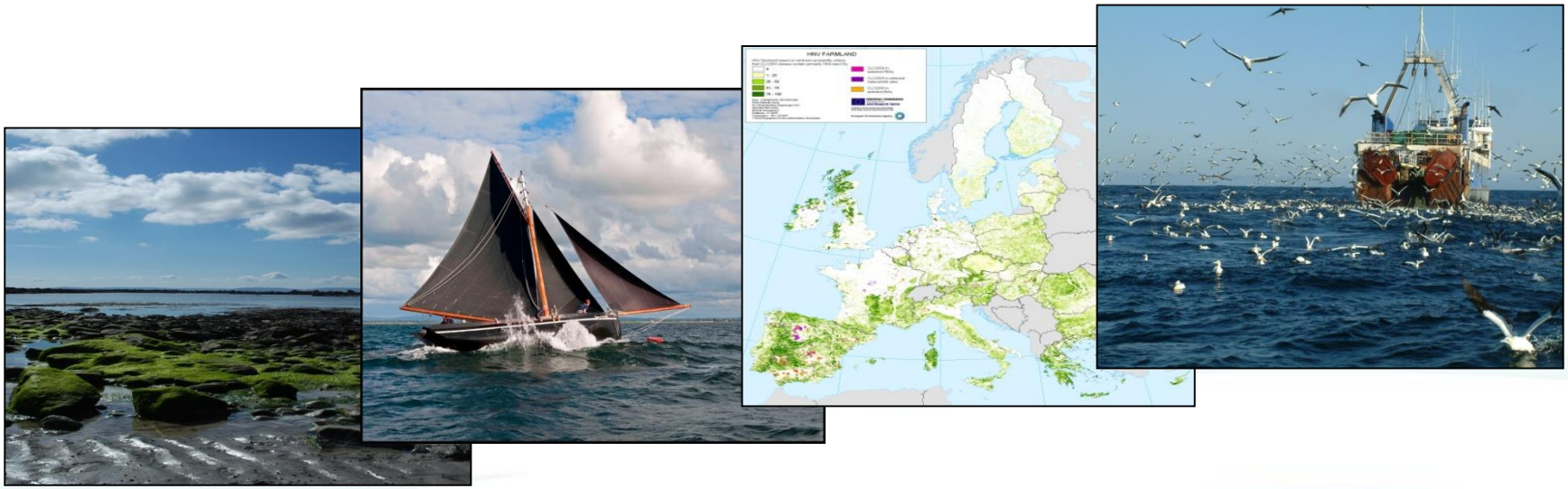
Approaches for Measuring Natural Capital

Stephen Hynes



EU-China Blue Year Brussels
2 June 2017

Overview

- Natural Capital
- Valuing Marine Ecosystem Services
- Issues with data and measurement
- Valuation techniques
- Some market and non-market marine ecosystem service values for Ireland

Natural Capital Accounting

- Need to align with the measurement approaches prescribed for national accounts (System of National Accounts; SNA)
- Need to go beyond GDP for environmental economic accounts (System for Environmental Economic Accounts; SEEA).
- Need to understanding of how ecosystem services, once quantified, can be incorporated in an accounting framework such as the SNA or the SEEA (the SEEA Experimental Ecosystem Accounting; SEEA EEA)
- Valuation central to applying an Ecosystem Approach to management at strategic policy level

