FISH-MED PhD

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Blue Growth and Ecosystem Services

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Presentation structure

1. INTRODUCTION to Marine Ressources Economics
2. THE EUROPEAN GREEN DEAL
3. BLUE ECONOMY AND BLUE GROWTH
4. ECOSYSTEM SERVICES
5. MULTIFUNCTIONALITY

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Economy and environment

- *Already at the beginning of modern economic thought (Malthus 1789, Mill 1857) it was believed that the **economic system** could only find **a balance**, a stationary stage imposed by the **limits** (scarcity) of **natural resources***

- Malthus argued that the *demographic increase* would have pushed to cultivate less and less fertile lands with a consequent *shortage of subsistence goods* to bring about the *arrest of economic development*, since the population would tend to grow in geometric progression, therefore faster than the availability of food, which instead they grow in arithmetic progression

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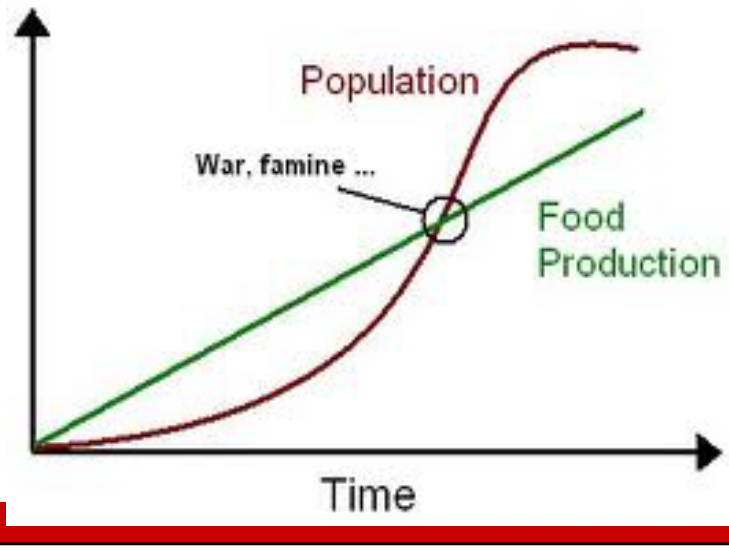
L'equilibrio di Malthus



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Exhaustible renewable resources

- The process of renewal of these resources cannot continue indefinitely, as the ***fish stock must respect the maximum level*** given by the ***livelihood capacity*** of the natural habitat in which it lives.
- Man can intervene by collecting the increase in the size of the stock without compromising the regenerative capacity of the resource and establishing a new level of balance: ***Sustainability***
- On the other hand, the possibility of *excessive exploitation that leads to the definitive extinction* of the resource cannot be excluded

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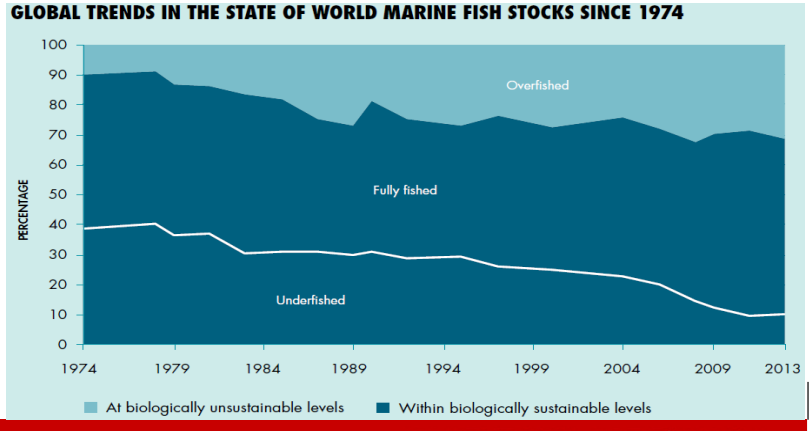
Trend of Marine fish stocks

- For FAO, 40% of world stocks are *overfished*. 60% for the Mediterranean! The catching capacity of the European fleet remains more than double what would be needed to exploit our fish stocks to a sustainable extent.



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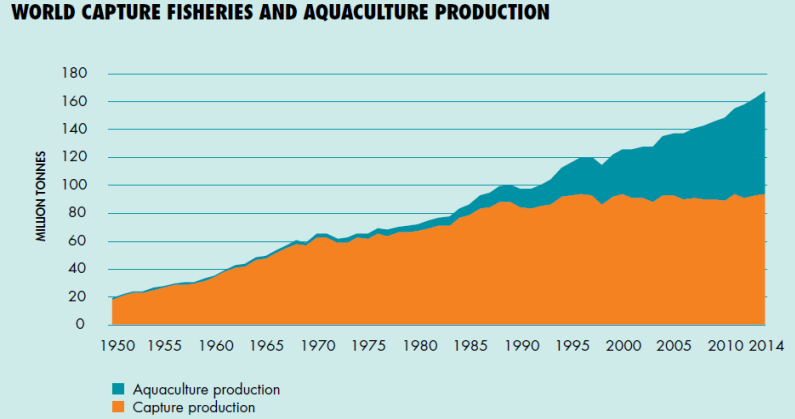
Fish and acquaculture contribution



World catches of fish peaked in 1996 and then declined slightly and stabilized at around 80 million tonnes.

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Public natural resources

- According to economic theory, a market system of free competition is able to guarantee *the efficient allocation of production factors*
- This is done through the free exchange of goods at prices set by the market
- *The price is the result of the system of preferences of buyers and sellers*
- There are, however, (public) goods available *free of charge*
- ***When a good is priceless, supply and demand are no longer representative of its scarcity***

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Marine resources as common goods

- ***Common goods or common resources*** are goods used by several individuals, with respect to which there are - for different reasons - *difficulties of exclusion and whose consumption by an actor reduces the possibilities of use by others*
- In economics, a ***tragedy of common goods*** means a situation in which several individuals use a common good for their own interests and in *which property rights are not clear* to the point of ensuring that those who bear the costs of using the resource derive the corresponding benefits.
- In reality, there is often confusion between common ownership and the absence of ownership, or ***free access***

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Private, public, common goods

- ***Rivalry***: the consumption of a good by someone determines the unavailability of that good for others.
- ***Exclusibility:*** non-payment of the asset determines the exclusion of the buyer from the market transaction.

