

Listen to the ocean

Opportunities and barriers of incorporating ecosystem service valuation in marine planning: A European perspective

Tobias Börger Plymouth Marine Laboratory

> East Asian Seas Congress 16 - 21 November 2015 Danang, Vietnam



Content

- **Ecosystem service valuation (ESV)**
- Legal drivers for ESV in marine planning (EU / UK)
- **Examples of ESV**
- Conclusions

Ecosystem management

and losses

Plymouth Marine

- Cost benefit analysis (CBA)
- Cost effectiveness analysis (CEA) **Evaluate who gains and who loses**
- Equity weights costs and benefits Rank different management options according to a set of evaluation criteria
 - Multi-criteria analysis



Hanley, N., Hynes, S., Patterson, D. and Jobstvogt, N. (2015) Economic valuation of marine and coastal ecosystems: Is it currently fit for purpose? Journal of Ocean and Coastal Economics 2.

Ecosystem service valuation (ESV)

Why use ESV in marine planning?

- Highlight ecosystem services and their benefit which might otherwise be overlooked
- Assess societal priorities
- Uncover trade-offs between ecosystem service (provision) and ecosystem benefit (demand)

Critical concepts:

PML

- Total economic value (TEV, use and non-use values)
- Valuation methods: Revealed preferences vs. stated preference methods
- Monetary valuation vs. non-monetary approaches
- Stock vs. flow

Legal drivers of valuation for marine planning

European Union (EU):

PML Plymouth Marine

- Habitats and Birds Directive 1992
 - \rightarrow MPA designation (Special Area of Conservation SAC)
- Water Framework Directive (WFD) 2000
 - → Exceptions can be justified by disproportional costs of management measures
- Marine Strategy Framework Directive (MSFD) 2008
 - → Requires cost-benefit (CBA) and cost-effectiveness analyses (CEA) of marine management measures
- Maritime Spatial Planning Directive (MSPD) 2014

 \rightarrow "...consider economic, social and environmental aspects..." (Art. 5)

United Kingdom (UK):

Marine and Coastal Access Act (2009), Marine (Scotland) Act (2010)

- → Require an "ecologically coherent" network of MPAs
- → Impact assessment (incl. economic benefits of alternative site designations)

Example I: Dogger Bank

EU-FP7 VECTORS (2011-2015)

Policy environment:

Plymouth Marine

PML



www.marine-vectors.eu

- Designation as Special Area of Conservation (SAC) a form of MPA in Europe
- Competing interests: Fishing, conservation, offshore renewables (wind farm)

ESV approach:

- Ecosystem service assessment and valuation of resulting benefits from different MPA configurations
- Mixed-methods approach
 - -Ecological Assessment
 - -Monetary valuation (Discrete Choice Experiment)
 - Deliberative valuation (Citizens' Jury)



Three-part mixed method approach:



1. Ecological assessment:

PML Plymouth Marine Laboratory

• Future trends in ecosystem service provision (qualitative assessment of change)

Ecosystem			Dogger Bank		A2 – National Enterprise
cosystem	High level indicator	Specific indicator	A2	B1	B1 – Global Community
Services			scenario	scenario	BT - Clobal Community
Food provision - wild capture seafood	Fish/shellfish populations	Biomass	Û	Û	
		Abundance	Û	Û	
	Quality of the fishery	Species composition	Û	⇔	
		Age profile	Û	Û	
		Length profile	Û	Û	
		Fishing mortality	Û	Û	
		% affected by disease	⇔	⇔	
Biotic raw materials	Quantity of raw materials	Biomass	Û	Û	
	Quality of raw materials	Mortality	Û	Û	
	Air–sea and sediment– water fluxes of carbon and CO_2	Air-sea flux	û	Û	
Climate		Carbon burial	⇔	⇔	
regulation		Total organic carbon	Û	Û	
	Air–sea and sediment– water fluxes of other greenhouse gases	Air-sea flux	?	?	
Gene pool protection	Genetic diversity	Species diversity	⇔	Û	
		Biodiversity intactness index	Û	Û	
	Number and diversity of species using the area for nursery or reproduction	Abundance of fish/shellfish eggs	Û	Û	
		Abundance of	_		

Hattam, C., Atkins, J.P., Beaumont, N., Börger, T., Böhnke-Henrichs, A., Burdon, D., de Groot, R., Hoefnagel, E., Nunes, P.A.L.D., Piwowarczyk, J., Sastre, S. and Austen, M.C. (2015) Marine ecosystem services: Linking indicators to their classification. *Ecological Indicators* 49, 61-75.

Plymouth Marine Laboratory

PML

2. Stated preference valuation study (choice experiment):



Börger, T., Hattam, C., Burdon, D., Atkins, J.P. and Austen, M.C. (2014) Valuing conservation benefits of an offshore marine protected area. *Ecological Economics* 108, 229-241.