Natural Capital

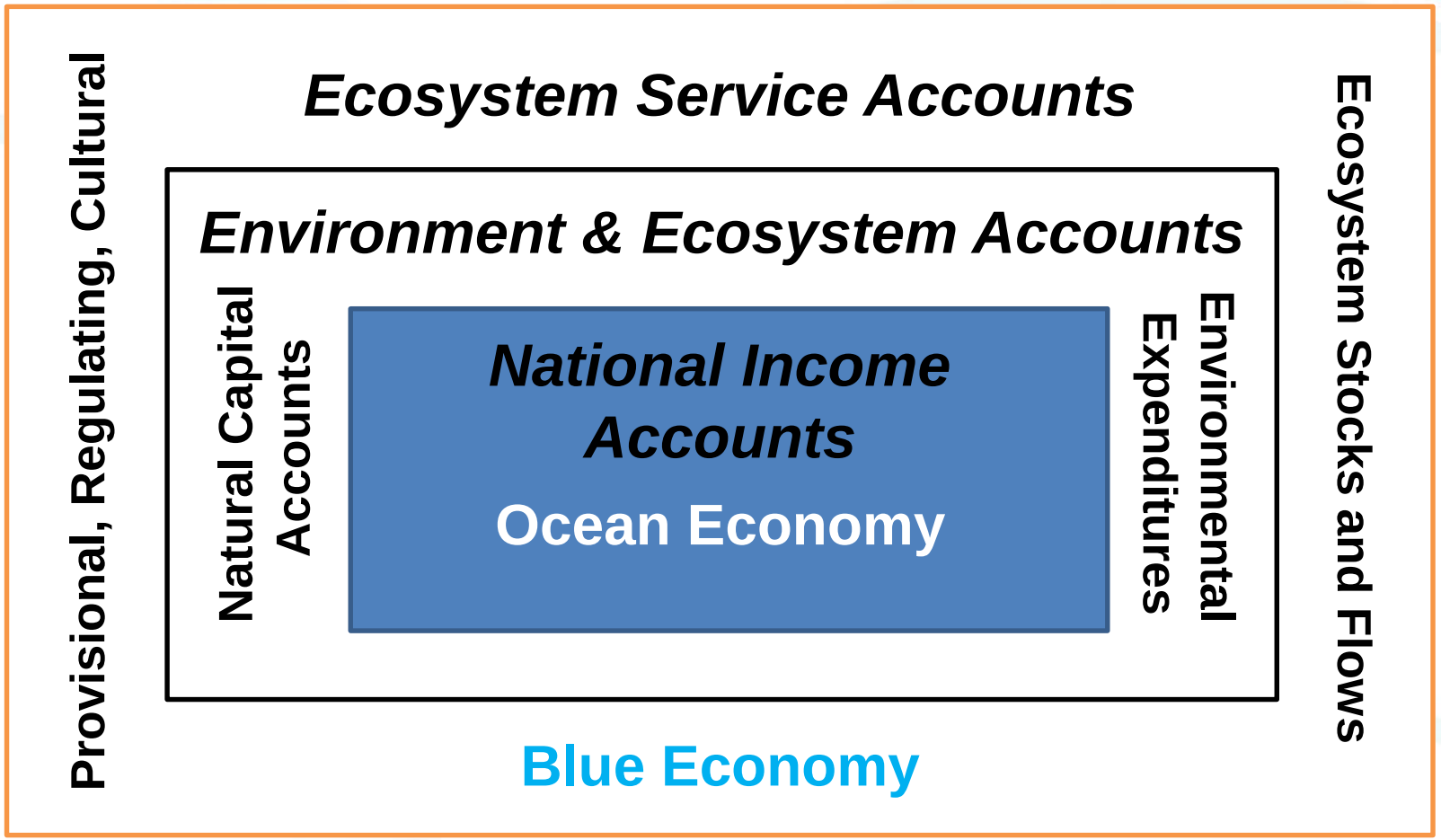
Within natural capital, one can identify non-renewable resources such as oil and coal reserves, but also the asset value of ecosystems which depend in turn on the flow of ecosystem services over time (Barbier, 2011).

From a national accounting perspective, the value of an ecosystem asset is the sum of the net present values of each ecosystem service generated by the asset under current management. (Obst et al. 2015)

Alternative definitions of NC

- SNA: falls under non-financial non-producing assets; Natural capital is the extension of the economic notion of (produced) capital to the natural environment, i.e. the 'stock' of natural (eco-)systems that yields a flow of valuable (ecosystem) goods or services into the future.
- UN Conference on Sustainable Development: Natural capital comprises Earth's natural assets (soil, air, water, flora and fauna), and the ecosystem services resulting from them, which make human life possible.
- SEEA Central Framework: Environmental assets are the naturally occurring living and non-living components of the Earth, together constituting the biophysical environment, which may provide benefits to humanity.