	Rivalry	Non Rivalry
Esclusibilty	Prvate goods (Agricultural products)	Club Goods (Private parks, patents)
Non Esclusibility	Common goods (Drinking water, fish stocks)	Public goods (air, light)

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The tragedy of the commons in game theory
(long term equilibrium)

Fisher A

Fisher B	**Fish little**	**Fish a lot**
Fish little	100 / 100	150 / 40
Fish a lot	40 / 150	60 / 60

In a free market situation, the choice is rational, but unsustainable

Main ways to reduce the "Freedom of Fishing"

Several measures have been adopted to reduce the "freedom of fishing" principle

- International treaties and regional commissions operating in international waters
- Development of territorial waters (12 miles) and exclusive economic zones (200 miles)
- Fishing licenses
- Territorial property rights (COGEMO)
- Total catch limitations (TACs) ⟹ Race to fish (catch as much as possible before reaching annual limit)
- Individual quote

Esternalities

- There is an ***externality, positive or negative,*** when the decisions of an economic agent interfere with another agent, and when this interference cannot be compensated economically.
- This exists, for example, when the production of a company depends on the activity of another company through a ***means whose ownership is not defined***.
- On the other hand, if the damage (or benefit) can be compensated by the parties, it is said that the externality is ***"internalized"***. In the event that the externality is internalized, an increase in costs is determined for the person who caused it and compensation for damages for the person who suffered it

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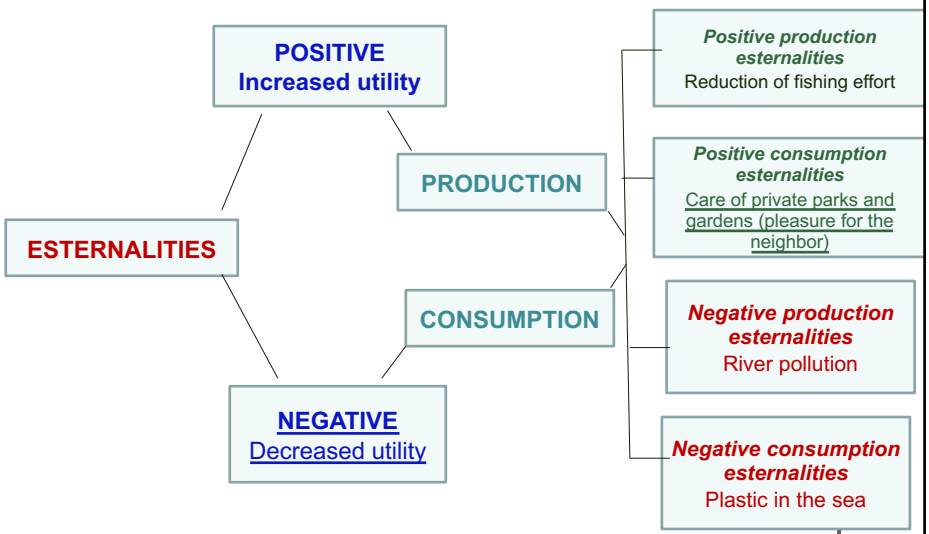
Consumption and production externalities



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Technical and pecuniary externalities

- The internalization process implies that the parties to the dispute have the ***proprierty right*** necessary to exchange the asset in question.
- ***This is not generally the case with fish stocks;***
- Stock exernality: the activity of each company reduces the size of the fish stock and increases the production costs of other companies.
- The elimination of externality requires the ***intervention of the state*** to restore efficiency conditions within the economic system which can:

➢ *Introduce a system of property rights to define the value of an asset through negotiation operations*

➢ *Introduce rules and controls to directly regulate the behavior of agents*

➢ *Introduce taxes and incentives into the system that induce economic agents to solve the problem*

Property right theory

- The proprerty right in a company consists of the right to:
  - ➢ Enjoy a good and exclude other subjects from enjoyment.
  - ➢ Freely transfer ownership of the asset.
- The exclusion creates a barrier to access to resources, which does not happen for common resources or in a situation of free access.
- The transfer allows the resource to be allocated to its best use.

1. THE EUROPEAN GREEN DEAL

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Sustainable development

- "Sustainable development is a development that guarantees the needs of current generations without compromising the possibility that future generations will be able to satisfy their own" Commissione mondiale sull'ambiente e lo sviluppo dell'ONU
- Three general conditions of equilibrium concerning the use of natural resources:
  - *the utilization rate of renewable resources must not exceed their regeneration rate;*
  - *the production of waste and its release must proceed at rates lower than those of assimilation by the environment itself*
  - *the stock of non-renewable resources must remain constant over time.*

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The Green Deal

- Climate change and environmental degradation are an existential threat to Europe and the world
- Europe needs a *new growth strategy* that will transform the Union into a modern, resource-efficient and competitive economy, where:
  - ***there are no net emissions of greenhouse gases by 2050***
  - ***economic growth is decoupled from resource use***
  - ***improve people's health and quality of life***
  - ***no person and no place is left behind***
- The European Green Deal is the plan to make the EU's economy sustainable.

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From farm to fork

- A healthier and more sustainable EU food system is a cornerstone of the European Green Deal
  - *Make sure Europeans have access to healthy, affordable and sustainable food*
  - *Tackle climate change*
  - *Protect the environment and preserve biodiversity*
  - *Ensure a fair economic return in the supply chain*
  - *Identify solutions* based on nature, technologies, digital and space to achieve better climatic and environmental results: *optimizing the use of production factors, circular economy, alternative feed, organic farming*

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Green Deal e ambiente marino

The oceans together represent *71% of the Earth's surface* and their habitats favor a rich (though often unknown) *marine biodiversity*, albeit in great loss

Over half of the *oxygen* we breathe comes from marine organisms.

Marine waters absorb 30% of the annual *CO2 emissions* released into the atmosphere, slowing down the warming of our planet.

We depend on it to regulate our climate. It has absorbed over 90% of the heat trapped by our carbon dioxide emissions

The ocean is the main *food* source for more than 3.5 billion people

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Implications of Green Deal

- ***End overfishing and shift European fisheries to low-impact fishing***
- ***Improve knowledge of marine ecosystems*** and the coastal strip: erosion, conservation, innovative technologies
- ***The 2030 biodiversity strategy:*** protection of fish stock recovery areas, vulnerable marine ecosystems and sensitive species
- ***Prioritize the protection of coastal habitats of "blue carbon"***: algae forests, salt flats and algae meadows capture CO 2 and mitigate climate change
- *European policies must ensure that companies and communities stop releasing plastics, organic pollutants, excess nutrients and hazardous substances that reach the sea and poison marine life.*

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Implications of Green Deal

- ***Expand the protection of our waters from the current 12% to 30% by 2030.*** Marine protected areas safeguard marine life hotspots and contribute to the recovery of fishing activities and the resilience of ecosystems to climate change.
- *Shipping activities will also have to drastically reduce their emissions of greenhouse gas, noise and waste,*

Incoraggiare la sostenibilità nell'acquacoltura attraverso:

- production diversification,
- the low energy consumption practices of the plants
- the traceability of products,
- brand development
- system for transferring information to the consumer.

