FISH-MED PhD

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Economy and politics of marine resources

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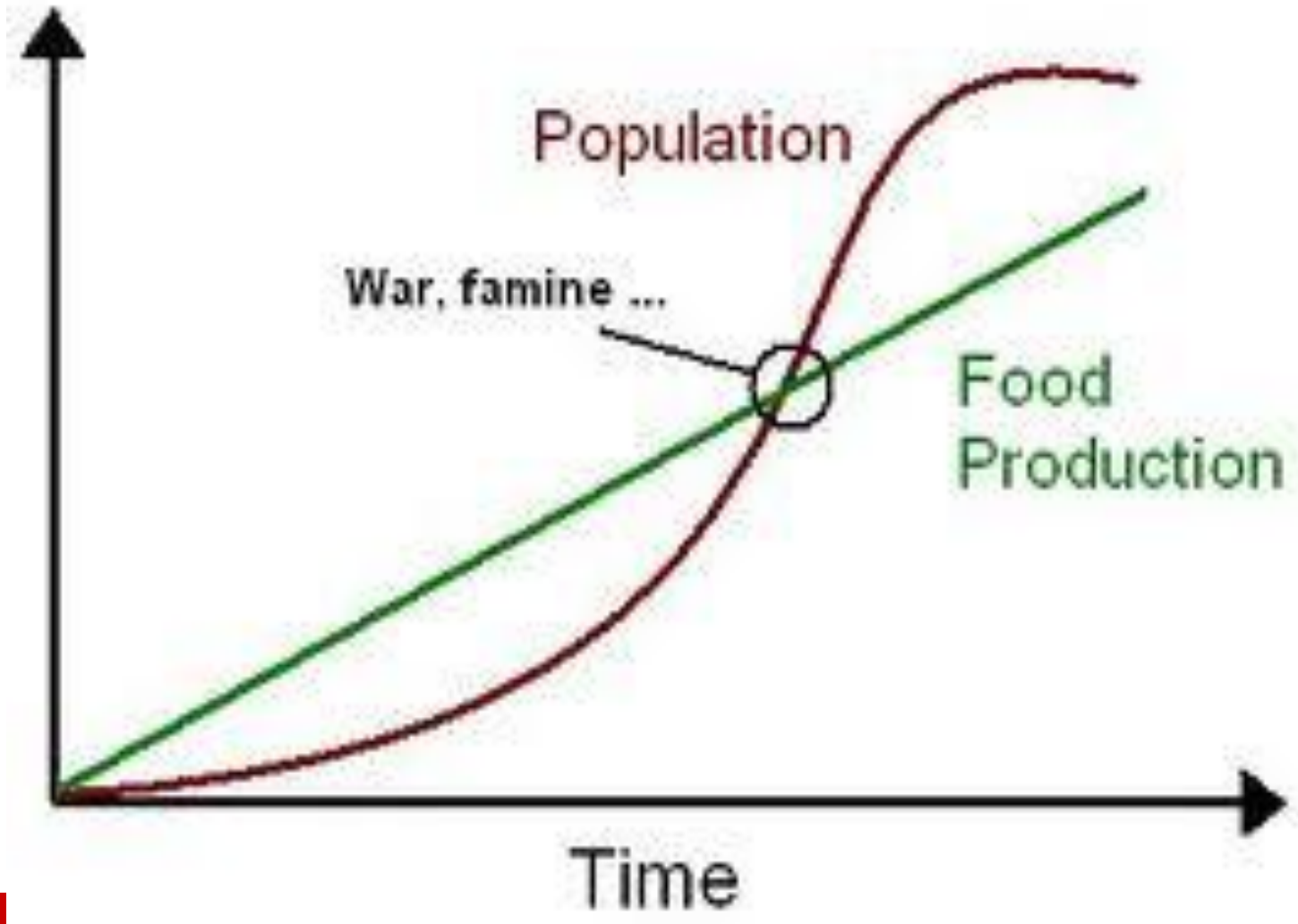
Economy and environment

- *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 (ocean) 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

Malthus Equilibrium



Economy and environment

- In recent times (the 1980s), various schools of thought have developed that can be classified according to the weight assigned to the relationship ***between natural and economic capital***
- The *(biocentric) positions* more attentive to environmental needs attribute an ***intrinsic value to nature and the environment*** regardless of human well-being
- On less extreme positions there are those who envisage sustainable development based on a certain ***possibility of substitution between natural and economic capital***
  - *Weak sustainability (full substitutability, anthropocentric approach)*
  - *Strong sustainability (critical natural capital, ecocentric approach)*
  - *Super-strong sustainability (intrinsic value, biocentric approach)*

Renewable and non renewable resources

- For ***non-renewables*** we can not talk about sustainability but only about *optimal use* for present and future generations.
- *Renewable* ones have an intrinsic ability to reconstitute themselves, so we distinguish:
  - Inexhaustible (continuous flows): solar and wind energy
  - Exhaustible (flows based on variable stocks): fish resources, forests, pastures

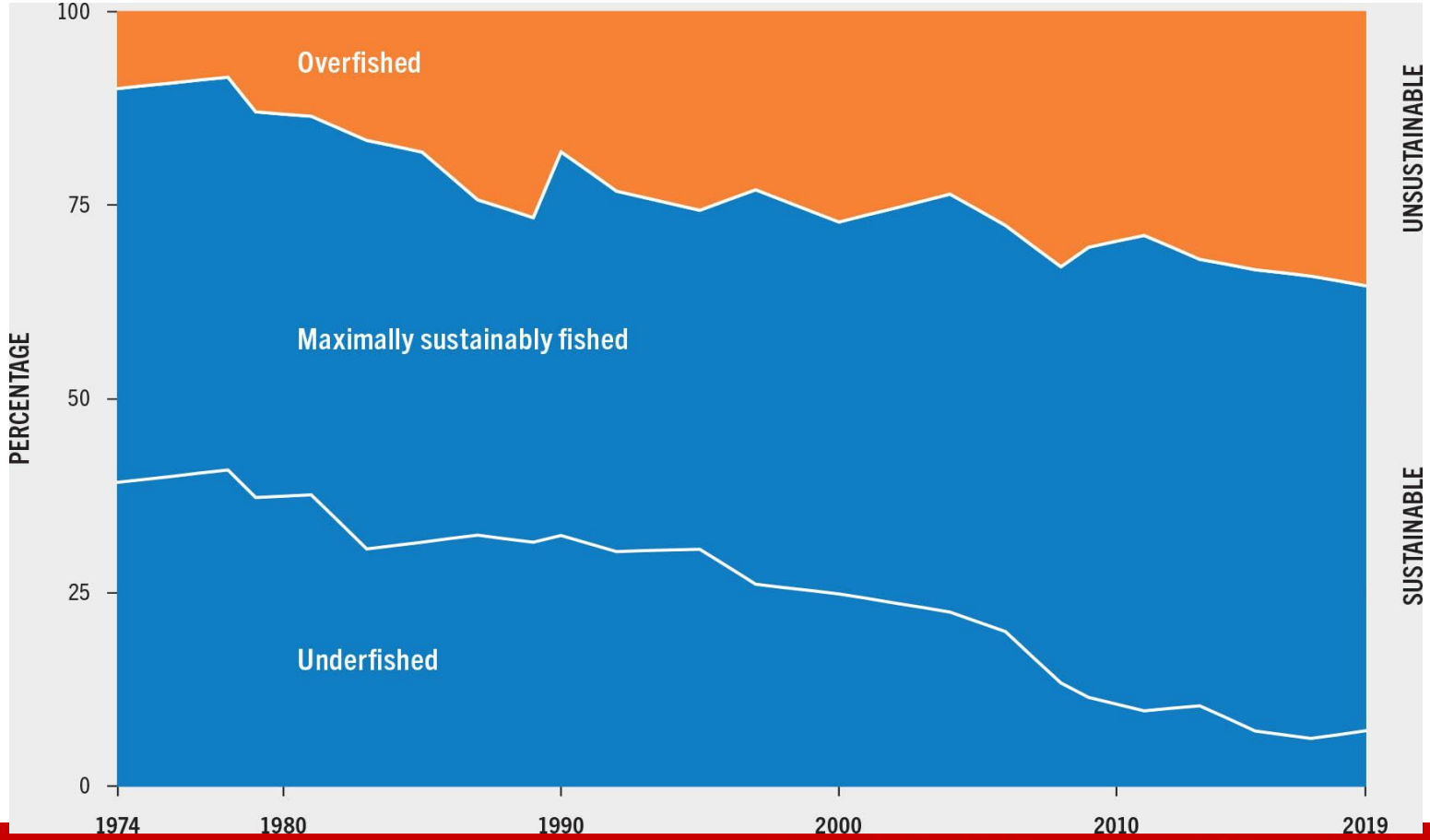
Exhaustible renewable resources

- The process of renewal of these resources cannot continue indefinitely, as the **stock must respect the maximum level** given by the livelihood capacity (carring 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 *excesive exploitation that leads to the definitive extinction* of the resource can not be excluded

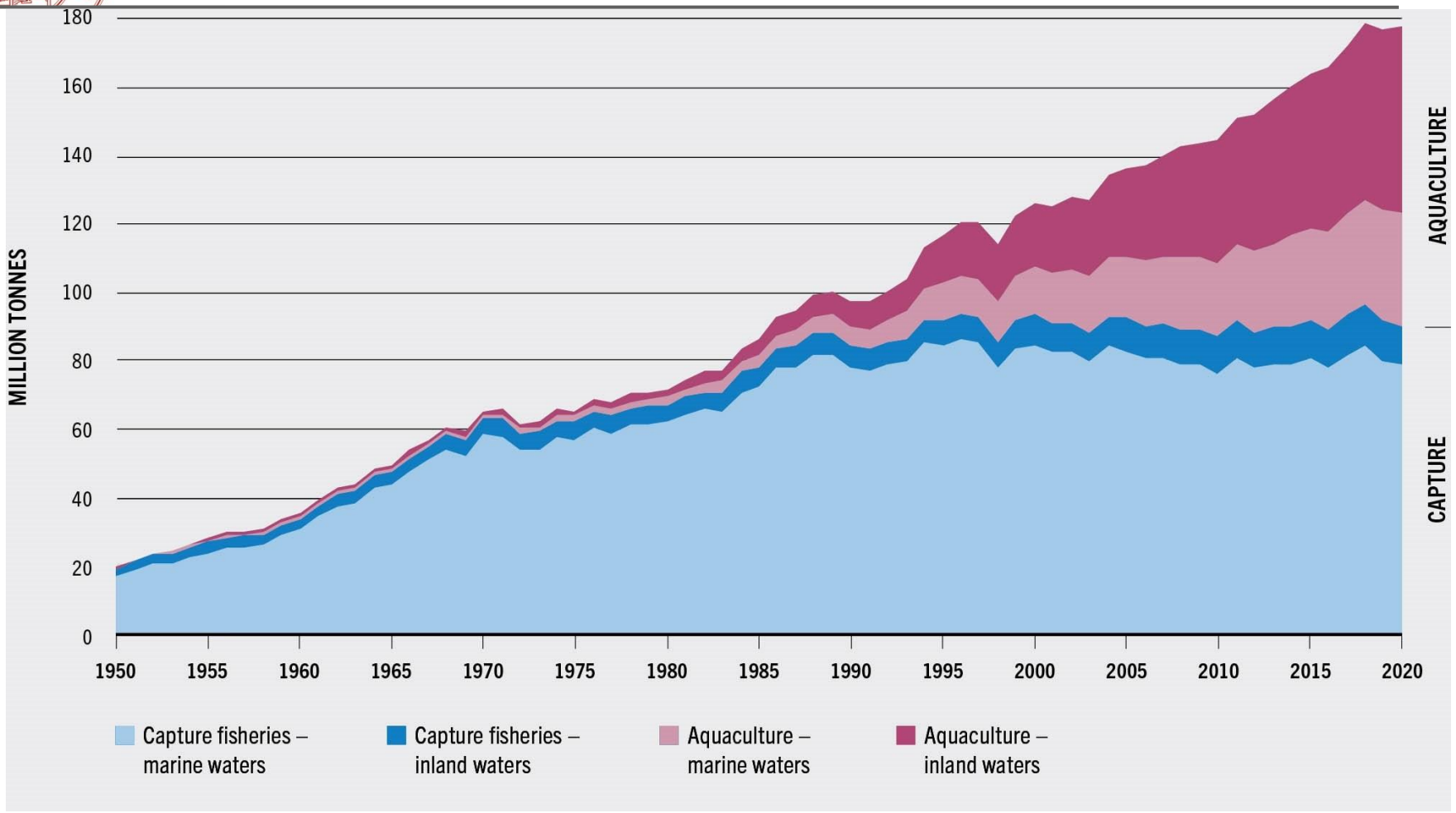
Trend of Marine fish stocks

For FAO, 30% of world stocks are *overfished*. 55% for the Mediterranean, following a decreasing trend.

The catching capacity of the European fleet remains more than double.