Multiple Lenses on the Blue Economy



Adapted from Colgan (2016)

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Some Challenges

- Need to distinguish benefits from services
- Need for valuation methods that exclude consumer surplus [to use exchange values]
- Measuring environmental degradation.
- Difficulty in estimating expected actual flows of a basket of ecosystem services, which will depend on the expected management and pattern of use of the ecosystem
- Standardised Estimates; e.g. UN CICIES framework

Data Requirements for the Ecosystem Accounting

- Asset Accounts

  - Physical models of resource stocks that can generate measures at regular intervals - Fisheries / Minerals
  - Price series
  - Production cost series (to identify resource values; e.g. in fisheries deduct harvesting costs from value of landed fish to get net unit price of the ecosystem service)

- Environmental Services
  - Government sector expenditure statistics that identify resource management
  - Survey of environmental expenditures

- Chain of custody for the ecosystem services in accounts

Other reasons to value marine services?

- To support sustainable growth across marine industries and sea basin strategies need to consider all costs and benefits, both internal and external
- Cost-benefit-analysis and environmental policy making
- Aid in communicating importance of marine ecosystems
- Legal claims and natural resource damage assessment
- Setting a framework to establish market based instruments such as taxes, fees, subsidies, etc.
- Guiding national and international strategies and directives
- Valuation central to applying an Ecosystem Approach to management at strategic policy level

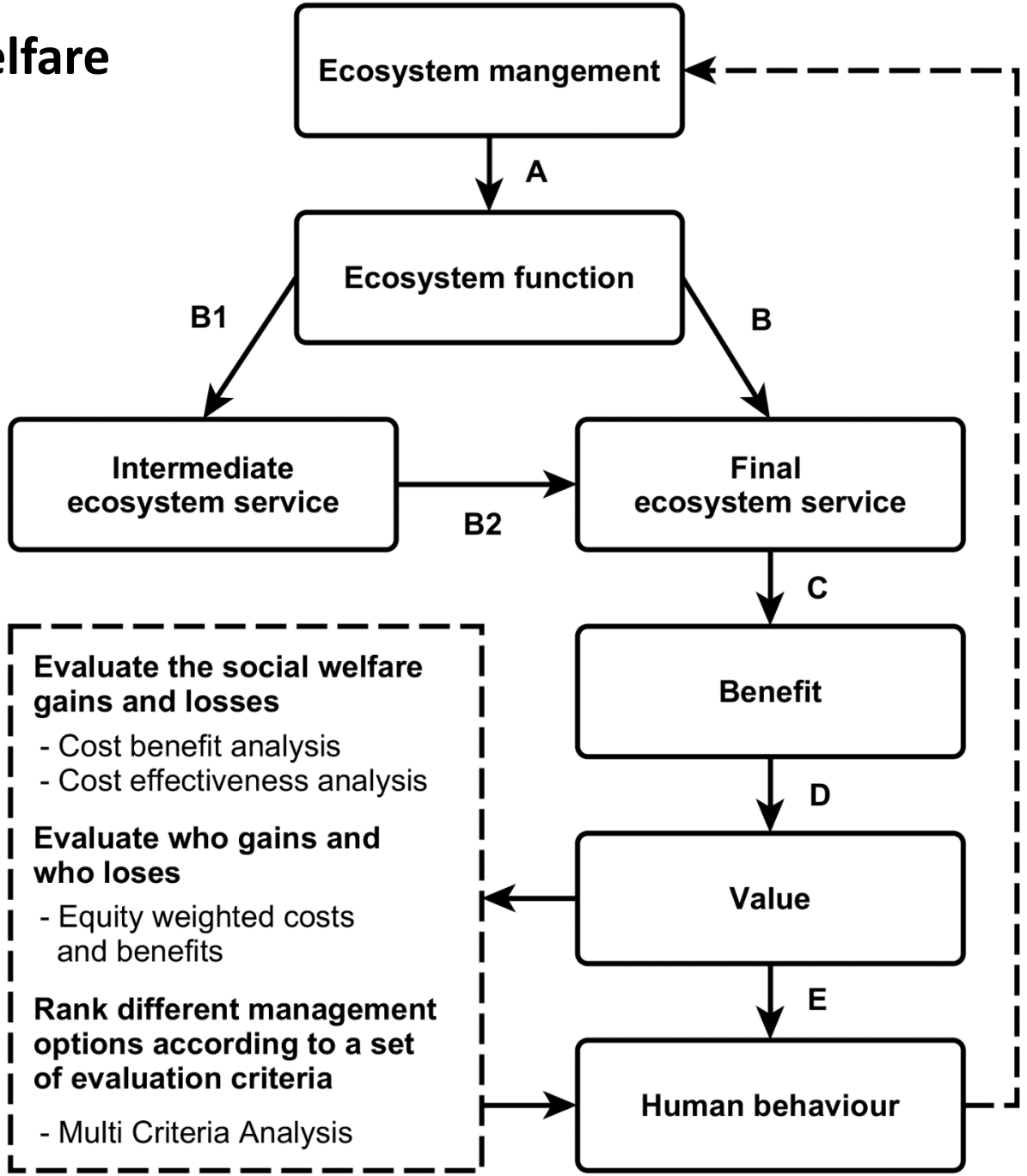
Common International Classification of Ecosystem Services (CICES) framework