2. BLUE ECONOMY

Blue Growth

- After the "Rio + 20 United Nations Conference on Sustainable Development" (2012), the concept of *Blue Economy* spread, which should differ from the classic concept of Ocean (or Maritime) Economy by including the aspect of sustainability

  "*Economic activity is in balance with the long-term capacity of ocean ecosystems to support this activity and remain resilient and healthy*" Economist Intelligence Unit (2015)

- In 2012 EU Commissionha pubblihed a communication on *Blue Growth*
  - as a contribution "*to the EU's international competitiveness, resource efficiency and job creation, whilst safeguarding biodiversity and preserving the services that healthy and resilient marine and coastal ecosystems provide*"

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Ocean Economy

- The ocean is considered as a source of jobs, innovation, and competitive advantage. It creates a value added equivalent to 3–4% of the global Gross Domestic Production (GDP)
- The ocean (or maritime) economy includes all the economic activities developed on the sea or that are based on sea products: ***fisheries (and fish processing), aquaculture, blue biotechnologies, blue energies (wind, waves), oil and gas, sea mining, coastal tourism, transports, ship-building, port activities, etc…***
- It may include also public sectors (e.g. research, environmental conservation and defence)

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From Ocean to Blue Economy

- Two economic element are missing in this accounting process:
  - ***Sustainability of economic activities*** (e.g. natural stocks like fish populations can decrease)
  - ***Non-market benefits*** (e.g. protection against coastal erosion, waste treatment, and climate regulation)

- A blue economy should be seen as a synonymous of a **sustainable ocean economy**

Related EU documents

- ***The Marine Strategy Framework (Dir. 2008/56/EU).***

It is considered the environmental pillar of the IMP (Integrated Maritime Policy). It aims to achieve good environmental status (GES) of EU marine waters and to protect the resource base on which sea-related economic and social activities depend.

Objectives: favor an integrated strategic vision, through an *ecosystemic approach* to managing the marine environment, for

- facilitate adaptation to climate change,
- ensure access to marine spaces within an integrated maritime planning framework
- foster synergy between the various maritime sectors.

Related EU documents

The **Directive *2014/89/EU*** establishing a framework for Maritime Spatial Planning

The rapid and high increase in the demand for maritime space for different purposes, such as plants for the production of *energy* from renewable sources, the exploration and exploitation of *oil and natural gas*, maritime *transport* and *fishing* activities, conservation of *ecosystems* and biodiversity, raw material extraction, *tourism*, aquaculture facilities and underwater *cultural heritage,* as well as multiple pressures on coastal resources require an *integrated planning and management strategy.*

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Sustainability

Conceptually …

Hard sustainability
Good environmental status
Ecosystem-based MSP

≠

Soft sustainability
Blue growth
Integrated-use MSP

… But near a 'point of no-return' of ecosystem degradation …

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Blue growth and ecosystem services

GDP data is a limited measure that does not give information about all of the impacts of economic growth on the marine environment (the environmental externalities) and how these in turn affect society.

It has difficulties in capturing and measuring the underpinning biophysical aspects of *natural capital and flows of ecosystem services, or of non-market economic values.*

Ecosystem services are public goods –no market exists for public goods/bads: Externalities related to marine ecosystems are not internalized

Risk that Blue Growth might not be sustainable

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Sustainable ocean economy

Emerges when economic activities is in balance with long term of ocean ecosystem to support this activities and remain resilient and healthy.

So we need to include the measurement of other benefits of human well-being which are commonly unpriced and not included in the GDP:

- ***market activities*** (e.g. aquaculture, fisheries, tourism, shipping and shipbuilding, mining, and hydrocarbon extraction)
- ***non-market activities*** (recreational activities such as bathing, sport fishing, and scuba diving) as well as indirect use values (e.g. carbon sequestration, nutrient cycling, and resilience) and non-use values (existence values, bequest values, and altruistic values)

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A proposal for Blue Economy valuation

- Following the logic of national accounts and environmental-economic accounting *(System of Environmental-Economic Accounting* –SEEA- adopted by the United Nations Statistical Commission in 2012), the Blue Economy could be measured as:

Ocean economy net value added
+ non market benefits (ecosystem services)
± ecosystem asset *depletion/degradation*

Depletion: the decrease (quantitative) in the value of the stock of natural resource due to the extraction occurring at a level greater than that of regeneration

Degradation: the decrease (qualitative) in the value of the ecosystem asset due to human activities

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Ecosystem assets and services

- **Ecosystem assets** are spatial areas from which ecosystem services are generated. For terrestrial areas this equates to forests, wetlands, cultivated areas…
- Ecosystem assets may be considered in terms of ecosystem condition and ecosystem extent; however, for economic valuation, they are better measured in terms of the change of ***expected*** flows of ***ecosystem service*** over an accounting period (following the *net present value* approach).

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Blue economy sectors and sub-sectors

Sector	Sub-sector
Marine living resources	Primary production
	Processing and distribution of fish products
	Biootecnologie marine
Marine non-living resources	Oil and gas
	Other minerals
Marine renewable energy	Offshore wind energy
Port activities	Cargo and waterhousing
	Port and water projects
Shipbuilding and repair	Shipbuilding
	Equipment and machinery
Maritime transport	Passenger transport
	Freight transport
	Services for transport
Coastal tourism	Accomodation
	Transport
	Other expenditure