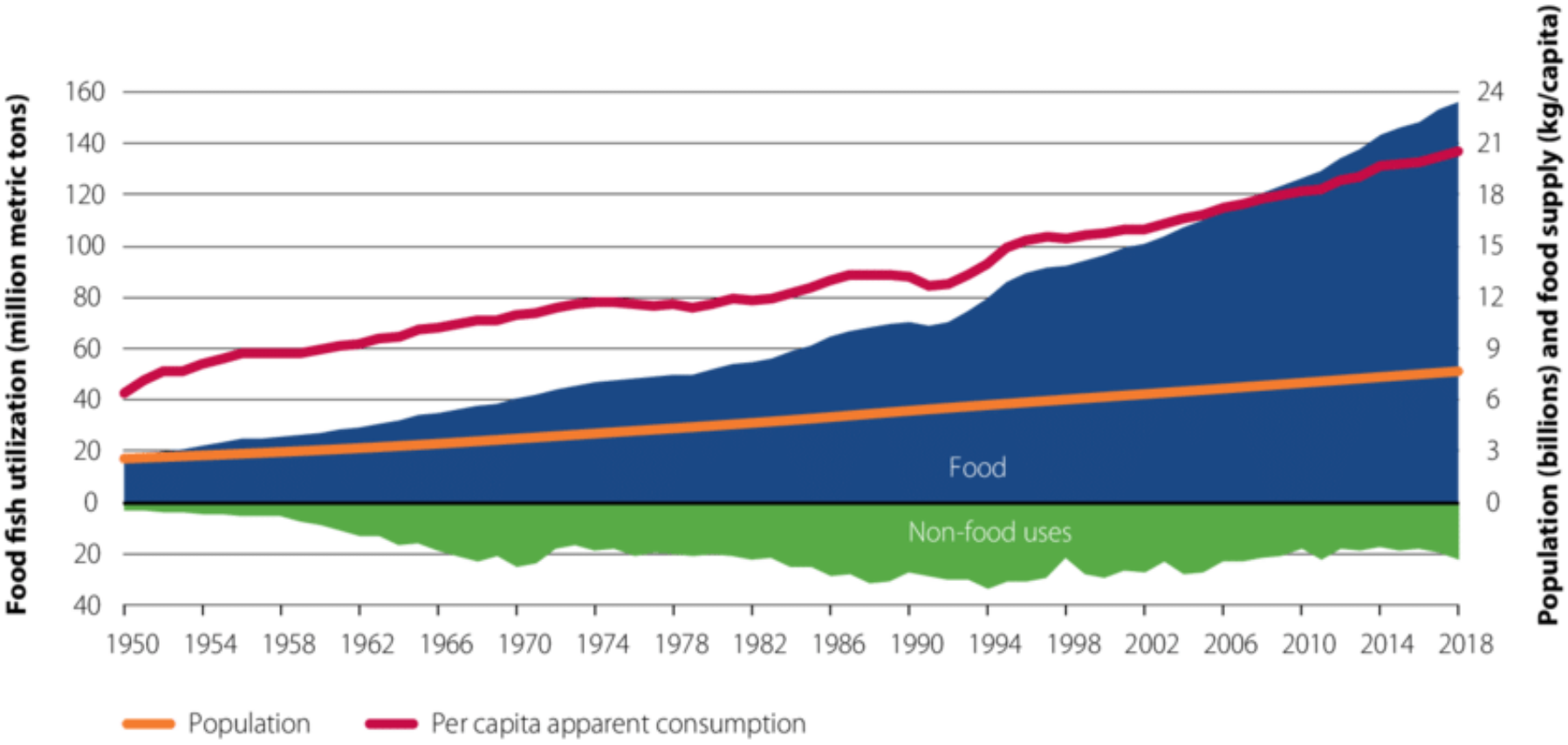


Fish and acquaculture contribution



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

Fish and aquaculture contribution



NOTE: Excludes aquatic mammals, crocodiles, alligators and caimans, seaweeds and other aquatic plants.

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***

Marine resources as common goods

- ***Common (public) 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***

Common natural resources

Like all common goods, fish resources enjoy two particularities, ***rivalry and non-excludability***

Rivalry: the consumption/possession of a good by someone determines the *unavailability* of that good for others.

Excludability: the degree to which a good, service or resource can be limited to only paying customers, or conversely, the degree to which a supplier, or other managing body (e.g. a government) can prevent »free» consumption of a good. ***Access is restricted***

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)

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"

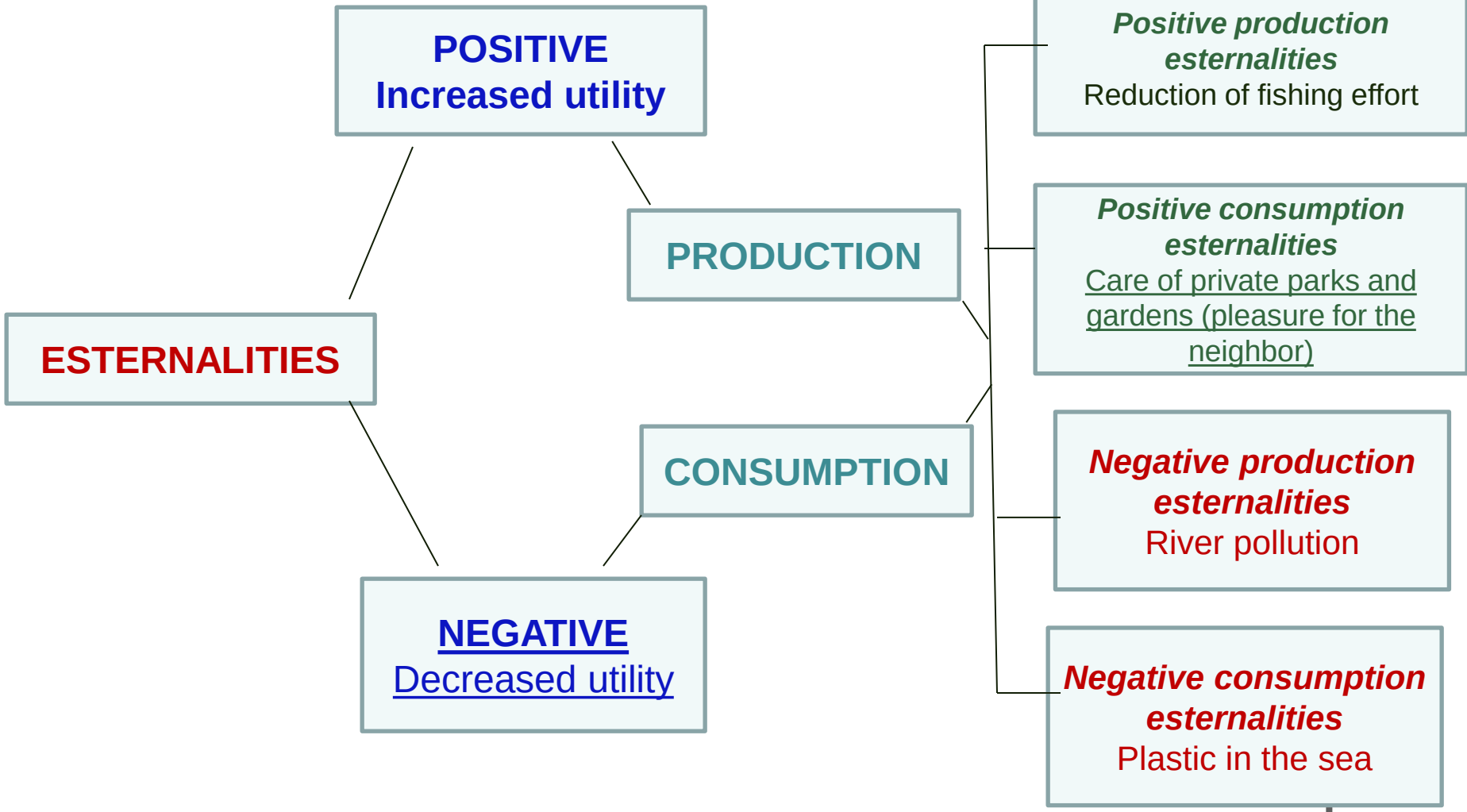
Several measures have been adopted to reduce the "freedom of fishing" principle

- International treaties and regional commissions operating in international waters
- Development of territorial waters (3/6 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 (IQ or ITQ) by effort?quantity?

Esternalities

- There is an ***externality, positive or negative,*** when the decisions of an economic agent interferes 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

Consumption and production externalities



Technical and pecuniary externalities

- In many cases the behavior of some economic agents influences the welfare of others through a ***change in price***
- 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:*** *it follows that there can be no exchange and that production units are induced to make an inefficient use of resources due to technical externalities.*
- **Stock externality:** the activity of each company reduces the size of the fish stock and increases the production costs of other companies.

Technical and pecuniary externalities

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*

The value of a good depends on the set of property rights that are conveyed in the negotiation operations

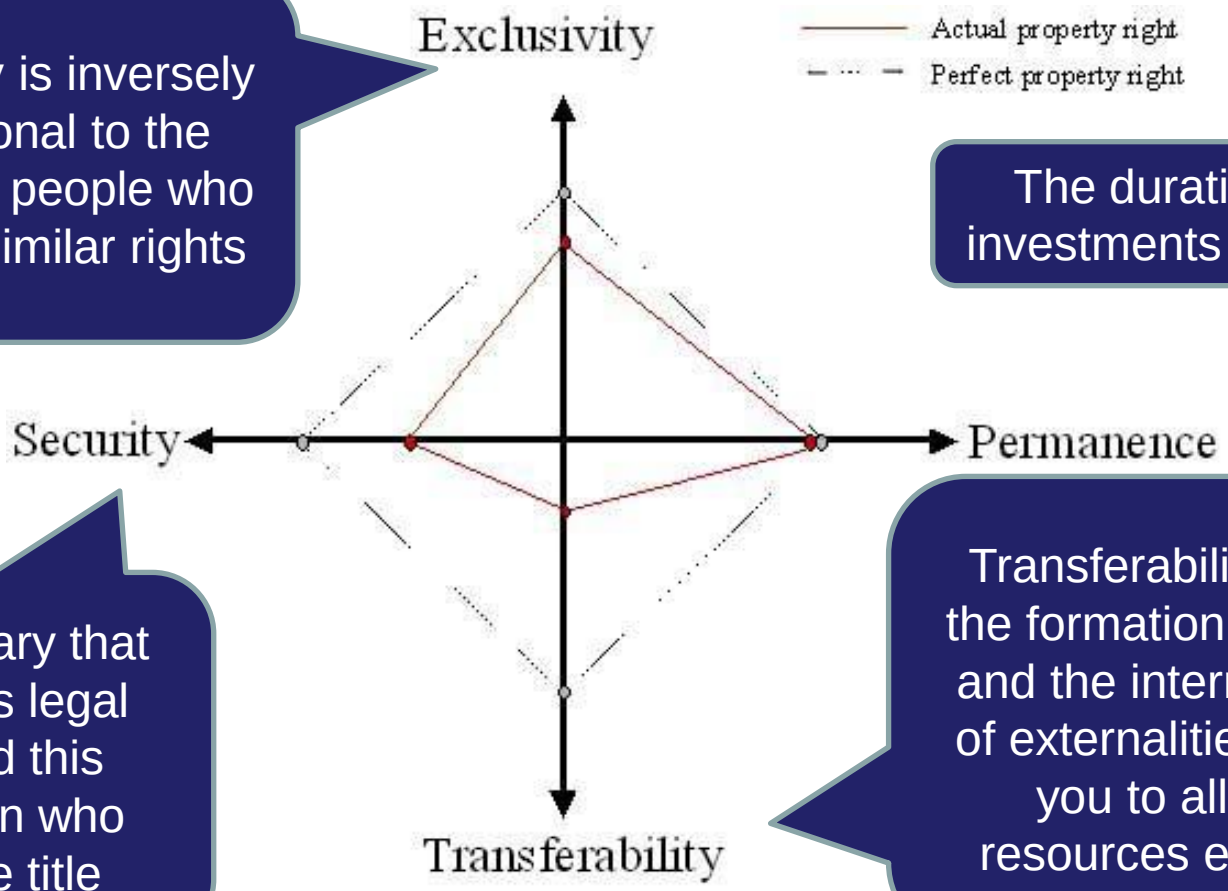
The market presumes the existence of property rights but does not contribute to their definition

Property right theory

- The proprerty right in a society 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.

Caracteristics of the prorierty right

Exclusivity is inversely proportional to the number of people who possess similar rights



The duration allows investments to be made

It is necessary that the title has legal value, and this depends on who issues the title

Transferability allows the formation of a price and the internalization of externalities. Allows you to allocate resources efficiently

Obstacles and fears about transferability

Conflict between the objectives of production efficiency and social equity: the transfer of property rights to the most efficient companies can give rise to socially undesirable consequences:

- Concentration of rights in the hands of a few large companies
- No workers compensation
- Consequences on the production chain at local level
- Disappearance of traditional techniques and crafts

1. THE EUROPEAN GREEN DEAL

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» *Source: 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.***

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.

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*

Green Deal and Marine resources

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.

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

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.*

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,*

Encouraging sustainability in aquaculture through:

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

2. ECOSYSTEM SERVICES

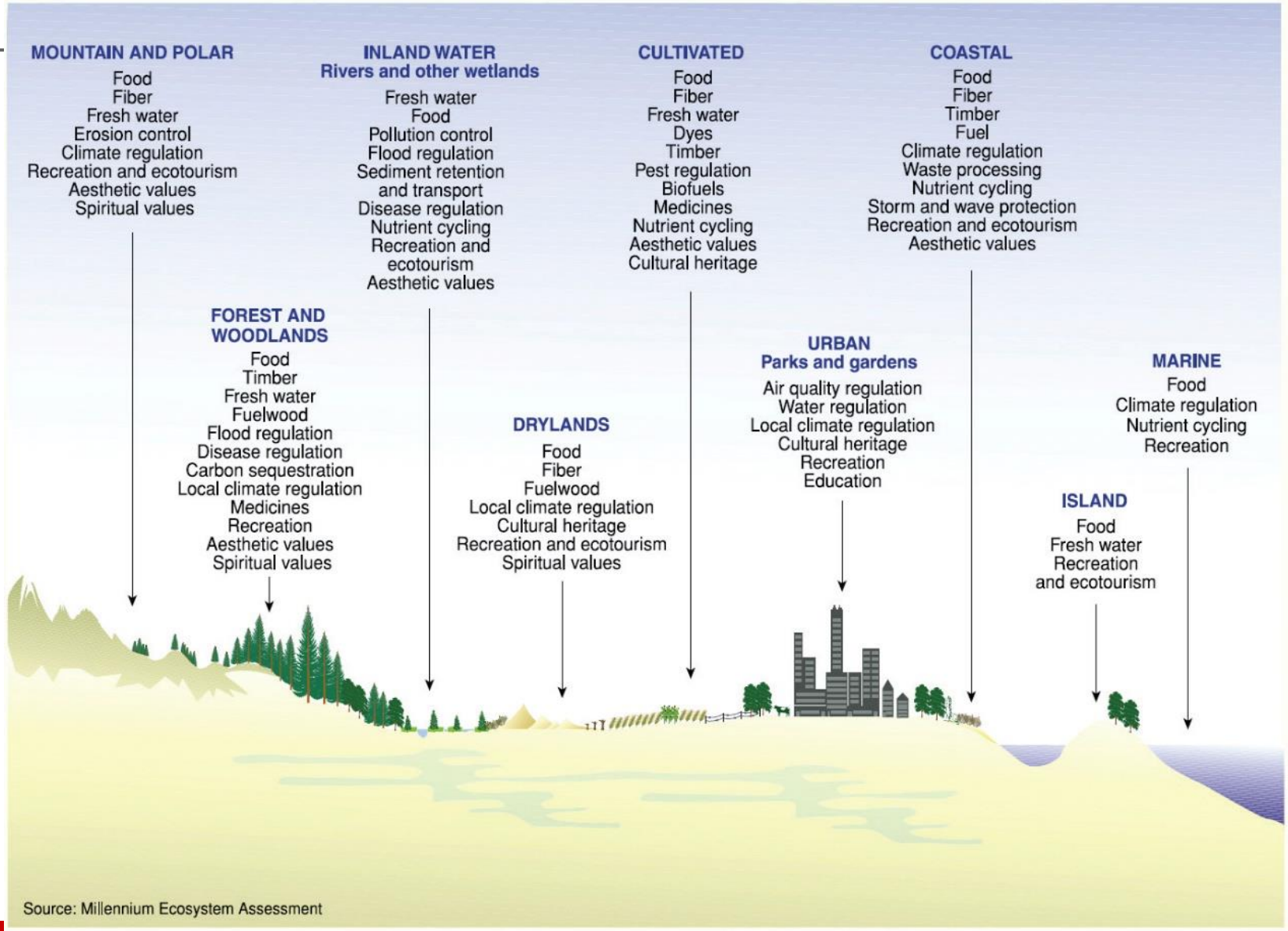
Ecosystem Services

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.