CICES Framework		
Section	**Division**	**VIBES Examples**
Provisioning	Nutrition	Capture fisheries, aquaculture
	Materials	Seaweed, genetic material
Regulation & Maintenance	Mediation of waste	Wastewater treatment
	Mediation of flows	Storm and flood protection, erosion control
	Maintenance of physical, chemical, biological conditions	Habitat protection, carbon sequestration, pest and disease control
Cultural	Physical and intellectual interactions	Recreation, aesthetic views, education, science, heritage
	Spiritual, symbolic and other interactions	Symbolic, religious, existence, bequest values

From ecosystem to welfare benefits.

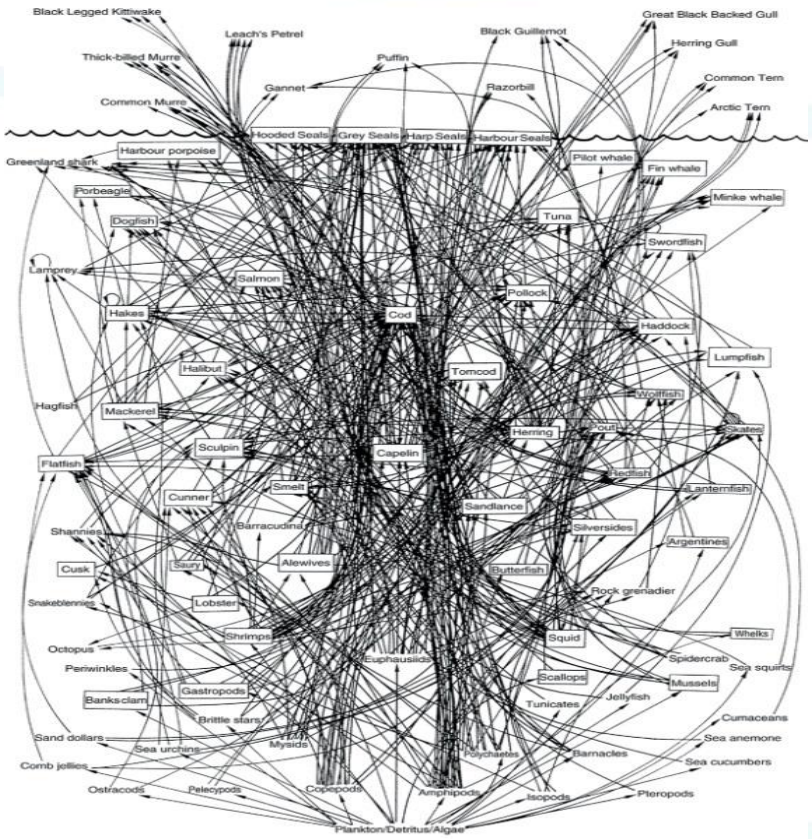
Simple Conceptual Framework

(Hanley et al. 2016)