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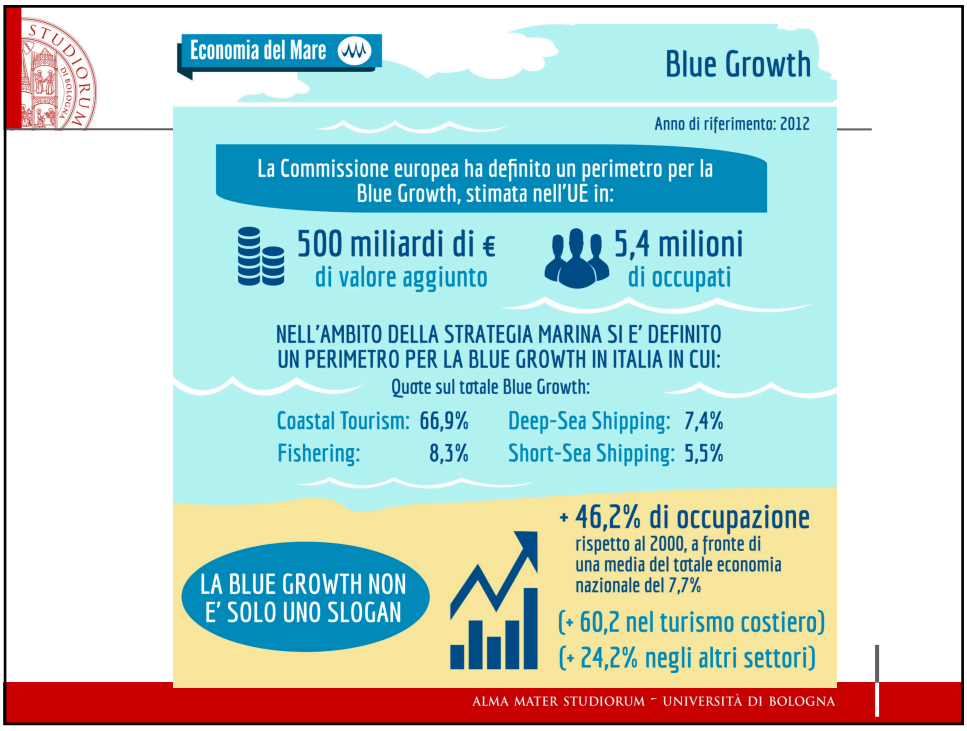

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VIII Rapporto sull'Economia del Mare - 2019

QUADRO DEFINITORIO

LA FILIERA DELL'ECONOMIA DEL MARE

- Movimentazione di merci e passeggeri via mare
- Filiera ittica
- Attività sportive e ricreative
- Industria delle estrazioni marine
- Ricerca, regolamentazione e tutela ambientale
- Servizi di alloggio e ristorazione
- Filiera della cantieristica

DIMENSIONE NAZIONALE

DIMENSIONE TERRITORIALE

FORZA MOLTIPLICATIVA
VALORE AGGIUNTO E OCCUPAZIONE
IMPRESE DELL'ECONOMIA DEL MARE
IMPRENDITORIA GIOVANILE, FEMMINILE E STRANIERA
COMMERCIO ESTERO

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VIII Rapporto sull'Economia del Mare - 2019

FORZA MOLTIPLICATIVA

Anno di riferimento dati: 2018

1 EURO PRODOTTO DALLA BLUE ECONOMY NE ATTIVA ALTRI 1,9 SUL RESTO DELL'ECONOMIA

Valore aggiunto prodotto: 46,7 MLD di €
Valore aggiunto attivato: 87,8 MLD di €

8,5% Incidenza su totale economia nazionale

MOLTIPLICATORI DEI COMPARTI

Movimentazione di merci e passeggeri via mare	2,8 €
Filiera della cantieristica	2,4 €
Attività sportive e ricreative	2,1 €
Servizi di alloggio e ristorazione	1,4 €
Filiera ittica	1,9 €
Industria delle estrazioni marine	1,2 €
Ricerca, regolamentazione e tutela ambientale	0,5 €

VALORE AGGIUNTO PRODOTTO E ATTIVATO PER MACRO AREE

Incidenze % sul totale economia e valori assoluti in miliardi di euro

Mezzogiorno:	11,0% - 39,0 MLD di €	Nord-Est:	7,4% - 27,0 MLD di €
Centro:	10,5% - 35,7 MLD di €	Nord-Ovest:	6,3% - 32,6 MLD di €

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VIII Rapporto sull'Economia del Mare - 2019

VALORE AGGIUNTO E OCCUPAZIONE

Anno di riferimento dati: 2018

		Incidenza sul totale economia nazionale
Valore aggiunto:	46,7 MLD di €	3,0%
Occupati:	885.200	3,5%

VALORE AGGIUNTO DEI COMPARTI

Servizi di alloggio e ristorazione	14,4 miliardi di €
Movimentazione di merci e passeggeri via mare	8,1 miliardi di €
Ricerca, regolamentazione e tutela ambientale	8,1 miliardi di €
Filiera della cantieristica	7,3 miliardi di €
Filiera ittica	3,7 miliardi di €
Attività sportive e ricreative	2,7 miliardi di €
Industria delle estrazioni marine	2,5 miliardi di €

VALORE AGGIUNTO DELLE ECONOMIE LOCALI

Prime 5 province (valore assoluto)		Prime 5 province (incidenza % sul totale economia provinciale)	
Roma	7,4 miliardi di €	Trieste	15,4%
Genova	3,4 miliardi di €	Olbia-Tempio	13,9%
Napoli	2,9 miliardi di €	Rimini	13,0%
Milano	2,4 miliardi di €	Genova	12,7%
Venezia	2,1 miliardi di €	La Spezia	12,3%

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VIII Rapporto sull'Economia del Mare - 2019

IMPRESE IN ITALIA

Anno di riferimento dati: 2018

DINAMICA DEL TESSUTO IMPRENDITORIALE

199.177 Imprese — 3,3% Incidenza sul totale economia

VARIAZIONE 2014-2018

Economia del Mare		Totale economia
+17.357	Valori assoluti	+58.485
+9,5%	Variazione %	+1,0%

DINAMICA DEI COMPARTI

	NUMEROSITA' (Val. assoluti e incidenza %)		VARIAZIONE 2014-2018 (Val. assoluti e variaz. %)	
Servizi di alloggio e ristorazione	88.636	44,5%	+14.597	+19,7%
Filiera ittica	33.549	16,8%	-335	-1,0%
Attività sportive e ricreative	30.326	15,2%	+1.915	+6,7%
Filiera della cantieristica	27.106	13,6%	-609	-2,2%
Movimentazione di merci e passeggeri via mare	11.411	5,7%	+428	+3,9%
Attività di ricerca, regolamentazione e tutela ambientale	7.664	3,8%	+1.400	+22,4%
Industria delle estrazioni marine	485	0,2%	-39	-7,5%
TOTALE	199.177	100%	+17.357	+9,5%

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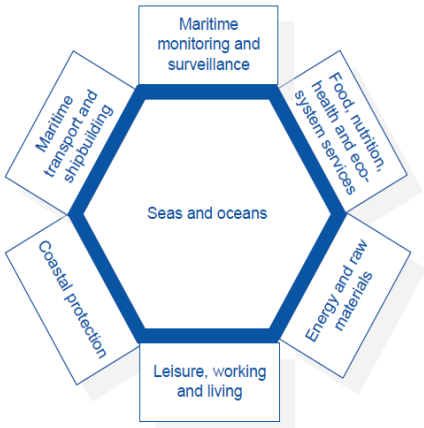
Blue Growth and Marine Spatial Planning

***Blue Growth** is* the long term strategy to support sustainable growth in the marine and maritime sectors as a whole. Creating synergies between economic activities and addressing tensions clearly helps in realizing the Blue Growth potential.