The benefits that people obtain from ecosystems



Classification of ecosystem services (MEA)

Category	Ecosystem services
Provisioning services Benefits obtained from ecosystems	• Food • Fibers • Biochemical and medicinal products • Genetic resources • Ornamental resources
Regulating services Benefits derived from the regulation of ecosystem processes	• Air quality regulation: intake and removal of chemicals from the atmosphere • Climate regulation: carbon sequestration and greenhouse gas emissions • Water regulation: flood control • Erosion control: prevention of erosion • Water purification: decomposition and filtration of organic waste • Natural hazard mitigation • Waste decomposition: removal of pollutants
Cultural services Non-material benefits of a recreational, ethical, and aesthetic nature	• Spiritual and religious value • Inspiration for art, folklore, and architecture • Social relationships • Aesthetic values • Cultural heritage values: landscapes and animal species • Recreation and ecotourism
Supporting services	• Soil conservation • Nutrient cycling • Primary production • Water cycling • Oxygen production • Habitat provision

Marine ecosystem services

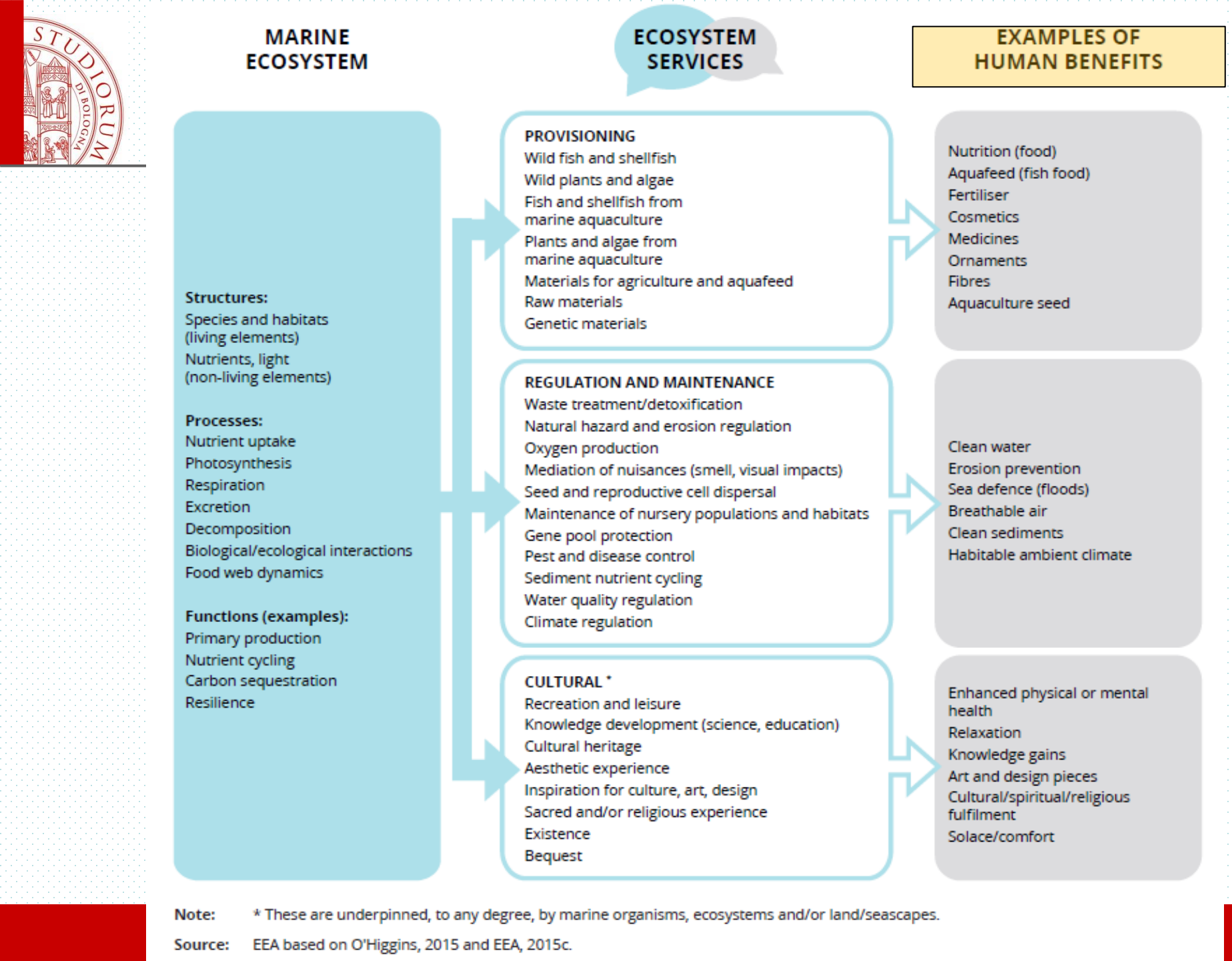
Natural Capital/
Marine ecosystem
Function
Biogeochemical cycling,
Flow of energy
Biological productivity
Refuge, Habitat
Structure:
Biotic (living) marine animal and plant communities
Abiotic (non living) components of the marine environment

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

Provisioning/Goods: fish harvests, water, genetic materials, wild plant and animal
Regulating/services: Recreation, tourism, erosion control, strom protection, pollution control, climate regulation, Habitat provision, carbon sequestration
Cultural: The way environmental interaction shapes our experiences (e.g. religiuos, bequest value, heritage)

Good and Benefit marine resources.

- **Human well-being**
- **-Production of goods and service**



Note: * These are underpinned, to any degree, by marine organisms, ecosystems and/or land/seascapes.

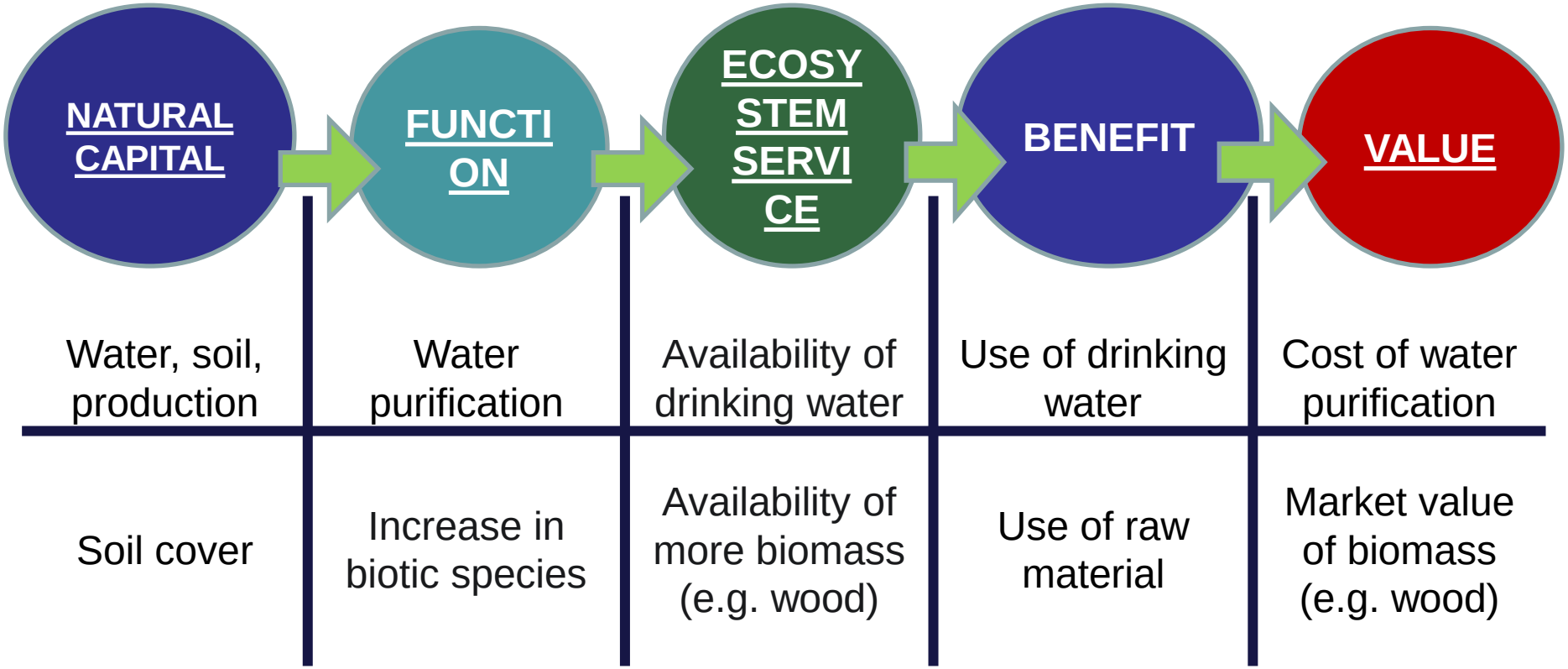
Source: EEA based on O'Higgins, 2015 and EEA, 2015c.

Marine and coastal ES

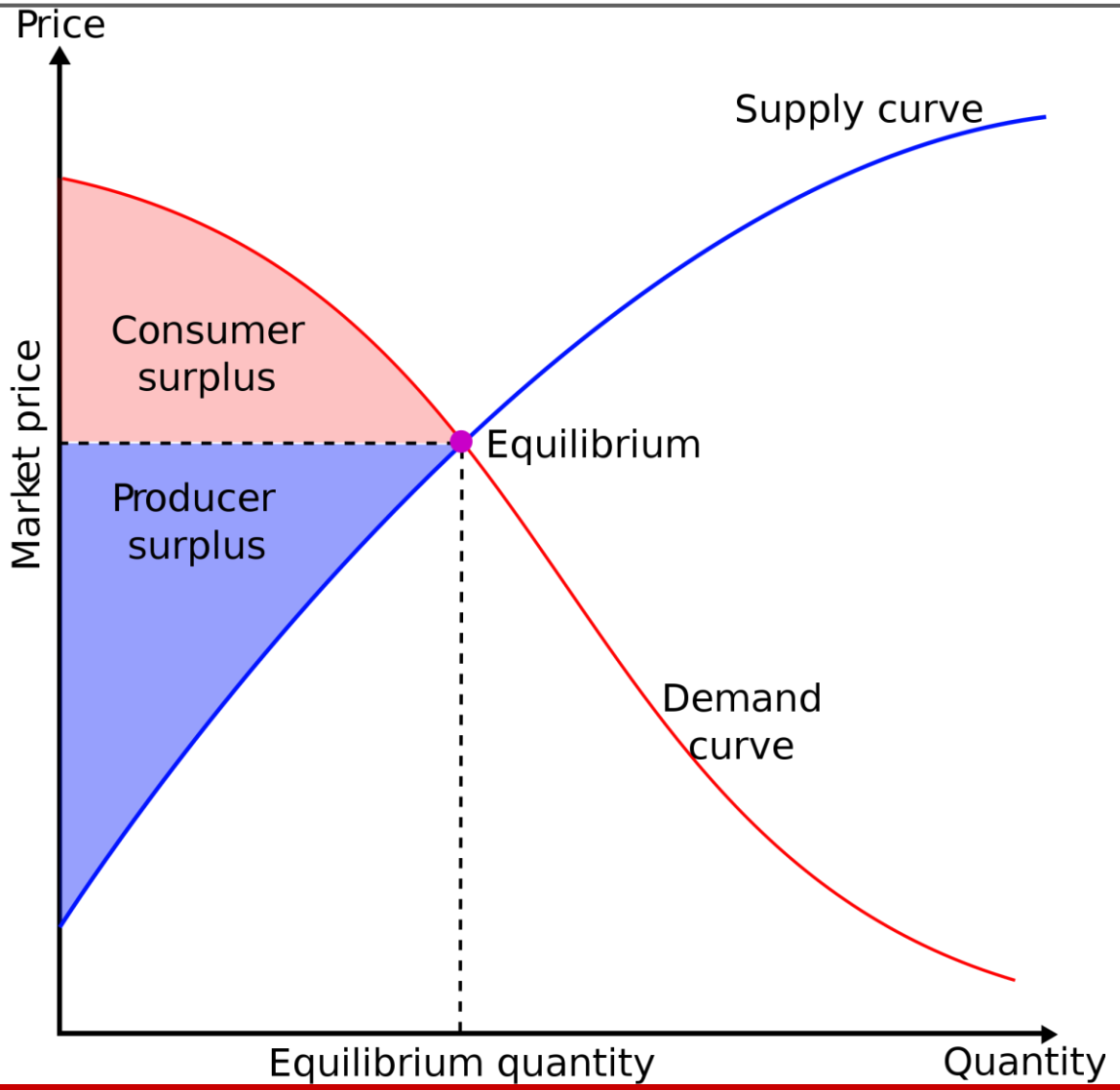
Table 1.1 EXAMPLES OF ECOSYSTEM SERVICES PROVIDED BY DIFFERENT MARINE AND COASTAL HABITATS
(X indicates the habitat provides a significant amount of the service)