Marine Ecosystem Restoration in Changing European Seas

Most important problem(s)



A simplified food web for the Northwest Atlantic (www.ifaw.org)

The functioning of many marine ecosystems is still poorly understood.

- This makes it difficult to
  - estimate impacts of existing policies
  - quantify impacts of measures
  - perform CBA in quantitative terms, let alone in monetary ones
- Not to mention quantifying ecological targets (GES)

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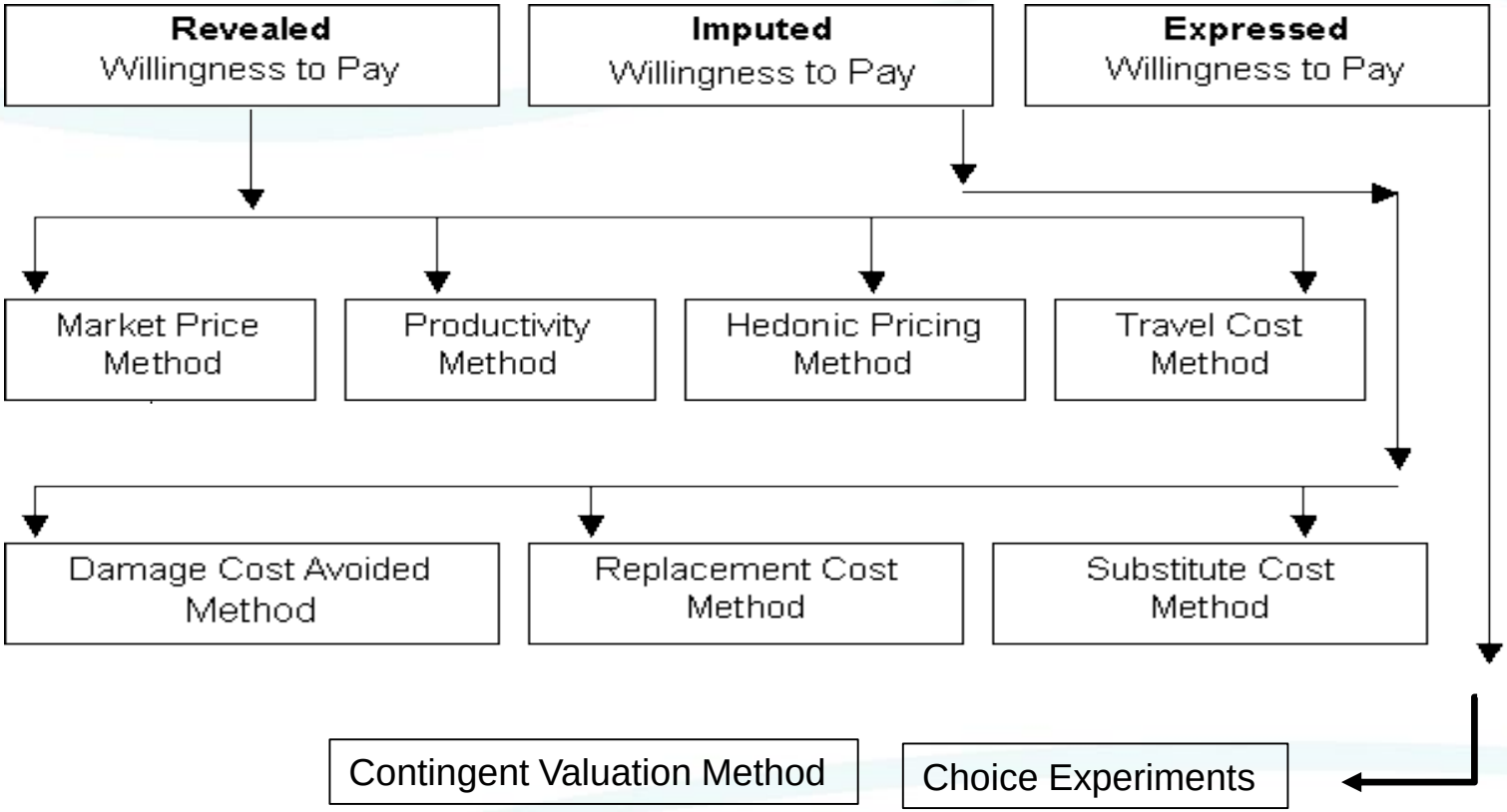
Valuation Methodologies