Synergies:

- **Shared suppliers**: construction/reparation of boats for both fishing and touristic purposes.
- **Enabling activities**: as technology or credit, for the development of other economic activities.
- **Common use of infrastructures**: ports or interventions of coastal protections, wholesale market can benefit several maritime activities.
- **Shared input factors:** specialized workers such as sailors or maritime engineers, often locally trained.

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3. ECOSYSTEM SERVICES

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Ecosystem Services

- Different definitions:
  - The benefits people obtain from ecosystems (MA, 2005).
  - The aspects of ecosystems utilized (actively or passively) to produce human well-being
  - **The contributions of ecosystems to benefits used in economic and other human activity** (SEEA)

Ecosystem valuation can help to highlight the often unrecognised benefits to society, such as recreation or carbon sequestration and their direct and indirect human health benefits

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Environmental roles and services

Classification of ecosystem services according to the Millennium Ecosystem Assessment (2005):

- ***life support*** (such as nutrient cycling, soil formation, and primary production),
- ***provisioning*** (such as the production of food, drinking water, algae, minerals or fuel),
- ***regulation*** (such as climate and tidal regulation, water purification, CO2 stock and recreation),
- ***cultural values*** (including aesthetic, spiritual, educational ones).

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Marine ecosystem services

Natural Capital/ Marine ecosystem
Function
Biogeochemical cycling,
Flow of energy
Biological productivity
Refuge, Habitat
Structure:
Biotic (living) marine animal and plant communities
Abiotic (non living) components of the marine environment

Ecosystem Services
The components of the natural environment that are directly useful to us.

Ecosystem services are grouped into three categories:
Provisioning/Goods: fish harvests, water, genetic materials
Regulating/services: Recreation, tourism, erosion control, strom protection, pollution control, climate regulation, Habitat provision
Cultural: The way environmental interaction shapes our experiences (e.g. religiuos, bequest value, heritage)

Good and Benefits
Products we take from nature and the increase in our welfare that results from using and enjoying it.
- **Human well-being**
- **-Production of goods and service**

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Example of marine ecosystem services

Goods	Services	Cultural benefits
Fish harvests	Recreation and tourism	Carbon sequestation
Wild plant and animal	Water transport	Bequest for fture generation
Raw material	Scientific and educational opportunities	Religious significance
Genetic material	Flood control	
Water	Storm protection	
	Pollution control	
	Breeding and nursery habitats	
	Shoreline stabilization and erosion control	
	Carbon sequestation	

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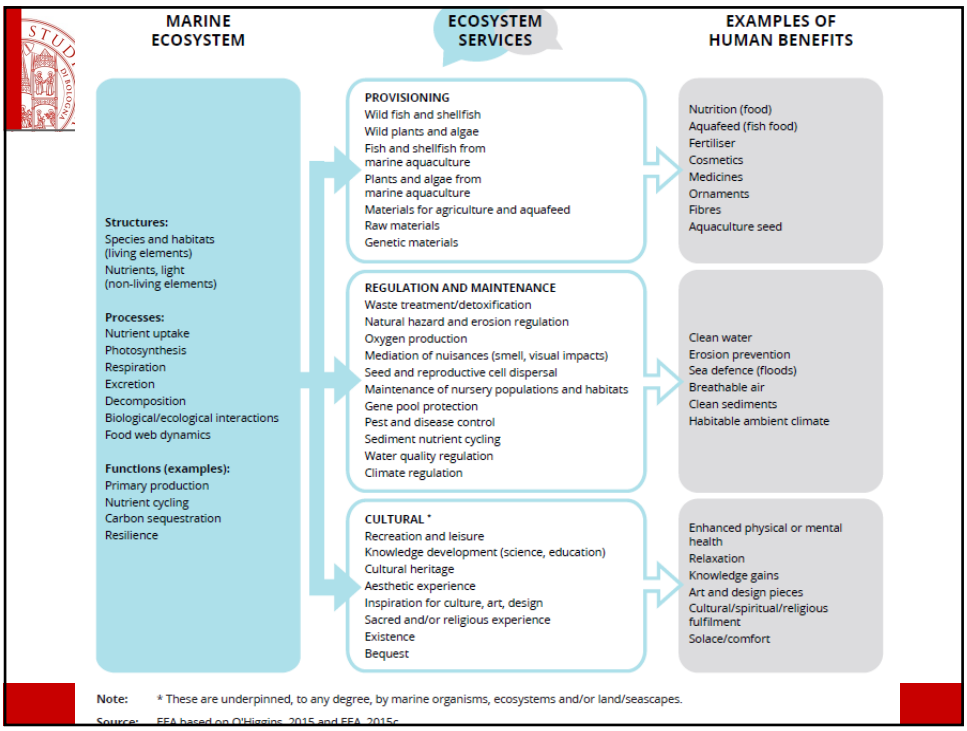

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Accounting

Intermediate Services	Final Services	Benefits
pollination	clean water provision	drinking water; domestic use water
primary productivity; structure and process	storm protection	property protection; decreased livelihood vulnerability
water regulation; soil formation	constant stream flow	recreation; water for irrigation; water for hydroelectric power

- Attention to "double counting"
- ESs are only one part of a broader set of inputs (investments, knowledge, work, technology) that are combined to provide the **benefits**

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Accounting

- **ESs contribute to two categories of benefits for human well-being:**
  - **Market benefits**: The products produced by economic units, which are already considered to measure GDP (e.g. fishes contribute to fisheries, aesthetic attributes contribute to touristic activities)
  - **Non-Market benefits**: The benefits that are not produced by economic units, which are not considered to measure GDP (e.g. water purification, carbon storage, and flood mitigation).