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

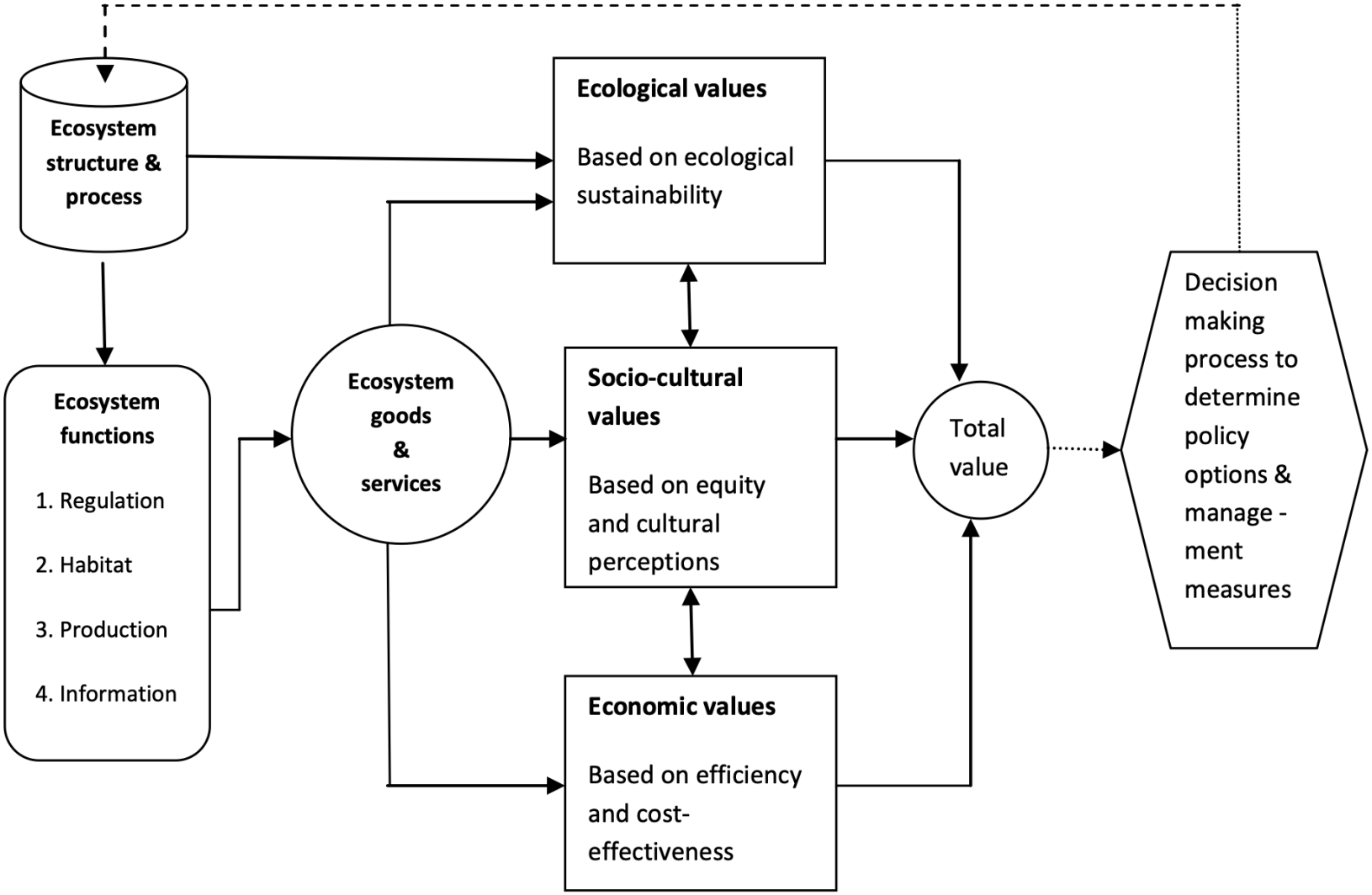
Environment–human well-being relationships



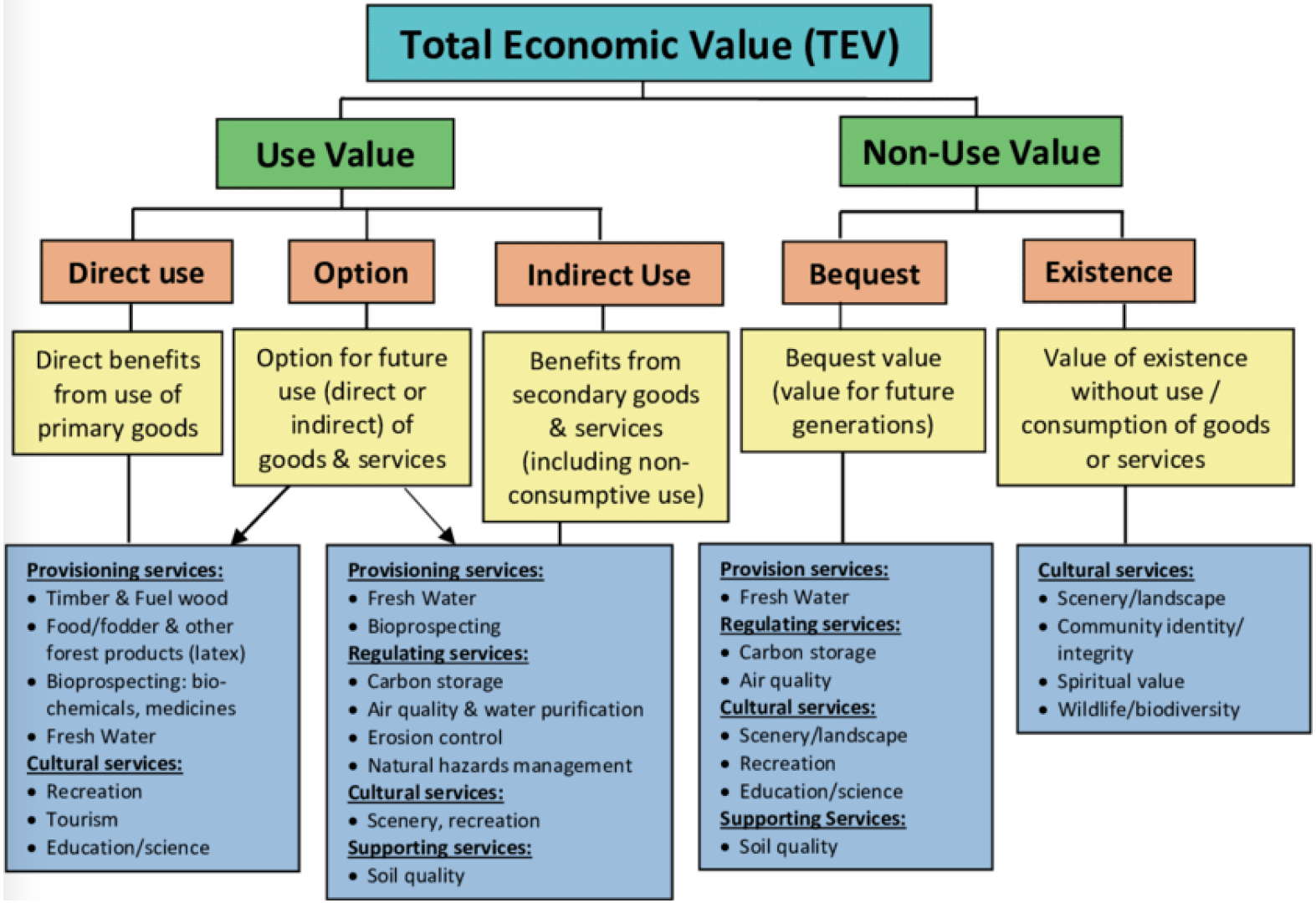
The value of the ES



Conceptual framework for the evaluation of "Ecosystem Services"



Quantification of "Ecosystem Services"



Techniques for economic valuation of ecosystem services

Category	Methods	Note
Direct market valuation	• Market price (proxy) • Production function • Damage Avoided cost • Replacement cost	*Methods based on markets and production processes.* Limitations: Since these methods rely on market transactions, in cases where markets do not exist, there may be a lack of data that does not accurately reflect market reality.
Revealed preferences	• Travel cost • Hedonic price	*Methods based on revealed values from behavior in associated markets.* Limitations: Due to market imperfections, the monetary value of services can be distorted. Reliable and representative data is required.
Stated preferences	• Contingent valuation • Choice experiment	*Methods based on surveys where respondents evaluate different scenarios.* Limitations: These methods can be costly and technically challenging to implement, and they are prone to biases and distortions.

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

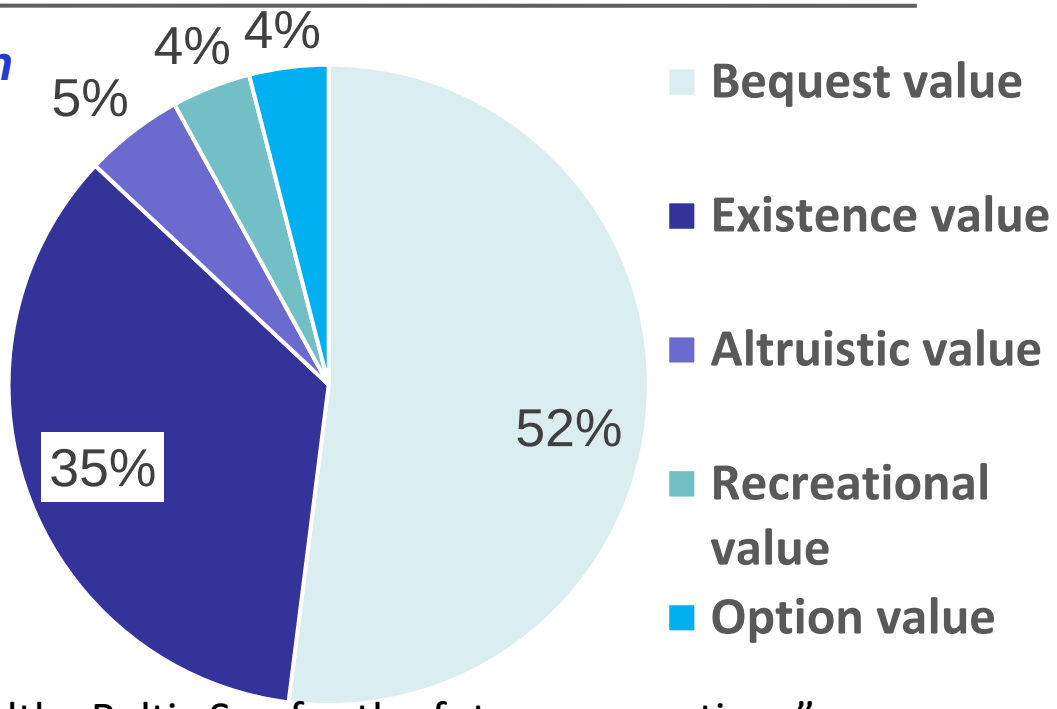
CATEGORY	TECHNIQUE	DESCRIPTION	MARINE ECOSYSTEM SERVICE EXAMPLE WHERE USED
Market based value	*Market price*	Market prices stemming from a normal production process.	*Quality certification products, organic products,*
	Production function	Values how changes in the quantity or quality of the ecosystem 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*
Market-based value	*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*

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 value	*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*

Why use public funds for marine protection?

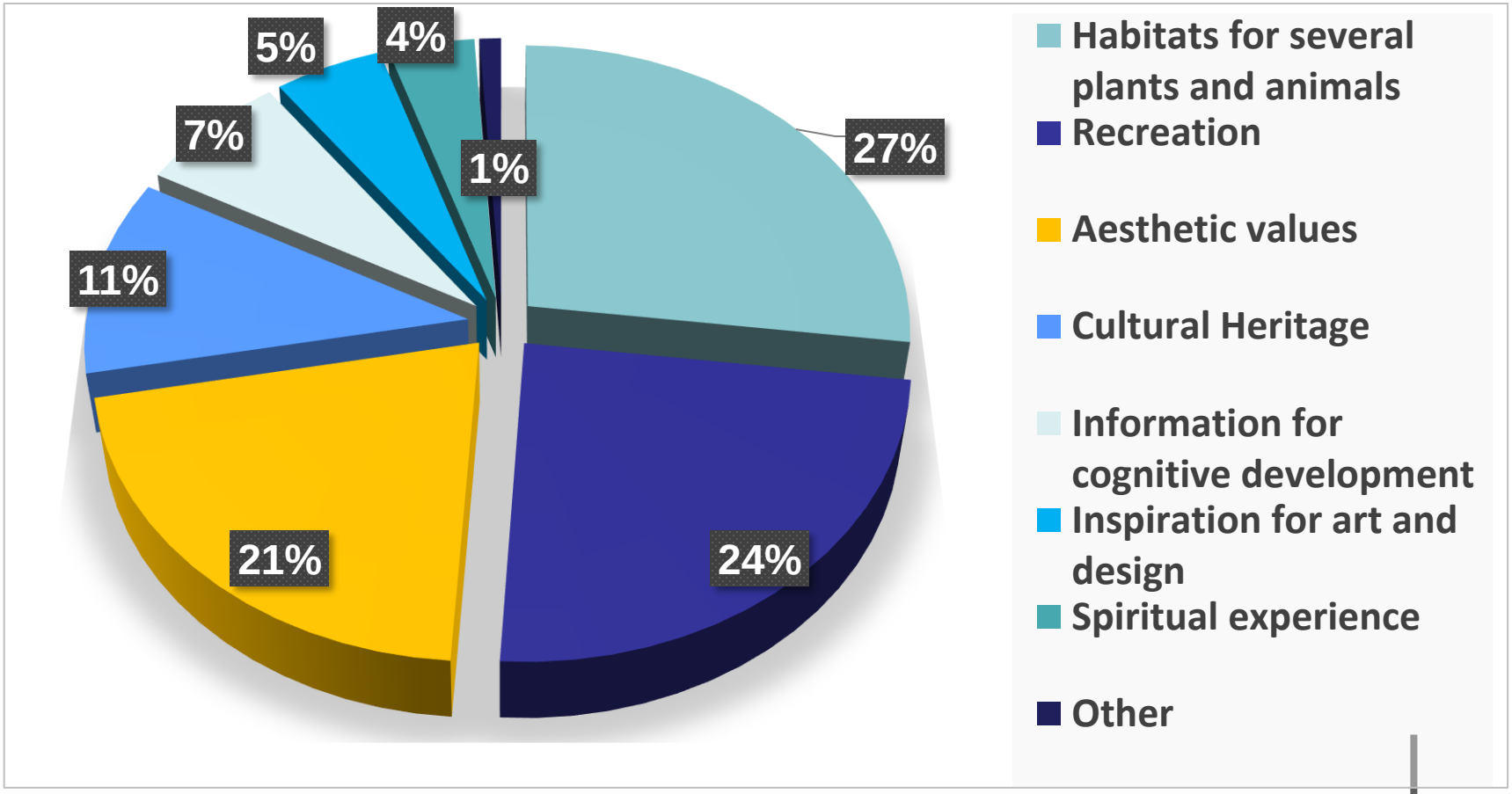
"What is the most important reason for you to be willing to pay for achieving the good status of the Finnish marine waters?"