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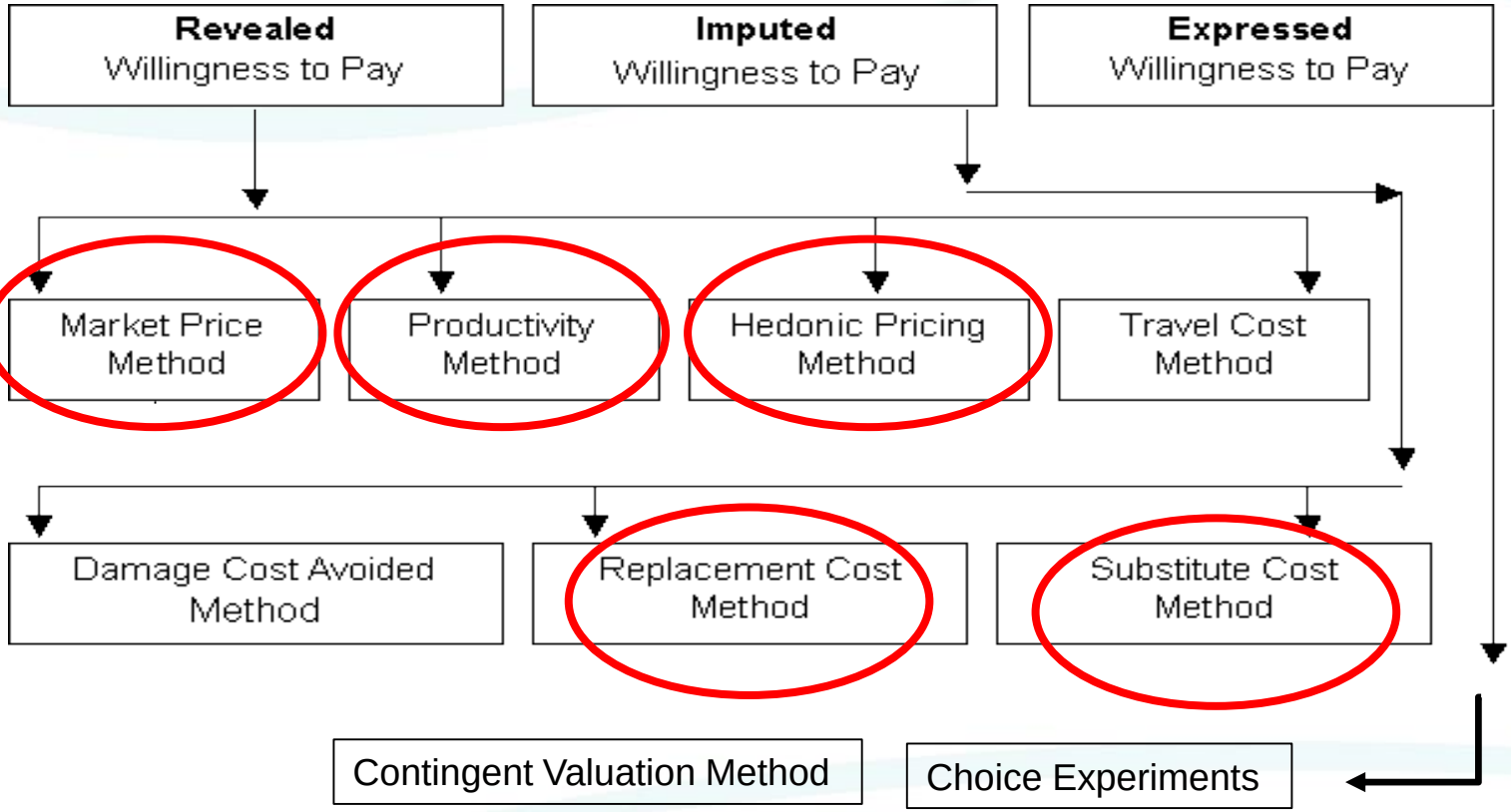