Ecosystem service value

Understanding conflicts, trade-offs and synergies between different ecosystem services and values:

- Fisheries
- Aquaculture
- . Seaweed
- . Tourism, leisure and recreation

} Use values

- Wildlife conservation } Non use value
- Cultural services: water quality, landscape } Non monetary value

Integrated valuation: Integrating ecological, economic, cultural and deliberative approaches;

Ecosystem service value

- Ecosystem services exist only if man can benefit from them, directly or indirectly
- It is an ***instrumental value*** (anthropocentric approach), or ***intrinsic value*** (biocentric approach)
- A ***whale*** can have three different values (which can also be added together) depending on the use made of it:
  - ***Consumptive use value***
  - ***Non-consumptive use value***
  - ***Non-use value***

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Marine and coastal ES

Table 1.1 EXAMPLES OF ECOSYSTEM SERVICES PROVIDED BY DIFFERENT MARINE AND COASTAL HABITATS
(X indicates the habitat provides a significant amount of the service)

ECOSYSTEM SERVICES	Coastal									Marine		
	Estuaries and marshes	Mangroves	Lagoon and salt ponds	Intertidal	Kelp	Rock and shell reefs	Seagrass	Coral reefs	Inner shelf	Outer shelves edges slopes	Seamounts & mid-ocean ridges	Deep sea and central gyres
Biodiversity	X	X	X	X	X	X	X	X	X	X	X	X
Provisioning services												
Food	X	X	X	X	X	X	X	X		X	X	X
Fibre, timber, fuel	X	X	X						X	X		X
Medicines, other resources	X	X	X		X			X	X			
Regulating services												
Biological regulation	X	X	X	X		X		X				
Freshwater storage and retention	X		X									
Hydrological balance	X		X									
Atmospheric and climate regulation	X	X	X	X		X	X	X	X	X		X
Human disease control	X	X	X	X		X	X	X				
Waste processing	X	X	X				X	X				
Flood/storm protection	X	X	X	X	X	X	X	X				
Erosion control	X	X	X				X	X				
Cultural services												
Cultural and amenity	X	X	X	X	X	X	X	X	X			
Recreational	X	X	X	X	X			X				
Aesthetics	X		X	X				X				
Education and research	X	X	X	X	X	X	X	X	X	X	X	X
Supporting services												
Biochemical	X	X			X			X				
Nutrient cycling and fertility	X	X	X	X	X	X		X	X	X	X	X

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Correlation between maritime activities and ecosystem services

Function	Economic activity	Associated ecosystem or abiotic services
Food, nutrition, and health	Fishing	Provisioning services (wild fish)
	Aquaculture	Genetic resources
	Blue biotechnology	Provision of space, regulating services
Leisure and living	Tourism	Aesthetic attributes, opportunities for recreation
	Living	
Energy and raw materials	Mining	Abiotic services (oil, gas, minerals, wind, etc.)
	Oil and gas	Provision of space
	Renewable energy	
	Carbon capture and storage	
Maritime transport and shipbuilding	Shipping	Provision of space
	Passenger services	
Coastal protection	Protection against flooding and erosion	
	Protection of habitats	
Maritime monitoring and surveillance	Prevent and protect against illegal movement of people and goods	No direct link with ecosystem services
	Environmental monitoring	

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Non use value (Wildlife conservation)

Table 2
Willingness to pay for diverse charismatic vertebrate species (average values in current dollars per household and per year).

Group	Species	Place	WTP ($)	Reference
Mammals	Wolf	Sweden	126	[57]
	Grizzly bear	USA	46	Id
	Sea otter	USA	29	Id
	Grey whale	USA	26	Id
	Bighorn Sheep	USA	21	Id
	Caribou	Canada	14–98	[79]
Birds	Northern spotted owl	USA	70	[57]
	Whooping cranes	USA	35	Id
	Red cockaded woodpecker	USA	13	Id
	Bald eagles	USA	24	Id
Reptiles	Sea turtle	USA	13	[57]
Fishes	Pacific salmon	USA	63	[57]
	Cutthroat trout	USA	13	Id
	Atlantic salmon	USA	8	Id
	Squawfish	USA	8	Id
	Stripped shiner	USA	6	Id

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Use Value- Leisure and living

- *National accounts* include marketed services such as accommodation, food, and recreation service activities.
- It also considers real estate activities, including imputed *rents* of owner-occupied dwellings.
- The value of the contribution made by ecosystems (*linked to aesthetic attributes and opportunities for recreation*) is a fraction of the value added of these economic activities.
- A ***resource rent*** is in fact strictly linked to the marine and coastal landscape, amenity of place, cultural heritage

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Use value - Food, nutrition, and health

- This function of a *blue economy is strictly related to provisioning ESs*, such as fish (*for food) and genetic/medicinal resources (for biotechnology purposes*)
- The contribution of these ESs is already included *in the national accounting value added,* but value added is not adjusted for ***depletion of ecosystem assets***
- Other human inputs, particularly labour and capital/assets, contribute to the production of benefits through these economic activities (food, biothecnology).
- Thus, these remuneration must be deducted from the value added if we want to calculate the effect (value) of the Ess ***(ocean rent).***

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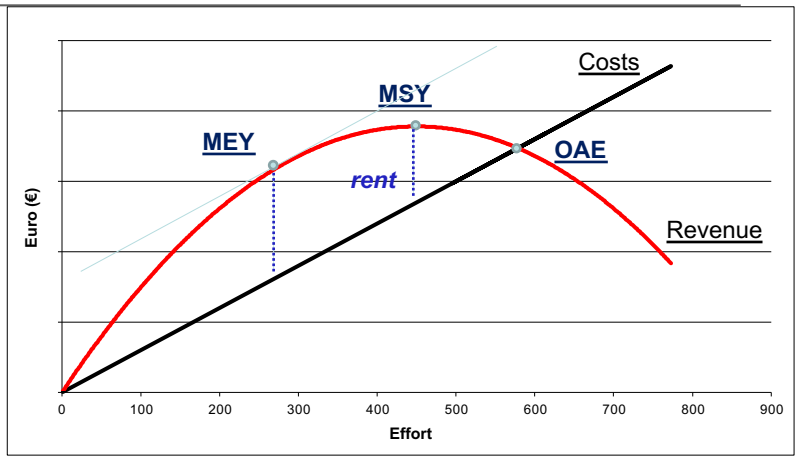
Gordon-Schaefer Model



Massimo Rendimento Economico (MEY) of the fleet. The marginal revenue equals the marginal cost.