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"

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?"



A new perspective for fish

- The United Nations Environment Program (2012), in a report on the blue economy, considers that "*fishers and fish-farmers* should, given the dependence of their businesses and livelihoods on ecosystem services, *be stewards of the marine environment.*"
- This implicitly suggests *a governance framework* where externalities are managed from and on the sector, with fair and responsible tenure systems that foster stewardship

Market failure

Market failure is a situation in which the allocation of goods and services by a free market is not efficient, often leading to a net loss of economic value.

Market failure occurs because commodity (i.e., fish) producers determine the level of production that maximizes their profit *(pursuit of pure self-interest),* while a higher or lower level of production, linked to the joint production of public goods (e.g., ecosystem services, food security, cultural heritage), might be necessary *to maximize social welfare.*

Solutions in the fisheries sector

- *Different solutions* can help reach the optimal supply of public and common goods.
- The precise structure of these approaches depends on the nature *of rights that private and public stakeholders* have on the provision of commodity outputs and NCOs.
- The distribution of these rights defines the direction of money exchanges (e.g., *incentives, payments, subsidies, fees*) that can be used to internalize the externalities.

Characteristic of fishers' activity

- Fishers don't influence the production but only *affect the size of fish stocks directly and indirectly* (through the impacts on the ecosystem)
- Fisheries are typically managed as a *common-property resource*
- Fishery doen't have the possibility (or obligation) to manage elements of the environment, landscape, and biodiversity, on the contrary, property rights (when they exist) are strictly linked to a specific resource (i.e., individual quotas), while *the rights (and duties) on the surrounding environment are poorly defined.*

Reference levels and payment for ecosystem services

- *If producers/fishers provide public goods* beyond the reference level, they might be entitled to ***compensation*** (the beneficiary-pays-principle).
- *Reference levels* define the benchmark between avoidance of negative externalities and provision of positive ones, and the one between environmental charges and environmental payments
- *PES internalizes externalities* and is based on the beneficiary-pays rather than the polluter-pays principle; this means that the right is held by the "polluter" (who manages the ecosystem and can, potentially, provide ESs) not the "pollutee".

NCOs in fisheries

- Based on the fishery specificities, the following groups on fishery NCOs can be identified:
  - Ecosystem- and biodiversity-related NCOs
  - Other environmental public goods/bads,
  - Cultural heritage and coastal viability
  - Coastal employment externalities
  - Food security
  - Strategic benefits
- What is new in this perspective: ***is the idea that fishers affect the provision of all these NCOs (negatively or positively) and that this total effect should be considered to calculate the social benefit generated by fisheries.***

Functions of fisheries: tradable and non-tradable

- Food production: this function clearly concerns a tradable commodity but also entails non-trade aspects such as quality products and food security and safety.
- Environmental functions: small-scale fisheries are linked to positive externalities (or reduced negative externalities) on environmental issues.
- Coastal/maritime functions: small-scale fisheries allow the monitoring of the sea, preserve cultural traditions and interaction with activities of maritime and coastal economy.
- Social functions: it concerns impacts that help improving the local quality of life in coastal communities, including employment and reduced emigration rates.

A new model for fisheries in Mediterranean and Black Sea

The multifunctional fishing entrepreneur:

from good producer... to (also) service provider

Some examples

- ***Healthy marine ecosystems and biodiversity***
  - Fisheries and fishers seem unable to increase the provision of this type of public environmental goods
  - However, this depends on the distribution of property rights and the determination of reference levels.
  - There are cases where fishers can be compensated (PES) for the profit loss incurred through a change in gear type, fishing location, or practice: i.e. protection of dolphins, turtles, ecosystems, etc…
- ***Other environmental public goods/bads***
  - Removal of marine litter
  - Reduction of CO2 emission

Some examples

- ***Coastal employment externalities***
  - The inclusion of employment in the discussion on multifunctionality is controversial. Employment related to fisheries is an input of commodity production and cannot be considered as an externality.
  - Coastal employment may contribute to reducing urbanization and congestion in cities
  - The preservation of a coastal population preserves per capita costs of public services
  - Some countries may wish to maintain a coastal population for national defence purposes
- ***Cultural heritage and coastal viability***
  - Fishers are often considered to be the guardians of coastal customs, traditions, and of an age-old way of life.
  - Fishing activities provide amenities for which there is demand that affects individual choices for tourism

Policy implications

- A classification scheme of *policy interventions* must be based on the subject in charge of the *NCO provision.*
- Possible providers include fishery firms, other private agents, fishers' associations or communities, and public authorities (sometimes in co-management with fishers' associations)
- If the separate provision of commodity outputs (i.e., catches) and NCOs is not technically feasible or economically efficient, jointly provision by fishers represents the best option to target social optimality
- Public authorities have several options to foster it, depending on the existence of property rights and reference levels

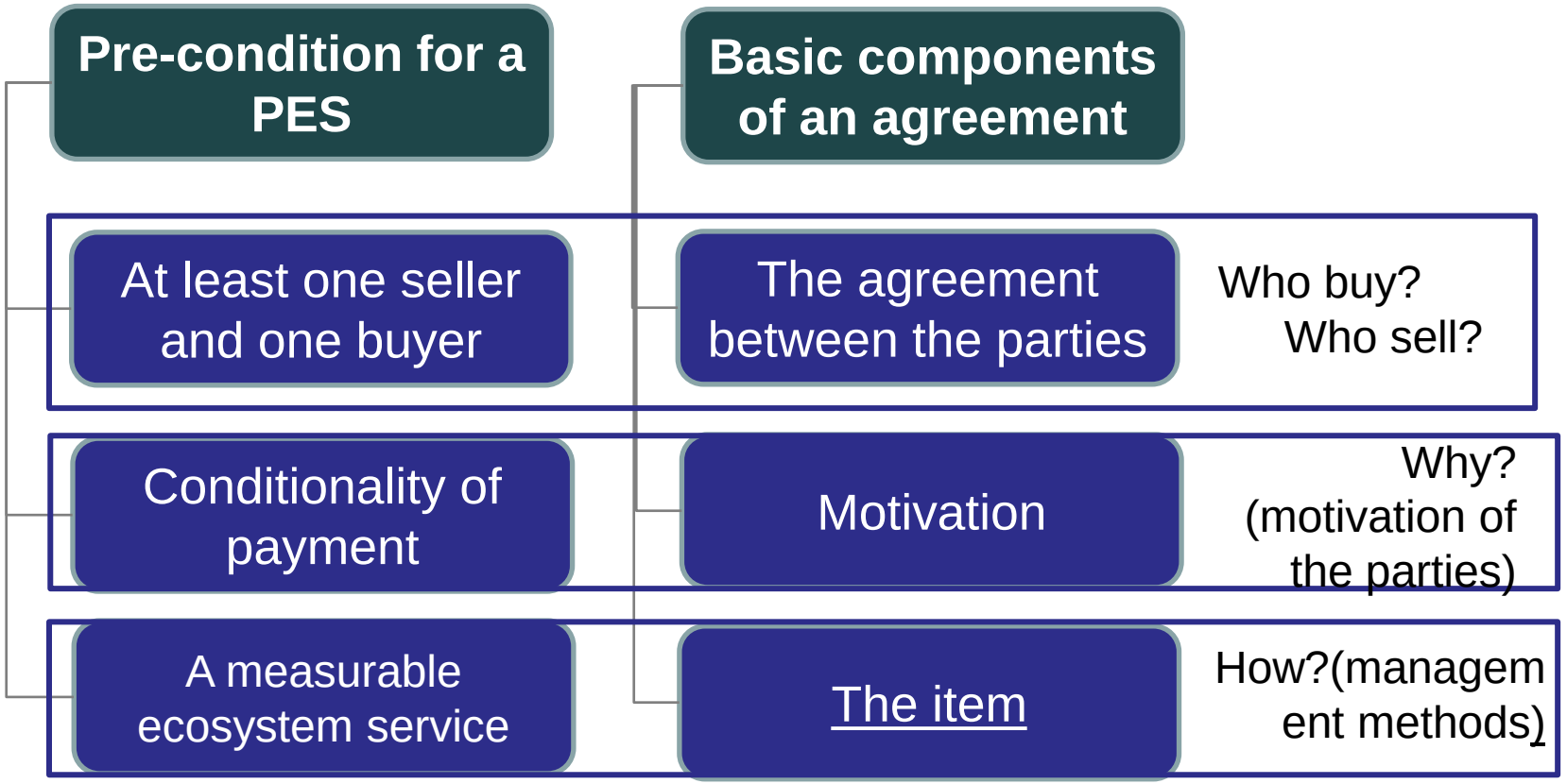
Payment for ecosystem services

Those who implement measures to protect the natural resource or sustainably manage the territory are not always the ones who take advatage from the benefit. This requires the use of mechanisms that aim to stimulate the production of positive externalities, transforming them into real products exchangeable on the market.

Definition:

«A voluntary transaction in which a well-defined environmental service, or a form of marine/land use that can guarantee such a service, is purchased by at least one user and sold by at least one supplier, if and only if the supplier guarantees the continuity of the service itself (conditionality)"

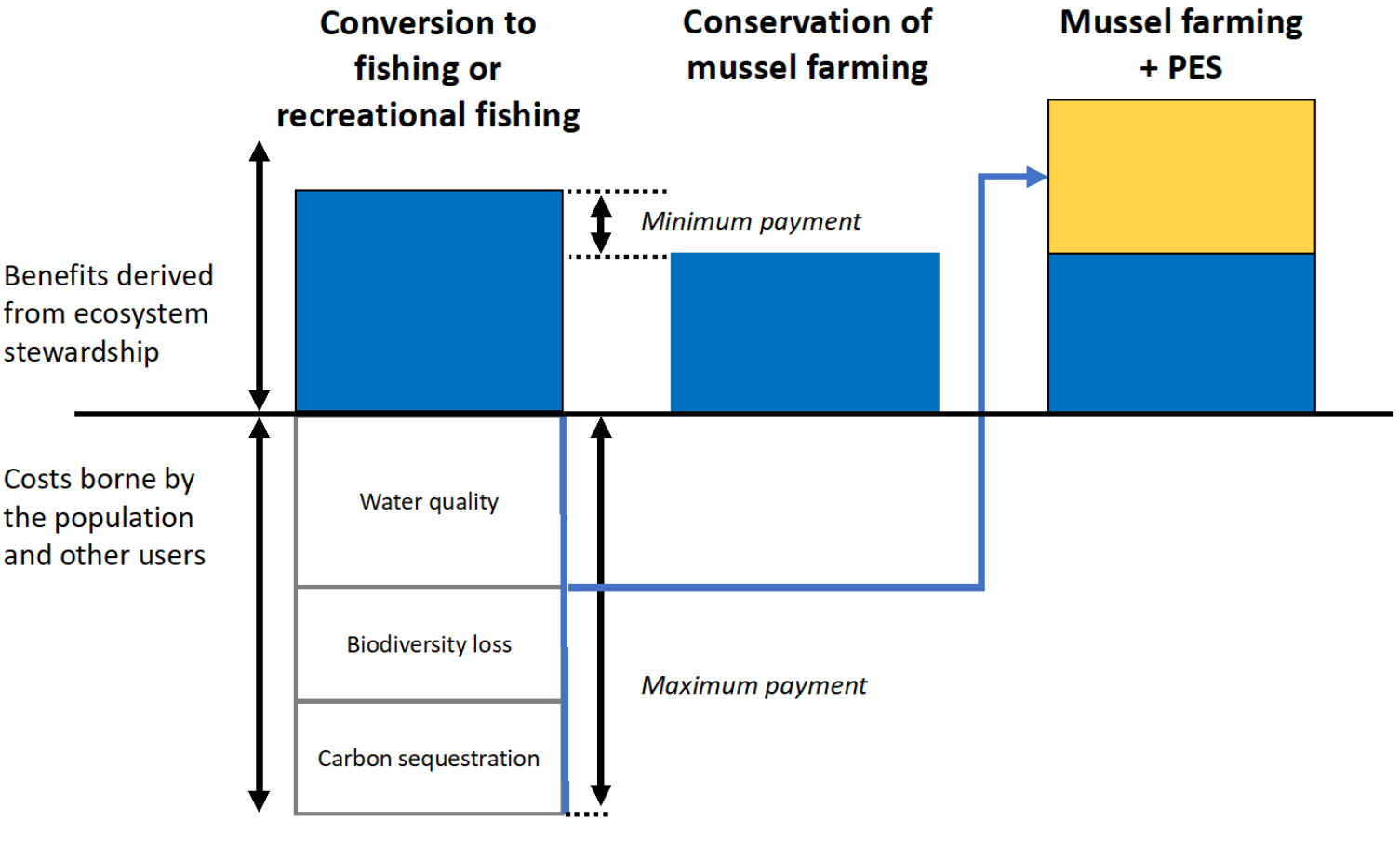
Pre-conditions for creating a PES scheme



Main types of PES schemes

- *public payment systems* through which governments pay land or resource managers to improve ecosystem services on behalf of a broad public (e.g. residents);
- *private payment schemes*, which are self-organized private arrangements in which beneficiaries of ecosystem services contract directly with service providers;
- *public-private payment schemes* that refer to mixed forms of contracting and/or payment.

Ex. of a payment structure within the framework of PES



Forms of payment

- ***Output-based payments*****:** made on the basis of ecosystem services provided, taking into account quantified levels of provision. For example, payments can be made for a certain level of carbon sequestration or for a measured increase in biodiversity.
- ***Input-based payments***: made on the basis of certain land or resource management practices. For example, schemes can be implemented for the creation and maintenance of buffer strips along watercourses or the restoration and maintenance of green spaces in residential areas.