VIBES: Valuing Irish Blue Ecosystem Services

Ecosystem Service	CICES Classification	Quantity of ES	Value of ES
Off shore capture fisheries	*Wild Animals*	449,848 tonnes	€405,991,000
Inshore capture fisheries	*Wild Animals*	17,102 tonnes	€43,453,690
Aquaculture	*Animals - Aquaculture*	35,627 tonnes	€128,711,470
Plants and algae	*Plants & Algae from Aquaculture*	29,500 tonnes	€3,914,000
Water for non-drinking purposes	*Surface water for non-drinking purposes*	1,019,692,399m^3	
Urban wastewater discharges	*Mediation of waste*	14,465,519 kg organic waste	€983,655
		6,207,986 kg nitrogen	€191,268,048
		1,276,828 kg phosphorous	€119,102,515
Habitat protection	*Lifecycle and habitat*	773,333 ha of CME inclusive SACs	
Storm protection	*Moderation of flows*	c. 350km protected by saltmarsh	
Carbon sequestration	*Climate regulation*	c. 47,000,000 tCO2 sequestered	€940,000,000

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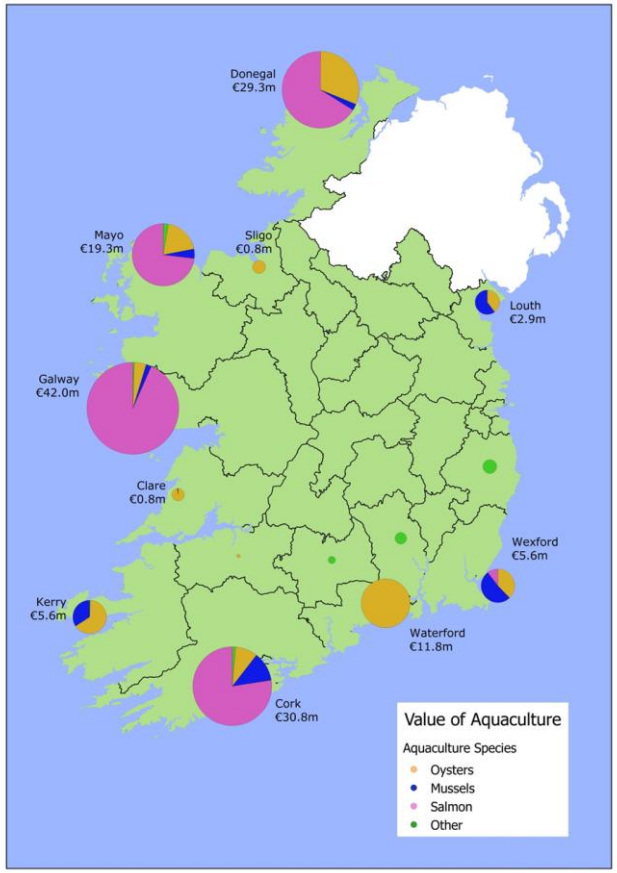
Provisioning Marine Ecosystem Services

