SUSTAINABILITY ASSESSMENT IN FISHERIES

Arantza Murillas-Maza**

Coauthors
Prellezo**, Garmendia*, Escapa*, Gallastegui*

* University of the Basque Country, Spain
**AZTI, Technological Institute for Fisheries and Food, Spain
OUTLINE

- Introduction. Threats to the sustainability of fisheries and the assessment of the sustainability.
- Case Study. The Basque trawl fisheries.
- Weak and strong sustainability
- Methodology. Rapfish analysis.
- Results
- Discussion
INTRODUCTION

Threats to the sustainability of fisheries worldwide:

– UN Millennium Ecosystem Assessment (2005)


Background of the two papers:

- ELME (EU project): links among the declining state of the marine environment and Europe’s human lifestyles.
- Four environmental issues
  - habitat change
  - eutrophication
  - chemical pollution
  - fishing
- Four major sea areas
  - Baltic
  - Mediterranean
  - North-East Atlantic
  - Black Sea
INTRODUCTION

- How to **define** and **assess** sustainability in fisheries (is fishery exploitation sustainable?)
- Using a **multidimensional** approach (economic, social, ecological, institutional, technological, ..)
  - how to **compare** the different dimensions
  - **compensability** and **substitutability** among dimensions
    - → **weak and strong** sustainability
Main objectives of the two papers

- To analyse the sustainability of fisheries exploitation by applying a technique to perform an inter-temporal and multidisciplinary analysis of the Basque trawlers.
- To compare the implications of applying weak and strong concepts to the sustainability assessment of fisheries.
- To analyse explicitly the trade-offs among different dimensions.
- We introduce critical thresholds for each dimension.
CASE STUDY


“Weak and strong sustainability assessment in fisheries” (Garmendia et al, *Ecological economics*, 2010)

Three fisheries:

1. Baka trawlers (hake, ICES division VIIIab)

2. Pair trawlers (hake, ICES sub-areas VII and VIII)

3. Baka trawlers (hake, megrim and anglerfish ICES sub-area VII)
CASE STUDY

Baka trawlers (ICES division VIIIabd)

Baka Trawler

European hake
WEAK & STRONG SUSTAINABILITY

- **Weak sustainability** assumes (Solow, 1974)
  - strong comparability (the possibility to measure all objects with the same scale (e.g., money).
  - substitution between dimensions
  - In other words: natural capital and human-made capital are interchangeable

- **Strong sustainability** assumes (Daly, 1992)
  - weak comparability
  - substitution between dimensions is constrained
  - some services provided by nature cannot be replaced by human-made capital
**RAPFISH** (rapid appraisal of the status of fisheries)

- non-parametric and multi-disciplinary evaluation method
- developed at the University of British Columbia (Pitcher and Preikshot, 2001, *Fisheries Research*)
- tell us if a fishery is more healthy than another but not “how much better”

**Previous papers using Rapfish:**

- Alder et. al. (2000), *North Atlantic fisheries*
- Baeta et. al. (2005), *Tagus estuary fisheries (Portugal)*
- Tesfamichael and Pitcher (2006), *Red Sea fisheries*
- Murillas et. al. (2008), *Basque trawlers fishing fleet in northern Spain*
Process to apply Rapfish to fisheries data

- Five evaluation dimensions with four attributes

- Score the attributes annually according to data (1996-2005)

- Multi-Dimensional Scaling (MDS): statistical ordination technique
  - Reduce a matrix of N fisheries and M attributes into an Nx1

Sustainability value: index from 0 to 100
METHODOLOGY

- Ecological dimension
  - Status exploitation
  - Recruitment variability
  - Change in T levels
  - Change in fish size

- Economic Dimension
  - Price
  - Profitability
  - Average wage
  - Landings

- Social dimension
  - Socialization of fishing
  - Fishing community
  - Trend of employment
  - Gross Added Value

- Technological dimension
  - Number of vessels
  - Vessel size
  - Change in catching power
  - Selectivity gear

- Institutional dimension
  - Limited entry (Input control)
  - Output control compliance (TAC)
  - Just management
  - Subsidy
### Ecological dimension

<table>
<thead>
<tr>
<th>Ecological dimension</th>
<th>Possible scores</th>
<th>“Bad”</th>
<th>“Good”</th>
<th>Definition:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploitation Status</td>
<td>0,1,2,3,4,5</td>
<td>5</td>
<td>0</td>
<td>ICES WGHAM criterion: MEY (0); Within PA values - (1); F too high (2); SSB too low (3); F too high and SSB too low (4); Probably unsustainable (5)</td>
</tr>
<tr>
<td>Recruitment variability</td>
<td>0,1,2</td>
<td>2</td>
<td>0</td>
<td>Coefficient of variability: low &lt; 40% (0); medium 40-100% (1); high &gt;100% (2)</td>
</tr>
<tr>
<td>Change in T levels</td>
<td>0,1,2</td>
<td>2</td>
<td>0</td>
<td>Tropic level of the catch in the ecosystem in which this fishery is embedded, decreasing: no (0), somewhat, slowly (1); rapidly (2)</td>
</tr>
<tr>
<td>Change in fish size</td>
<td>0,1,2</td>
<td>0</td>
<td>2</td>
<td>≤ legal size 27 cm(0); ≤ maturity (42 cm)(1); &gt; 42 cm (2)</td>
</tr>
</tbody>
</table>

Council Regulation (EC) 1998
METHODOLOGY

Sustainability analysis

- **Critical value** for each attribute:
  acknowledge the limits to substitution

- **Critical threshold** for each dimension:
  determine the limits below which assuming compensability becomes too risky
  - “dummy fishery” is estimated according to the critical values
Weak sustainability:
- all selected attributes are merged into a single composite indicator
- compensability among all attributes pertaining to the five dimensions is allowed

Strong sustainability:
- each dimension is considered separately
- compensability **only** among attributes pertaining to the same dimensions
RESULTS

Weak sustainability index

- FIFG
- Management plan for hake
- Emergency plan for hake
- Parcipatory
- Recovery plan for hake
- Weak Index
- Reference value

EAFE Workshop 2012
RESULTS: strong sustainability

Economic

Ecological

Technological

Social

Institutional
Results

Strong sustainability index: Economic

- deterioration due to low prices and low profitability
- Improvements in other dimensions have not implied improvements here
Strong sustainability index: Ecological

Before 2001:
- TACs,
- technical measures
- subsidies on scrapping and new vessels

2001: emergency plan

2003: recovery plan
- no subsidies
RESULTS

Strong sustainability index: Institutional

Regional Advisory Council (RAC)
- participatory management system
- increase stakeholder involvement in Common Fisheries Policy
RESULTS

Strong sustainability

![Graph showing strong sustainability over time across ecological, economic, technological, social, and institutional dimensions from 1996 to 2005.](image)
DISCUSSION

- Sustainability assessment of fisheries requires multidimensional approach

- Including multiple dimensions in an integrated assessment:
  - **compensability** and **substitutability** among dimensions
DISCUSSION

- Weak and Strong sustainability are complementary measures.

- Applying jointly both measures with the help of critical thresholds is a useful procedure for identifying trade-offs among dimensions

  support of policy advice
DISCUSSION

Identify relevant dimensions
Define indicators/attributes
Determine reference values
Strong Sustainability Assessment
Weak Sustainability Assessment
Trade-off analysis
Fisheries Sustainability Integrated Assessment
Policy advice
Thanks