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Good management of fisheries

- Good management of fisheries should provide both higher commodity outputs and NCOs
  - Commodity outputs are maintained at their maximum level (MSY)
  - NCOs related to fish stocks (e.g., there exists a willingness to pay of citizens to maintain high levels of tuna stocks) are also maintained at high levels and may roughly correspond to the value of annual licenses or quotas, when these are marketed.
- There is no depletion.

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Es. Food, nutrition and health

But, where the fishery has *free access*, market forces will not bring the system to reach equilibrium at the MEY, but *at the effort level where the total revenue equals the total cost.*

This is due to the existence of *an income that remains available* to anyone, so that as long as the revenues are higher than the costs *there is the convenience to expand the fishing effort*, both with the intensification of effort by the existing companies, and part of new units.

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Es. Food, nutrition and health

So, the second situation is when catches are higher than the sustainable yield and part of the resource rent has to be considered as depletion.

The adjustment process ends only when the total costs are equal to the total revenues, that is when the income of the resource is completely dissipated.

At this point, however, no company will record extra profits (annuities).

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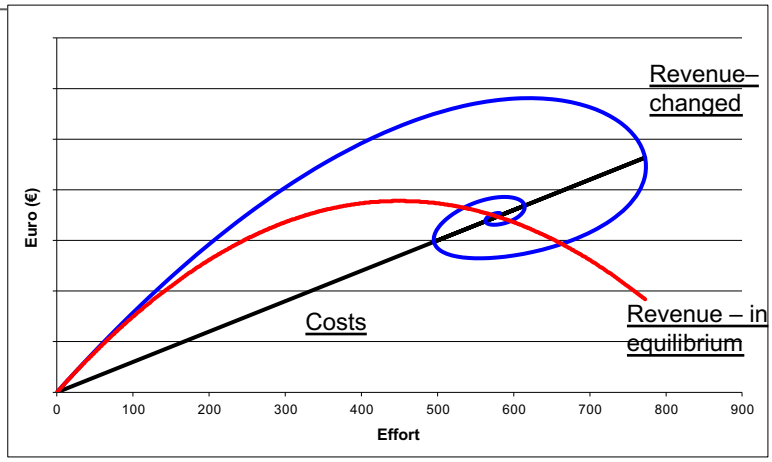
The dimanics of the Gordon-Schaefer model



If the fleet as a whole is profitable then there will be a tendency to increase the effort, while if the sector is at a loss, there will be companies that will abandon the activity or reduce it $dE/dt = \varphi\pi(t)$

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Es. Food, nutrition and health

Finally, there is the case of fisheries at a bioeconomic equilibrium (i.e. with no depletion), but are overexploited, with catches far below the *maximum sustainable yield, and rents close to (or below) zero*.

For some authors, under these circumstances (i.e. open access), the resource rent approach to valuating ESs and ecosystem assets may not be appropriate

Reduce eventual licence value and provisioning ES

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Value of ESs and Value added of Blue Economy in the Mediterranean

Estimated value of Mediterranean marine ecosystem services and Mediterranean maritime activities.
Sources: [33,41].

Benefits rendered by Mediterranean marine ecosystems	Value (in millions of €/year)	Gross Value Added of marine and coastal activities	Value added (in millions of €/year)
Resource rent related to the provision of food resources	2871	Fisheries	1900
Resource rent related to the provision of amenities and recreational support	17,808	Aquaculture	1900
Benefits relating to climate regulation	2219	Tourism	136,800
Benefits relating to protection against coastal erosion	527	Maritime transport	26,600
Benefits relating to waste treatment	2703	Offshore exploitation of oil and gas	22,800
Total	**26,128**		**190,000**

Fonti:

- A. Mangos, J.-.P. Bassino, D. Sauzade, The Economic Value of Sustainable Benefits Rendered by the Mediterranean Marine Ecosystems, Blue Plan Papers 8. Valbonne, 2010.
- Plan Bleu, Economic and social analysis of the uses of the coastal and marine waters in the Mediterranean. Valbonne, 2014.

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Esempi di tecniche di valutazione monetaria per stimare i valori dei benefici derivanti dai servizi ecosistemici

CATEGORY	TECHNIQUE	DESCRIPTION	MARINE ECOSYSTEM SERVICE EXAMPLE WHERE USED
Revealed WTP (direct market)	*Market price*	Market prices stemming from a normal production process.	*Quality certification products, organic products,*
	Production function	Values how changes in the quantity or quality of the ecosystem affects ES and ultimately the costs of production of the final benefit.	*Water quality in an estuary, filtration services provided by oyster reef in a bay*
Revealed WTP (surrogate market)	*Travel cost*	Inferred from the cost of travel to a site (i.e. expenses and value of time incurred).	*Marine and coastal recreation use*
	Hedonic pricing	Value of goods/service is based on the value of individual components. The contribution that the interest attribute makes to the observed price.	*Sea/lake view premium in property prices. The absence of pollution*
Imputed WTP	*Damage cost avoided*	Value of an asset is equivalent to the value of the economic activity or assets that it protects (e.g. the value of damage that is avoided by maintaining a coast protection function).	*Protection of coastal property from storm surges*
	Replacement cost	Value is based on the cost of replacing the environmental function.	*Coastal defence*
	Substitute cost	Value of a non-marketed product is based on the market value of an alternative product providing the same or similar benefits.	*Waste water treatment*

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Esempi di tecniche di valutazione monetaria per stimare i valori dei benefici derivanti dai servizi ecosistemici

CATEGORY	TECHNIQUE	DESCRIPTION	MARINE ECOSYSTEM SERVICE EXAMPLE WHERE USED
Stated WTP	*Contingent valuation*	Survey technique asking a representative sample of individuals how much they are willing to pay to prevent loss of, or to enhance, an environmental good or service.	*Protection of a marine species or habitat, marine non-use values*
	Choice experiments	Asking respondents to select their preferred package of environmental attributes at different prices and then inferring specific component values.	*Climate regulation, potential use of marine genetic materials*
Transfer of values	*Benefits transfer*	Values estimated in one context and location are used to estimate values in a similar or different context and location	*All of above*

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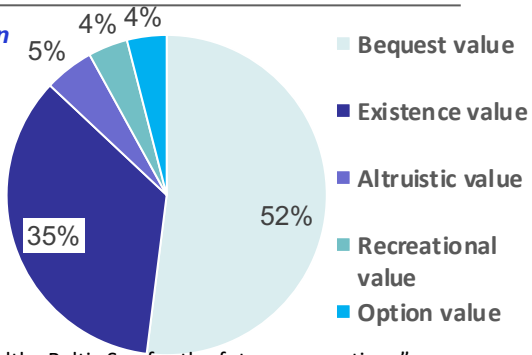
Why use public funds for marine protection?