3. 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 Commission published 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*"

Ocean/blue 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)

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.*

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

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. GDP of aquaculture, fisheries, tourism, shipping and shipbuilding, mining, and hydrocarbon extraction)
- ***non-market activities: benefits by (***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)

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

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, Other expenditure
	Transport

Trend of Blue Economy by sectors

Italy — **Evolution of the Blue Economy established sectors**

Persons employed *(thousand)*	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Living resources	73.5	73.6	72.2	74.6	71.6	70.5	69.6	72.2	72.3	74.7
Non-living resources	11.2	11.1	10.8	10.3	9.6	9.6	9.5	6.3	2.0	2.2
Ocean energy	-	-	-	-	-	-	-	-	-	-
Port activities	38.9	37.1	35.2	34.3	34.5	33.5	33.8	35.2	34.9	35.2
Shipbuilding and repair	45.8	41.4	38.0	34.4	32.3	32.7	34.0	35.4	39.2	40.1
Maritime transport	45.3	42.9	41.7	43.0	41.8	60.7	63.3	63.8	67.9	69.0
Coastal tourism	396.6	331.2	261.5	235.4	222.0	199.6	204.9	227.7	244.2	307.3
Blue economy jobs	611.2	537.2	459.4	431.9	411.9	406.6	415.2	440.6	460.5	528.7
National employment	22,324	22,152	22,215	22,149	21,755	21,810	21,973	22,241	22,444	22,586
Blue economy *(% of national jobs)*	2.7%	2.4%	2.1%	1.9%	1.9%	1.9%	1.9%	2.0%	2.1%	2.3%

GVA *(€ million)*	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Living resources	2,380	2,380	2,523	2,195	2,231	2,156	2,548	2,621	2,623	2,666
Non-living resources	2,074	2,071	2,014	1,703	1,324	1,199	1,385	1,287	739	819
Ocean energy	-	-	-	-	-	-	-	-	-	-
Port activities	1,732	1,922	1,877	1,994	2,047	1,983	2,142	2,194	2,222	2,229
Shipbuilding and repair	1,894	1,664	1,848	1,457	1,489	1,736	1,694	2,092	2,555	2,785
Maritime transport	3,175	4,310	3,595	3,443	3,595	4,118	4,741	4,534	4,768	4,772
Coastal tourism	10,158	9,978	8,040	6,939	6,621	6,290	6,902	7,918	8,551	10,524
Blue economy GVA	21,413	22,326	19,896	17,730	17,307	17,482	19,412	20,646	21,457	23,795
National GVA	1,425,157	1,449,430	1,480,875	1,458,007	1,451,514	1,462,745	1,488,049	1,522,917	1,557,833	1,583,358
Blue economy *(% of national GVA)*	1.5%	1.5%	1.3%	1.2%	1.2%	1.2%	1.3%	1.4%	1.4%	1.5%

Value added and employment

The size of economic activities can be assessed using standard measures of value added and employment.

taly		Activity	Persons employed		Δ 2018-09	Turnover (M€)		Δ 2018-09	Value added at factor cost (M€)		Δ 2018-09
ector	Sub-sector		2009	2018		2009	2018		2009	2018	
Living resources	Primary production	Capture fisheries (SSCF)	13,698	12,333	-10%	338.5	180.2	-47%	242.6	133.8	-45%
		Capture fisheries (LSF)	15,269	13,426	-12%	965.7	763.8	-21%	584.0	431.4	-26%
		Capture fisheries (DWF)	255	84	-67%	25.3	5.8	-77%	16.1	4.1	-75%
		Marine aquaculture	306	375	23%	133.2	96.8	-27%	25.5	51.9	103%
		Freshwater aquaculture	1,374	683	-50%	337.4	129.7	-62%	108.2	56.7	-48%
		Shellfish aquaculture	4,204	3,703	-12%	156.1	160.1	3%	75.2	108.1	44%
	Processing of fish products	Processing and preserving of fish, crustaceans and molluscs	5,343	5,953	11%	2,211.2	2,672.4	21%	295.8	410.9	39%
		Manufacture of oils and fats									
		Prepared meals and dishes	4,496	3,472	-23%	696.8	557.0	-20%	195.0	147.7	-24%
		Other food products	437	494	13%	112.6	180.1	60%	28.6	40.7	42%
	Distribution of fish products	Wholesale of other food, including fish, crustaceans and molluscs	16,904	20,831	23%	9,007.2	11,787.0	31%	635.6	1,092.6	72%
		Retail sale of fish, crustaceans and molluscs in specialised stores	11,258	13,394	19%	956.8	1,184.4	24%	173.3	188.6	9%

L'ASCESA DELL'ECONOMIA BLU NELL'UNIONE EUROPEA

(2019, variazione % rispetto al 2009)

VALORE AGGIUNTO LORDO

184 Mld di €

+20%

UTILE LORDO

73 Mld di €

+22%

OCCUPATI

4,5 mln

+0,5%

VALORE AGGIUNTO PER PAESE

(2019, composizione %)

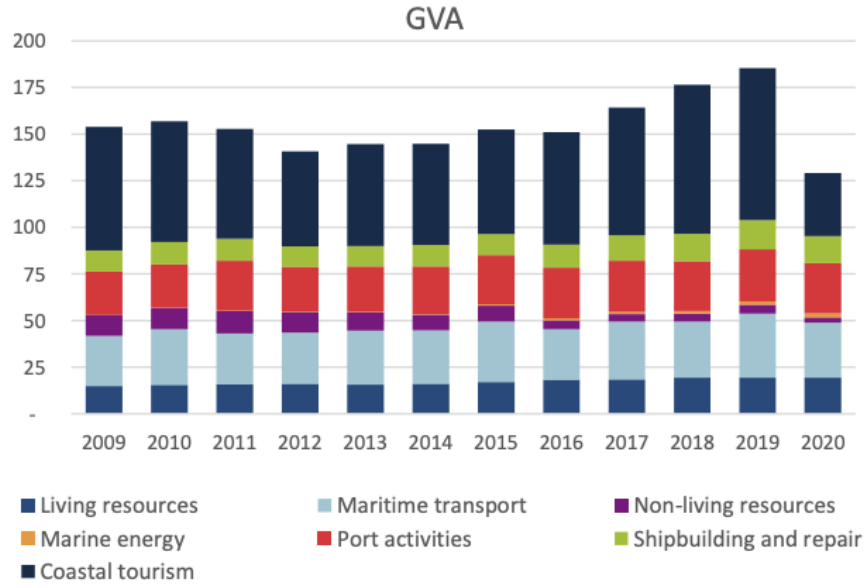
OCCUPAZIONE PER PAESE

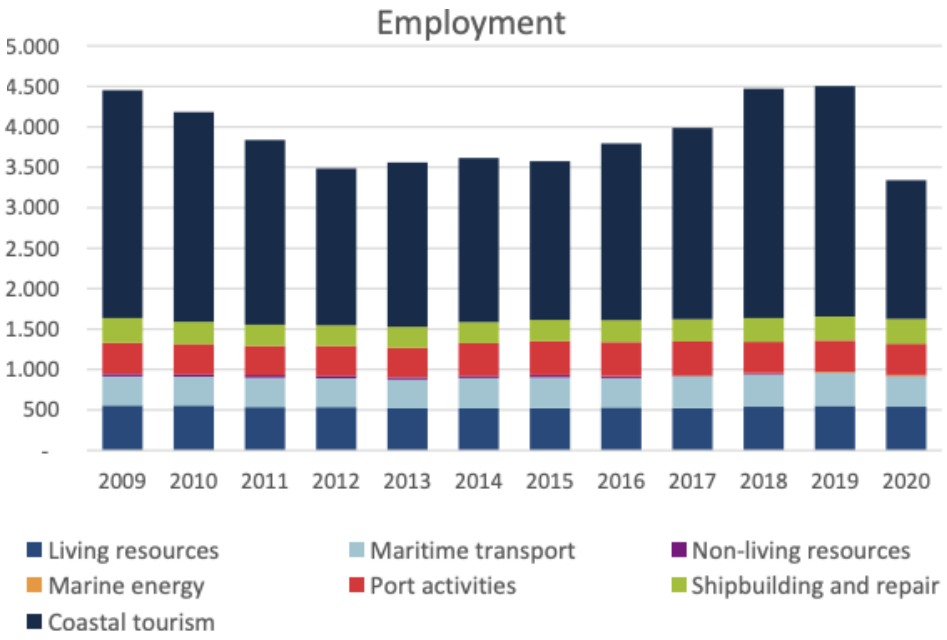
POSIZIONAMENTO E CONTRIBUTO DELL'ITALIA IN TERMINI DI VALORE AGGIUNTO LORDO PER SETTORE *(2019)*

Cantieristica navale e riparazioni	3° posto	19%
Risorse marine non biologiche	3° posto	16%
Trasporto marittimo	3° posto	14%
Turismo costiero	3° posto	13%
Risorse biologiche marine	4° posto	14%
Attività portuali	5° posto	8%

Fonte: The EU Blue Economy Report, 2022

Blue economy per sectors





FORZA MOLTIPLICATIVA

Anno di riferimento dati: 2021

1 EURO PRODOTTO DALLA BLUE ECONOMY NE ATTIVA ALTRI 1,7 SUL RESTO DELL'ECONOMIA

Valore aggiunto prodotto: 52,4 Mld di €

Valore aggiunto attivato: 90,3 Mld di €

8,9% *Incidenza sul totale economia nazionale*

MOLTIPLICATORE PER COMPARTI

Movimentazione di merci e passeggeri via mare	2,7 €
Filiera della cantieristica	2,5 €
Attività sportive e ricreative	2,1 €
Filiera ittica	1,9 €
Servizi di alloggio e ristorazione	1,9 €
Industria delle estrazioni marine	1,1 €
Ricerca, regolamentazione e tutela ambientale	0,5 €

DINAMICA DEL VALORE AGGIUNTO E DEGLI OCCUPATI

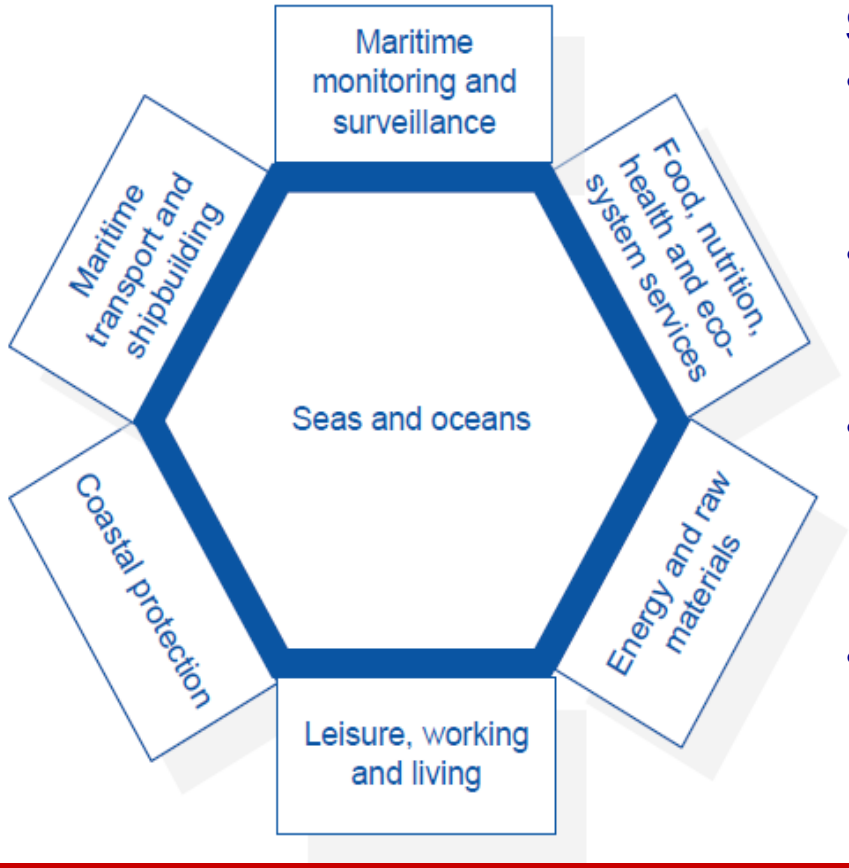
	ECONOMIA DEL MARE			TOTALE ECONOMIA
	Valori assoluti	Incidenza sul totale economia nazionale	Variazione % 2021/2020	Variazione % 2021/2020
Valore aggiunto:	52,4 Mld di €	3,3%	+9,2%	+6,4%
Occupati:	913.965	3,6%	+0,5%	+0,6%

VALORE AGGIUNTO DEI COMPARTI

(in miliardi di €. Tra parentesi, variazione % 2021/2020)

Synergies in the Blue Growth

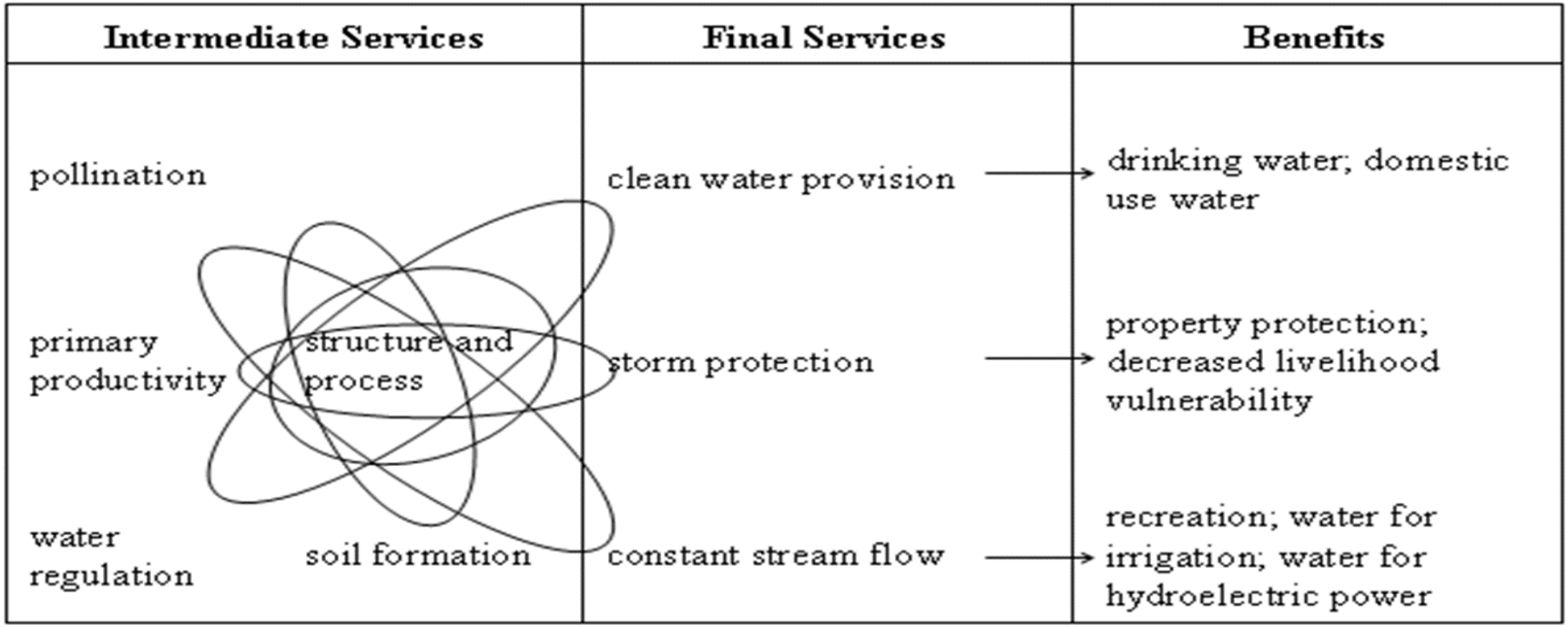
***Blue Growth** is* the long term strategy to support sustainable growth in the marine and maritime sectors as a whole. Creating synergies between economic activities and addressing tensions clearly helps in realizing the Blue Growth potential.



