 300,000 (100,001 – 1,000,000)
Conservation of Atlantic Sea Turtles (CAST) Project Goals

Identify

• Sociocultural and economic data needs
• Research and data gaps
  • Collaborate where possible (e.g. GARFO’s Atlantic coast recreational survey to assess turtle interactions)
• Prioritize threats ~ where social sciences can make a contribution to recovery
• Short term projects team can tackle
• Long term project proposals
• Potential funding sources
What have we learned (commercial fishery threats)?

Data
• CBA framework may allow a larger suite of policy instruments to be considered, but link to benefits is absent.

Policy Instruments
• A collective consideration of policy instrument choice, observer sampling as well as economic and normative factors should support greater success in achieving management objectives (and reduce non-compliance).
• Instruments vary in cost-effectiveness (e.g. gear modification costs less than closures)\(^1\)
• Instruments can be designed to achieve PR and non-PR goals simultaneously.\(^2\)

Methods
• Derived demand curves provide measure of value of information – fisher’s WTA to not catch one porpoise (shadow prices)\(^3\)
• Modified/extended PR bycatch models may allow economic evaluation of multiple mitigation strategies\(^4\)
• There are many different methods to modeling behavior

\(^1\) Magnusson, Bisack and Milliken (2012); \(^2\) Bisack (2008); \(^3\) Bisack and Sutinen (2006); \(^4\) Pan and Li (2016)
Final Comments and Questions that Remain

Sampling:
  • Can the compliance-inducement effect be generalized?

Asymmetry of Information:
  • Would increased consumer awareness impact management options?

Technology:
  • What are the incentives for innovation under the alternative management options?

Transboundary:
  • Does consideration of costs across national boundaries impact the choice of mitigation alternatives?

Still work to do..
  • address additional human threats beyond commercial fisheries bycatch
  • conduct Biodiversity Mitigation Hierarchy research; can move NMFS from single species toward EBM.
  • work more closely with biologists to address what would be required for recovery?

Additional resources and equitable funding opportunities might increase the speed of research and advice to management
References


Thank-you!