Ecosystem Service	CICES Classification	Quantity	Value (€'000)
Off shore capture fisheries	Wild Animals	469,735t	€472,542
Inshore capture fisheries	Wild Animals	14,421 t	€42,113
Aquaculture	Animals - Aquaculture	39,725 t	€148,769
Algae/ Seaweed harvesting	Wild Plants & Algae/ Plants	29,500 t	€3,914
Water for non-drinking	Surface water non-drinking	1,189,493,326 m^3	

- Values based on market prices (sector turnover)

Value of Irish aquaculture activity by county



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Regulating Marine Ecosystem Services

Ecosystem Service	CICES Classification	Quantity	Value (€'000)
Waste services	Mediation of waste, toxics and other nuisances	9,350,642 kg organic waste	€316,767
		6,834,783 kg nitrogen	
		1,118,739 kg phosphorous	
Coastal defence	Mediation of flows	179km of coastline protected by saltmarsh	€11,500
Lifecycle and habitat services	habitat protection	773,333 ha protected through SAC's	
Climate regulation	Atmospheric composition	42,743,000 tonnes CO2 absorbed	€854,700

- Waste Services: The shadow prices of Hernandez-Sancho et al. (2010) used as estimate of cost avoided by not having to bring the discharged water from water treatment services up to full re-use quality
- Coastal Defence: Replacement cost approach
- The value of the carbon dioxide removed is based on the Irish carbon tax of €20 per tonne of CO_2 equivalent.

Ecosystem	Irish area (ha)	Carbon absorption (tCO_2/ha)[1]
Saltmarsh	5,179	5.2 (2.4, 8.0)
Sand dunes	12,013	2.2 (1.3, 3.1)
Estuaries	80,680	-20.8 (-0.9 - -32.4)
Coastal waters and bays	1,314,374	0.4 (0.0 - 1.0)
Offshore waters	87,685,626	0.5 (0.35 - 0.7)

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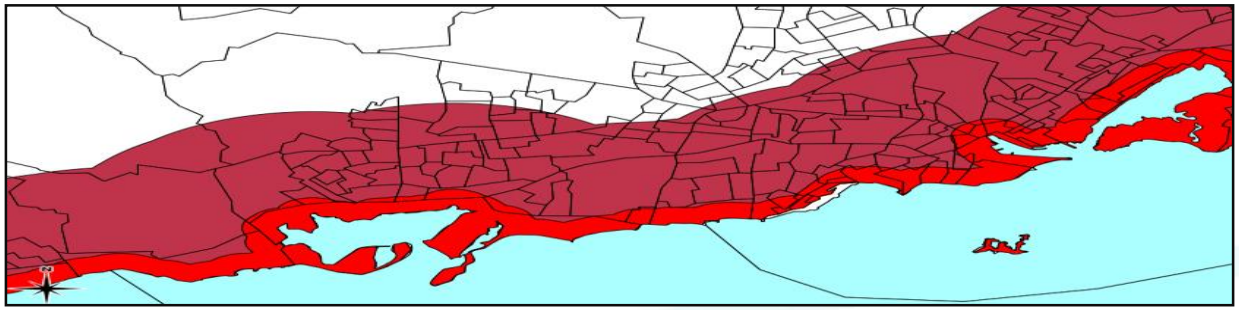
Cultural Marine Ecosystem Services

Ecosystem Service	CICES Classification	Quantity	Value (€'000)
Recreational services	Physical interactions	96 million marine recreation trips per year	€1,683,590
Scientific and educational	Scientific & educational	Marine education and training fees	€11,500
Aesthetic services	Aesthetic	Flow value of coastal location of housing	€68,000



- Recreation: Primary studies and Benefit transfer
- Aesthetic: Hedonic Modelling

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Conclusions

- Factoring marine ecosystem service values into ocean economy account frameworks may help to ensure a more sustainable “blue economy”.
- The application of ecosystem services assessment at a smaller spatial scale may help to improve knowledge in the planning process whether it be a local area plan or a one off development.
- While valuation of ecosystem service values should not be the sole determinant of a decision, their inclusion in national accounts and impact assessments should contribute to a more explicit and transparent decision making process.