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.

SEEA Accounting



- 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**

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

- 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***

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	

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

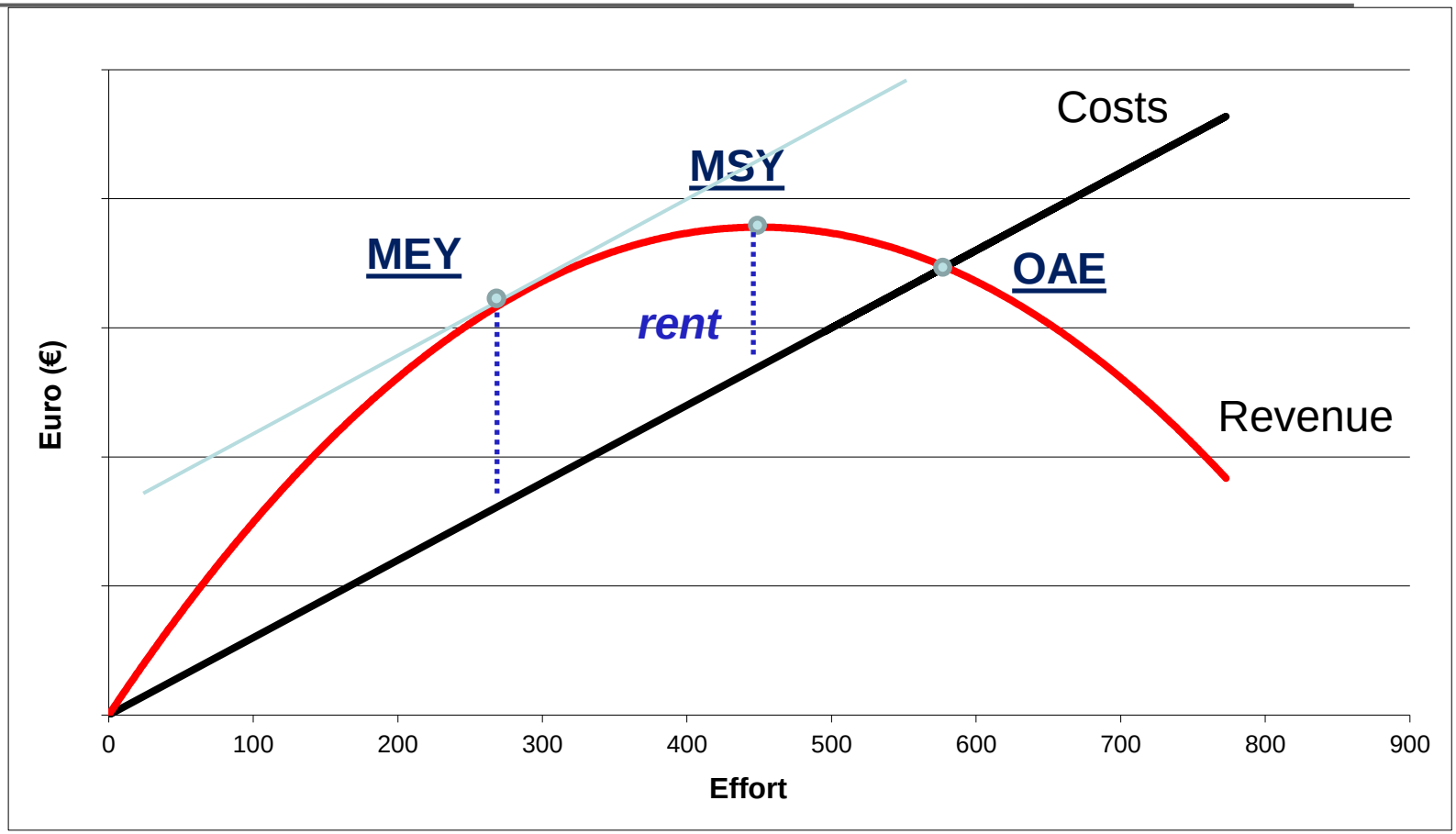
Ex. Use Value- Leisure and living

- *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 homes.
- 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

Ex. 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).***

Gordon-Schaefer Model



Maximum economic yield (MEY) of the fleet. The marginal revenue equals the marginal cost.

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*.

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.

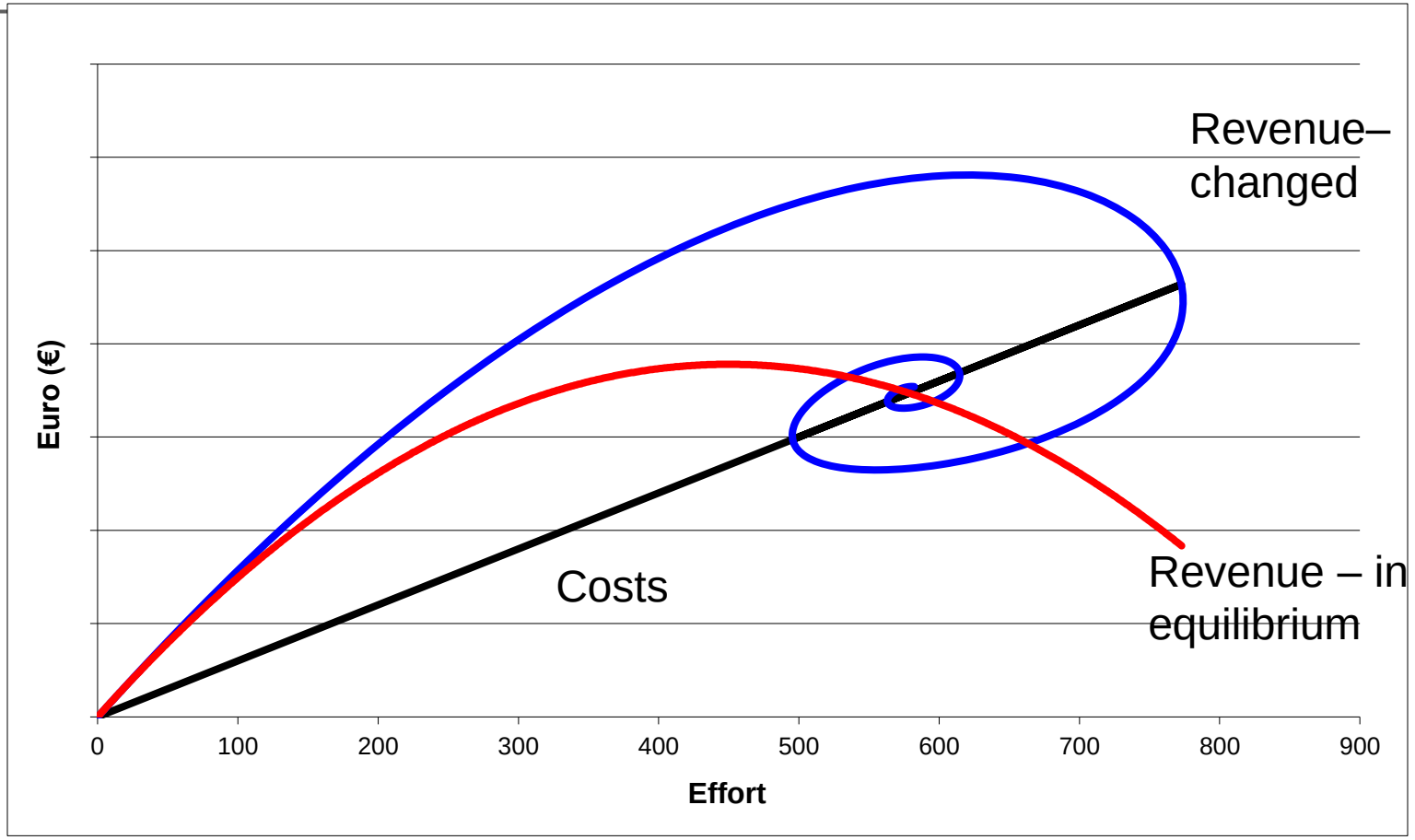
Es. Food, nutrition and health

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).

The dymanics 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 $\underline{dE/dt = \varphi\pi(t)}$

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

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**

Sources:

- 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.

4. MARINE SPATIAL PLANNING

Marine Spatial Planning

28.8.2014 EN Official Journal of the European Union L 257/135

DIRECTIVES

DIRECTIVE 2014/89/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 23 July 2014

establishing a framework for maritime spatial planning

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

This Directive establishes a framework for maritime spatial planning aimed at promoting the sustainable growth of maritime economies, the sustainable development of marine areas and the sustainable use of marine resources.

…..'maritime spatial planning' means a process by which the relevant Member State's authorities analyse and organise human activities in marine areas to achieve ecological, economic and social objectives.

Maritime activities currently taking place in the European sea areas

MARITIME ACTIVITIES	
Dumping zones	Dumping of dredged materials
Fisheries	Fisheries and aquaculture
Marine aggregates	Sand and gravel extraction, sand and gravel transport
Maritime services	Research and development, classification and inspection, bunkering, ship supply
Maritime works	Dredging and ship wreck dismantling
Nautical cables and pipelines	Oil and gas transportation, telecom
Navy and coastguard	Defense and rescue
Offshore activities	Oil and gas exploration and production, seismic research, carbon capture and storage (CCS)
Offshore supply	Construction of platforms, offshore-related transport
Recreational boating	Leisure navigation, boat chartering and renting, marinas
Renewable energy	Wind, waves and tide
Seaports	Shipping related storage, port development
Shipping	Merchant shipping, short-sea shipping, ferry services, ocean towage
Tourism at sea	Diving, sailing, recreational fishing, cruise tourism
ENVIRONMENTAL AND CULTURAL ASPECTS	
Coastal protection	Construction of dykes, beach nourishment, dune rehabilitation, protection against climate change
Marine protected areas	Areas for the sustainable use of marine resources and for the conservation of biodiversity
Quality of Life	Preservation of cultural heritage, environment protection

Source: Policy Research Corporation

Conflict matrix for maritime activities

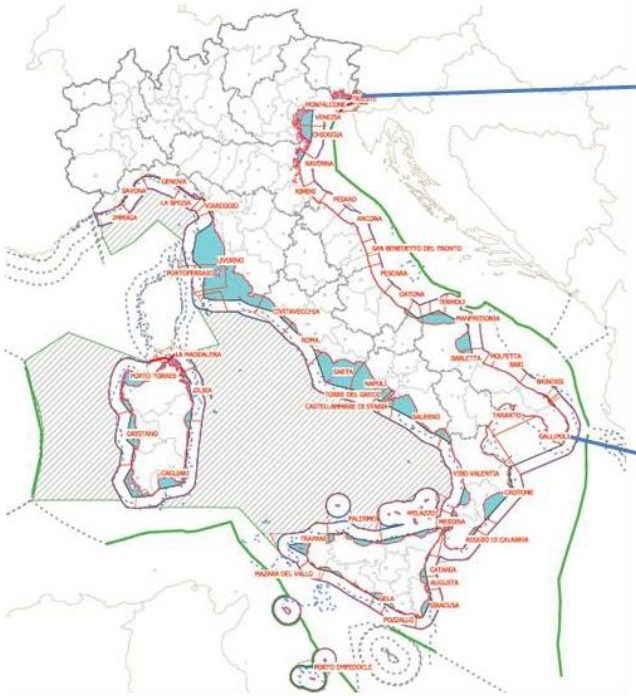
No conflict	Incidental conflict, activities can co-exist (○)	Considerable conflict, co-existence may lead to costs (-)	Strong conflict, co-existence is implausible (x)

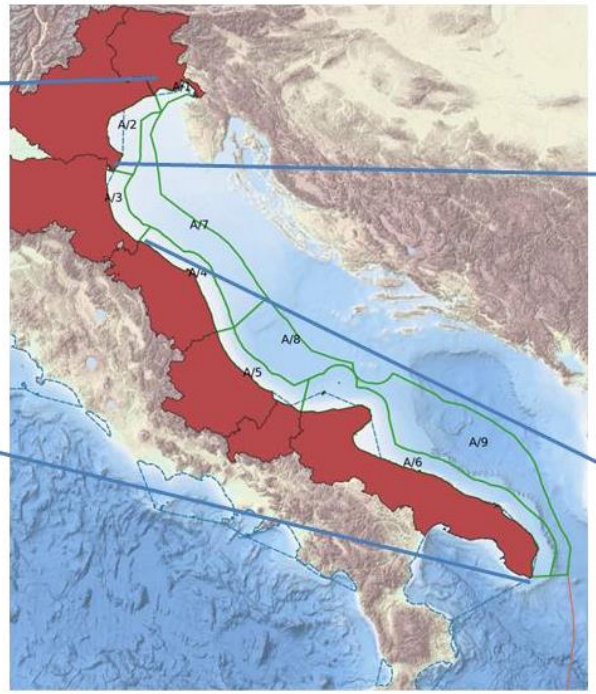
	Shipping	Cruise tourism	Dredging	Oil & gas	CCS	Offshore wind	Wave & tidal	Fishing	Aqua-culture	Marine tourism
Shipping										
Cruise tourism										
Dredging	○	○								
Oil & gas	○	○								
CCS	○	○	○							
Offshore wind	-	-	○	-	-					
Wave & tidal	-	-	-	-	x	○ (?)				
Fishing			-	○	-	x	x			
Aqua-culture	-	-	-	x	-	?	x	x		
Marine tourism				x		-	x	○	○	

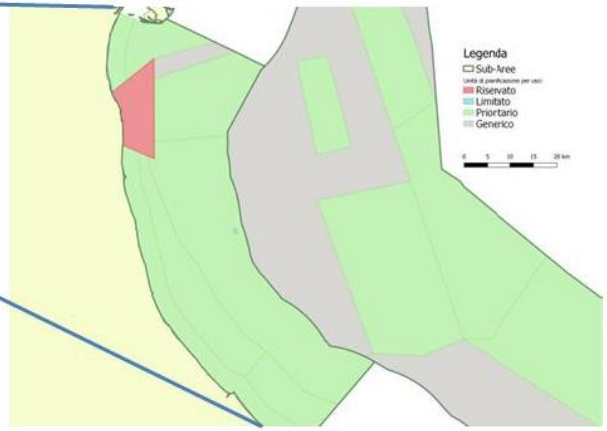
(?) Potential synergies apply.