"What is the most important reason for you to be willing to pay for achieving the good status of the Finnish marine waters?"



Bequest value = "I want to ensure a healthy Baltic Sea for the future generations"
Existence value = "The existence of a healthy ecosystem is important for me"
Altruistic value = "I want to ensure that other people in my generation can use the Baltic Sea for recreation"
Recreational value = "I use the Baltic Sea for recreation"
Option value = "I want to ensure that I will have the opportunity to use the Baltic Sea for recreation in the future"

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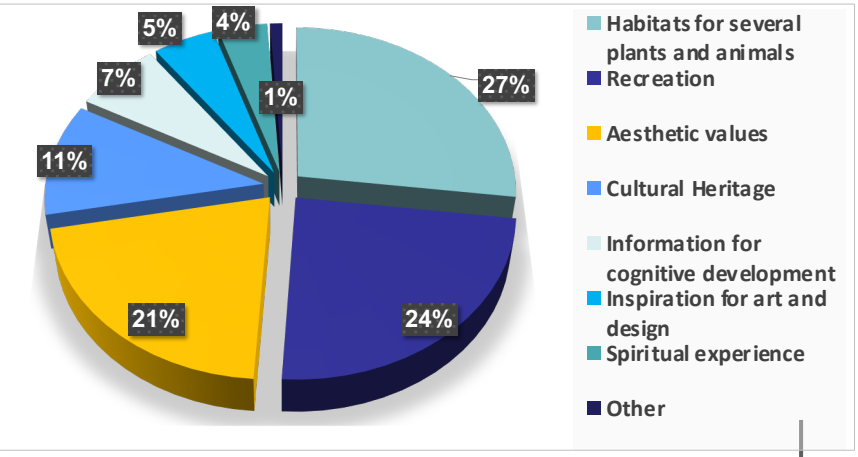
Importance of cultural (non-monetary) ecosystem services

"How important are the following matters for you on the Finnish coast or at the Finnish marine waters?"



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Case study

Consumer appreciation of a shark-free ecolabel for small pelagics

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Objective and results

- The objective is to assess if Italian fish consumers are sensible to *shark protection* and if they would contribute paying more for small pelagic fishes coming from fisheries that are ***certified as "shark-free"***
- ***Contingent Valuation*** is used to estimate willingness to pay with a double approach, including a dichotomous choice and an open-ended question
- Premium price is estimated at +26%.
- *Variables affecting WTP in the sample are age, income, environmental attitude, knowledge of organic labels and frequency of small pelagics' consumption.*

Originality

- Ecosystems provide different benefits to humankind, *including non-use services*, such as the satisfaction to know that a species is well conserved.
- Generally, appreciation is higher for what are considered charismatic species.
- We investigate if sharks can be considered charismatic species despite their "bad reputation".
- The interest in shark survival is measured indirectly using a "*shark-free" label on a commercial species like anchovy,* allowing to increase the value added of this low-price species.

Ecolabels

- *Ecolabelling* is a tool that permits markets, through consumption preferences, to *internalize some of the values of ESs* (in particular non-use values) in the price of sustainable fish products.
- The main aim of ecolabels is in fact to inform consumers about environmental and ecological issues, and giving people the chance to evaluate their purchase choices.
- *Marine Stewardship Council (MSC), Dolphin safe and Friends of the Sea* are some of the most known third-party ecolabels used in fish products

Data and methods

- *200 face-to-face interviews* were done to consumers of Emilia-Romagna region
- Several replications have been conducted to allow generalization
- In fact, *the survey* was carried out in one large coastal town (Ravenna) and in one small inland town (Pavullo nel Frignano) inside four shops.
- The interviews have been equally distributed in one fish shop and one supermarket in each city.
- WTP will be tested independently for every couple of replication in order to see if results are consistent under different conditions

Data and methods

- This study uses the Contingent Valuation approach, which permits to reveal individual preferences for products that are not on the market yet
- Traditionally, Contingent Valuation has been used for the valuation of public goods, but in recent years it has been applied to private goods, including products with specific ecological attributes such as organic products, quality labels, sustainability claims and country of origin.
- *WTP represents the difference between consumers' surplus before and after adding the "shark free" label.*

Data and methods

- Consumers were asked to answer how much they would be prone to pay for "shark-free" ecolabelled anchovies through a two steps approach:
  - a close-ended question (yes-no)
  - an open-ended question (stated price)
- This two-steps approach has several advantages since it permits to generate two classes of data (discrete and continuous variables), provides more statistical information, and allows comparison of WTP values
- The close-ended question format is probably more familiar and requires less cognitive effort for people
- Decision may be affected by the desire of the respondent to satisfy the expectations of the interviewers and by moral concerns

Close-ended question

- With the first procedure, a single dichotomous choice is done by the respondent, between accepting or not to pay a given price (which is different from consumer to consumer) for "shark-free" anchovies, having as a reference the average price of conventional anchovies, which was 6 €/kg.
- The following values have been proposed: 6.3, 6.6, 6.9, 7.2, 7.5
- Results are analyzed with an econometric (logit) model that permit to calculate the average WTP

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Open-ended question

- The maximum willingness to pay for the product is asked with an open-ended question, without any hint or advice, and the mean is simply calculated as the average of the answers

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Valuation function

- A Valuation Function is a function that relates WTP to variables that are supposed to have an influence on them.
- The following variables were tested:
  - Consumer's socio-economic characteristics: sex, age, education, income.
  - Consumption habits: frequency of consumption (for different species or group of species) and aspects considered in the choice of fish (origin, method of production, freshness, nutritional properties, preparation, price, habit, ecolabels).
  - Knowledge of quality labels and ecolabels: EU Protected Designation of Origin (PDO), Organic and MSC.
  - Environmental behavior (using a specific scale)

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Results

- Only few respondents state to recognize the most common quality labels and ecolabels shown to them: ***50% for the organic label; 38% for the PDO; 35% for the MSC labels***
- However, when asked to explain the meaning of the labels, ***only 17% of people*** (for each label) is able to provide an appropriate description

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Results

- As it was expected WTP calculated with **close-ended** approach is appreciably higher ***(8.35 €/kg)*** than WTP calculated with ***open-ended approach (7.58 €/kg)***
- Knowledge of organic labels, environmental behavior and *income have a positive effect* on WTP
- *Age has a negative effect*
- *Gender, education* and other variables did not show any sign of relevance

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