3. Citizens' jury:

PML Plymouth Marine

- Workshop with 19 members of the public (Newcastle, October 2013)
- Participants were informed by four expert witnesses
- Two rounds of facilitated discussion



Main results:

- Fishing should be prioritised over wind farm development
- Conservation should be a priority, but with caveats

Hattam, C., Böhnke-Henrichs, A., Börger, T., Burdon, D., Hadjimichael, M., Delaney, A., Atkins, J.P., Garrard, S. and Austen,
M.C. (forthcoming) Integrating methods for ecosystem service assessment and valuation: mixed methods or mixed messages? *Ecological Economics* 120, 126-138.

Example II: Linking MSFD Descriptors to ES categories

EU-FP7 DEVOTES (2012-2016)

Plymouth Marine

PML

Marine Ecosystems Research Programme (2014-2019



www.devotes-project.eu

EU Marine Strategy Framework Directive

- Adaptive management framework
- Member States to reach Good Environmental Status (GES) by 2020
 www.m
- 11 Descriptors of GES
- CBA of new management measures
- Link proposed management measures to ecosystem functions, services and benefits





Marine Ecosystems Research Programme

www.marine-ecosystems.org.uk

Example II: Linking Descriptors to ES categories (cont'd)

On cultural ecosystem services...

Table 4/	Continued
IdDie 4	continuea)

PML Plymouth Marine Laboratory

Ecosystem services	Examples of ecosystem benefits	Indicators of benefits and their measurement (units)
		Number of scuba-divers (Hedonic) property prices
14: Inspiration for culture, art and design	Marine themed media (e.g., films) Marine themes artwork and installations Use of marine themes in design (bionics, biomimetics) Employment	Number of films, revenue generated (e.g., in £, \$ or \textcircled{e}) Number of films, revenue generated (e.g., in £, \$ or \textcircled{e}) Number of products developed and revenues generated Number of jobs
15: Cultural heritage 16: Cultural diversity	Cultural importance of a site Indicator and unit of measurement are unknown	Discourse analysis to identify associations between relevant themes
17: Spiritual experience	Spiritual and religious significance to the marine environment	Number of people that attach spiritual and religious significance to the marine environment, discourse analysis
18: Information for cognitive development	Knowledge generated from natural patterns/prototypes	Number of documentaries/movies/paintings/advertisements derived from a particular site/ecosystem. Number of research articles and scientific findings

from Hattam et al. (2015)

Example III: Valuing MSFD Descriptors in Ireland

PML Plymouth Marine

Norton and Hynes (2014): Choice experiment survey: Annual WTP of Irish population for consequences of marine management under MSFD

	MSFD Descriptor of Good Environmental Status (GES)		Change	WTP (€)
D1	Biological diversity is maintained including sufficient quality and quantity of habitats and species	Biodiversity	Maintained	-16.70
D2	Marine food webs occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of each species	and healthy marine	Decrease	-2.74
D3	Healthy stocks of all commercially exploited fish and shellfish which are within safe biological limits	ecosystems		
D4	Contamination fish and other seafood for human consumption do not exceed unhealthy levels	Sustainable	Safe to eat but unsustainable	-26.67
D5	Concentrations of contaminants are at levels not giving rise to pollution effects	fisheries	Unsafe to eat and unstainable	-73.04
D6	Human-induced eutrophication is minimised	Pollution levels	No change	-28.26
D7	Marine litter does not cause harm to the coastal and marine environment	in sea	Increase	-74.37
D8	Non-indigenous species introduced by human activities have minimal affect on native ecosystems	Non-native	Existing remain	-27.63
D9	Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded	species	New species	-25.30
D10	Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems	Physical	Moderate	-21.37
D11	Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment	sea	Wide scale	-42.74

Norton, D. and Hynes, S. (2014) Valuing the non-market benefits arising from the implementation of the EU Marine Strategy Framework Directive. *Ecosystem Services* 10, 84-96.

Example IV: Triage approach to facilitate ES assessments Interreg ValMER (2012-2015)

Stage 1. The need for a marine ecosystem services assessment and general scoping.

Plymouth Marine

Laboratory

PML

- 1. For which purposes is a valuation of marine ES needed in the area?
- 2. What are the most important policy issues in relation to marine ES in the area?
- 3. What parts of the marine social-ecological system are concerned by these policy issues?





Pendleton, L., Mongruel, R., Beaumont, N., Hooper, T. and Charles, M. (2015) A triage approach to improve the relevance of marine ecosystem service assessments. *Marine Ecology Progress Series* 530, 183-193.

Conclusions

Plymouth Marine

PML

Challenges

- Absence / scarcity of data on the marine environment
- Linking ecosystem functions, services and benefits for valuation
- Data and concepts come at different spatial and temporal scales
- Engaging society with the marine environment
- Limited valuation data bases hinder the use of value transfer

Ways forward

- Further strengthen interdisciplinary work
- Mixed methods approached provide a wider set of valuation results (for MCA)
- Valuation does not have to be in monetary terms. But then clear metrics for ecosystem services and benefits are necessary (Hattam et al. 2015).
- ESV needs to be geared towards specific policy context (e.g. MSFD Descriptors)
- A triage approach helps to ensure the use of the appropriate framework and methods for ecosystem service assessments and valuation.



PML | Plymouth Marine Laboratory

> Tobias Börger Plymouth Marine Laboratory Email: tobo@pml.ac.uk Twitter: @tobias_borger