Source: Policy Research Corporation based on multiple sources[21]

Spatial schematization within the Plans







Aree Marittime
(Adriatico, Ionio-Mediterraneo Centrale, Tirreno-Mediterraneo Occidentale)

Sub-Aree
(A/1 – A/9)

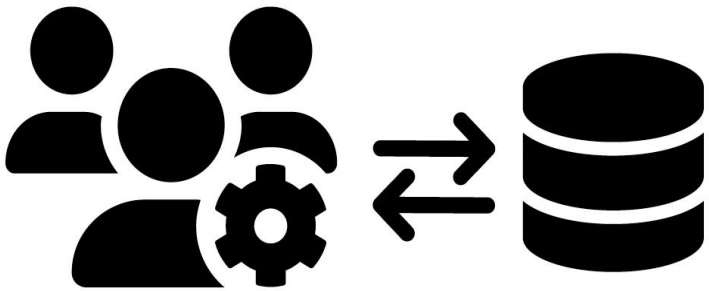
Unità di Pianificazione
(usi Generici, Prioritari, Limitati, Riservati)

MSP Data and information needs

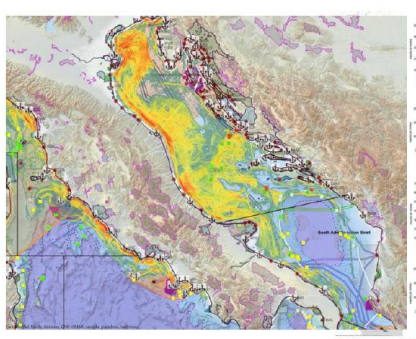
Multi-actors

- PUAD
- Managers
- Planners
- Scientists
- Private sectors
- Citizens

DSS Decision Support Tools
Data and info visualization

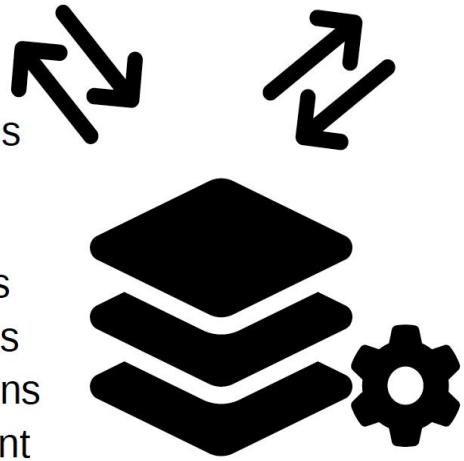


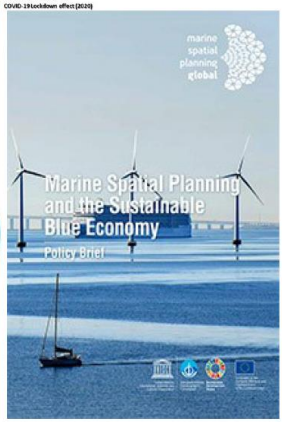
Multidisciplinary data



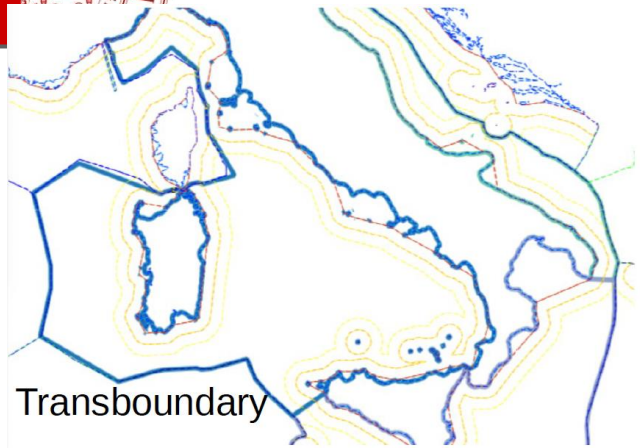
Multi-stages

1) Define goals and objectives
2) Gather data and define current conditions
3) Identify issues, constraints, and future conditions
4) Develop alternative management actions
5) Evaluate alternative management actions
6) Monitor and evaluate management actions
7) Refine goals, objectives and management actions





Challenges



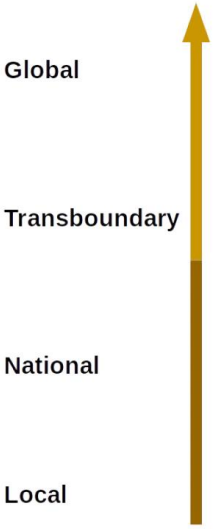
Transboundary

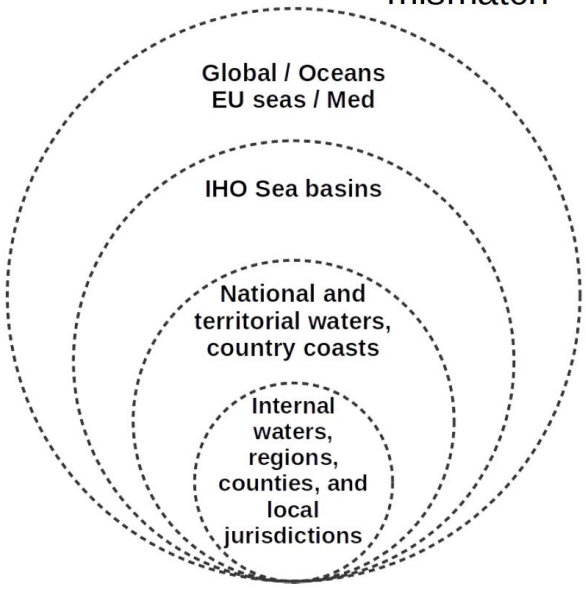
Spatial and temporal mismatch

Duplication, overlap, fragmentation

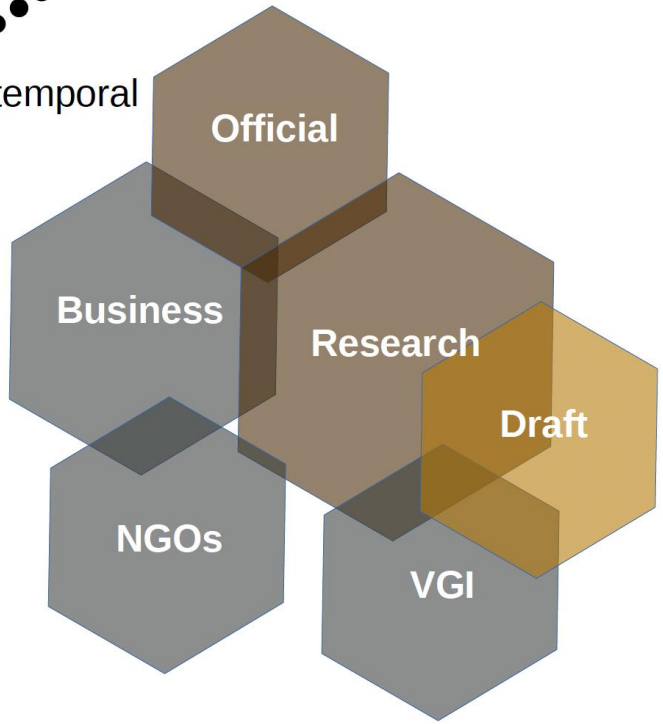
Heterogeneity
- representation
- model
- format

Changes over time
Fix and update





Multi-scales



Marine Spatial Planning Process

Adjustments

MAKING THE CASE

- Economic/ Social Benefits
- Entry Points
- Ecological

ENABLING CONDITIONS REVIEW

- Regulatory
- Institutional
- Funding

PLANNING

- Define Goals & Objectives
- Define Study Area
- Compile Data
- Various Studies and Analyses
  - Sectoral
  - Ecosystem
  - Socio-economic
- Trade-offs, Modelling, Conflict Analysis
- Prepare and Endorse the Plan

IMPLEMENTATION

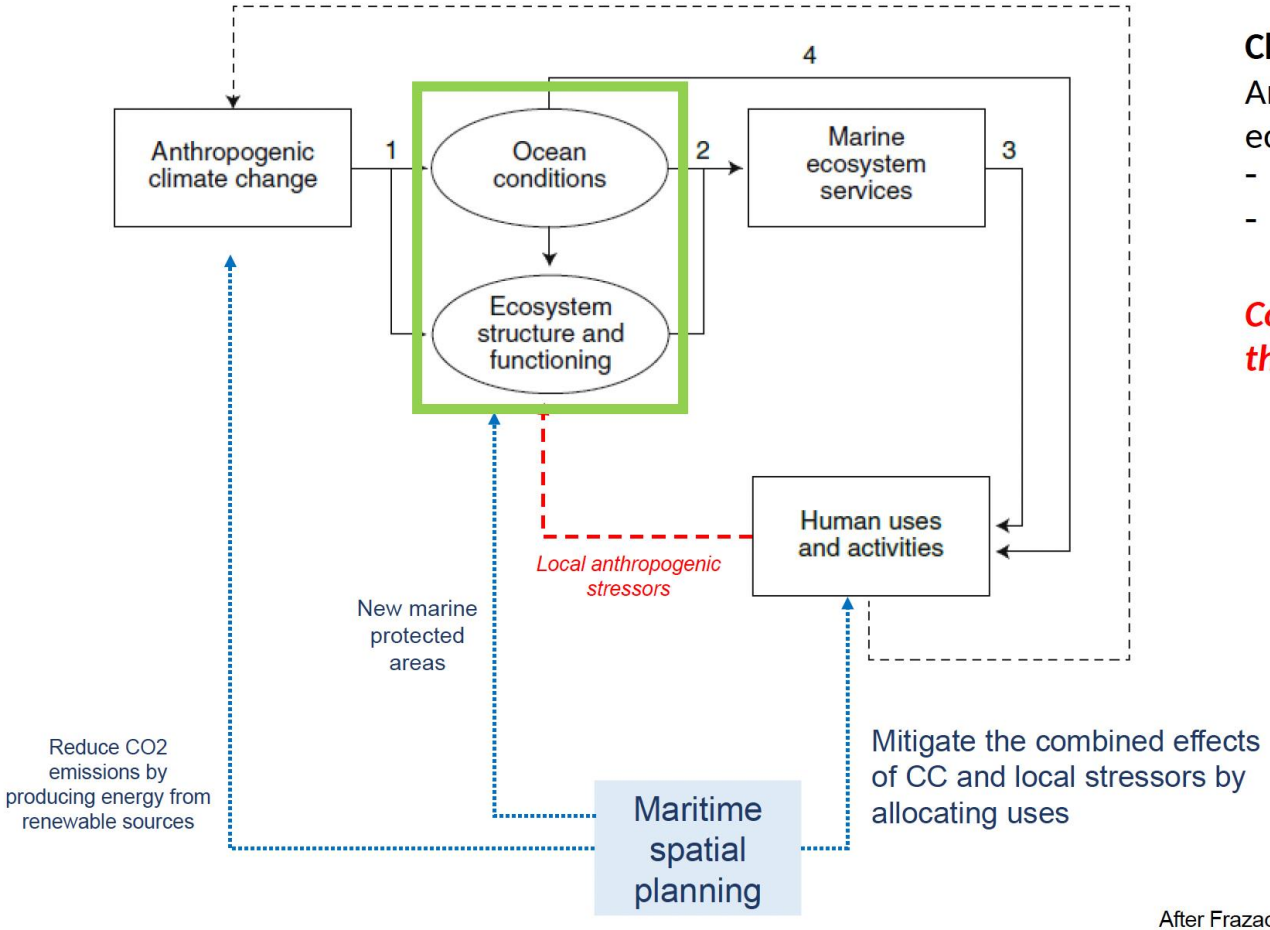
- Investments
- Coordination & Integration
- Monitoring & Evaluation

Activities

Information relating to the activity of fishing

- Different uses of maritime space from fishing
- Areas subject to protection
- Spawning and recruitment areas of the main species of interest commercial
- Environmental analysis
- Characterization of the chain trophic
- Socio-ecological analysis and development of management hypotheses

MSP, Climate change, climate refugia



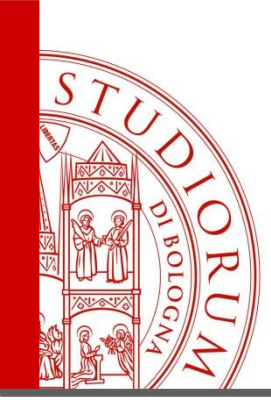
Climate refugia

Areas that persist in providing ecosystem services:

- Climate analogs
- Biotic analogs

Control CEA over refugia through MSP

After Frazao-Santos et al. (2020)



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